OECD

INTERNATIONAL ENERGY AGENCY

COMING IN FROM THE COLD

Improving District Heating Policy in Transition Economies

OECD

INTERNATIONAL ENERGY AGENCY

COMING IN FROM THE COLD

Improving District Heating Policy in Transition Economies

INTERNATIONAL ENERGY AGENCY
9, rue de la Fédération,
75739 Paris Cedex 15, France

The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-six* of the OECD's thirty member countries. The basic aims of the IEA are:

- to maintain and improve systems for coping with oil supply disruptions;
- to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- to operate a permanent information system on the international oil market;
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- to assist in the integration of environmental and energy policies.

** IEA member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States. The European Commission also takes part in the work of the IEA.*

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996), the Republic of Korea (12th December 1996) and Slovakia (28th September 2000). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

FOREWORD

District heating is a critical energy source for countries in transition as it covers 60% of heating and hot water needs in transition economies currently. It can provide a cost-effective, environmentally friendly source of heat and power for cities and also play a significant role in reducing or stabilising carbon emissions. Successfully reforming district heating in major energy producer or transit nations like Russia and Ukraine can have broad benefits for energy security in the region and Western Europe. Yet many district heating systems in transition economies face difficulties: inefficient heat production, costs that exceed revenue and declining sales.

This book aims to help governments design policy approaches that can effectively address the key challenges facing the district heating sector. It begins by highlighting the benefits of district heating, providing motivation for policy reform. It then assesses the root causes of the sector's dilemma in most transition economies: poor customer focus, low efficiency, excess production capacity and uneven playing field. It outlines two paths for addressing these issues and allowing the sector to achieve its full potential: better regulation or competition. Both are viable options. It is important, however, for governments to clearly select which mechanism will balance supply and demand, whether it is tariff regulation and energy planning, or competition between different types of heating. Even with competition, the government still has an important role in monitoring the market, addressing imbalances to ensure that the competition is fair and that the poorest consumers are supplied in a way which is compatible with efficiency and fair competition. Selecting a clear path can help in creating a cultural shift from a production-driven business model to one that focuses first on customers. Fully understanding district heating's importance to national energy policy is important in order to integrate it into the broader agenda and ensure a level playing field.

The International Energy Agency has a long history of working on district heating and integrating it into broader energy policy efforts. The most visible element of this is the Implementing Agreement on District Heating and Cooling and Combined Heat and Power (IA DHC). This is a joint research programme of ten countries, which is dedicated to researching and promoting new district energy technologies to save energy and protect the environment. The IEA also collects and publishes detailed statistics on heat and periodically assesses district heating policy in specific countries as part of broader energy reviews. The IEA launched an initiative on district heating in

transition economies in 2002 to understand and highlight this policy issue through conferences, policy briefs and discussions with individual governments. This book is the culmination of that effort. Since the initiative began, two of the three national heat laws in transition economies have gone into effect and several additional countries are now considering draft heat laws. We hope this book provides timely advice and encouragement to these and other governments as they shape and perfect their district heating policy and include it in a comprehensive energy policy.

Claude Mandil
Executive Director, International Energy Agency

ACKNOWLEDGEMENTS

This book draws on research and input from numerous governments, district heating companies and research programmes. The IEA held two conferences – one in Paris in December 2002 and a second, larger event in Prague in February 2004 – that provided insight, information and support for the book. The first of these events was an expert roundtable to brainstorm on key directions, resulting in a brief summary of key district heating policy priorities. The second conference involved a broad range of participants, from deputy ministers to regulators, corporate executives, bankers, project developers and experts. We would like to express our deep appreciation to all these individuals for their candid views and constructive input. We also received invaluable assistance and encouragement from the Executive Committee of the Implementing Agreement on District Heating, Cooling and Combined Heat and Power.

Approximately 30 outside experts reviewed the book and provided helpful technical or policy advice. We would like to express our gratitude in particular to: Jiri Zeman, W.U. Chandler, Norela Constantinescu, Peter Dahl, Peter Johansen, Sergey Katyshev, Susan Legro, Astghine Pasoyan, Mykola Raptsun, Mike Rundle, Thomas Secrest, Mark Velody, Sven Werner and Robin Wiltshire.

The principal authors of this book are M. Evans and E. Douraeva, in the Office of Non-Member Countries. Gordon Duffus supervised and encouraged the authors in this endeavour. Numerous other IEA staff provided helpful comments or support in developing the book including William Ramsay, Riccardo Quercioli, Andrew Matheny, Teresa Coon, Sally Wilkinson, Loretta Ravera, Muriel Custodio, Emmanuel Bergasse, Ulrik Stridbaek and Amanda Watters. Caroline Varley edited the book.

TABLE OF CONTENTS

List of Maps

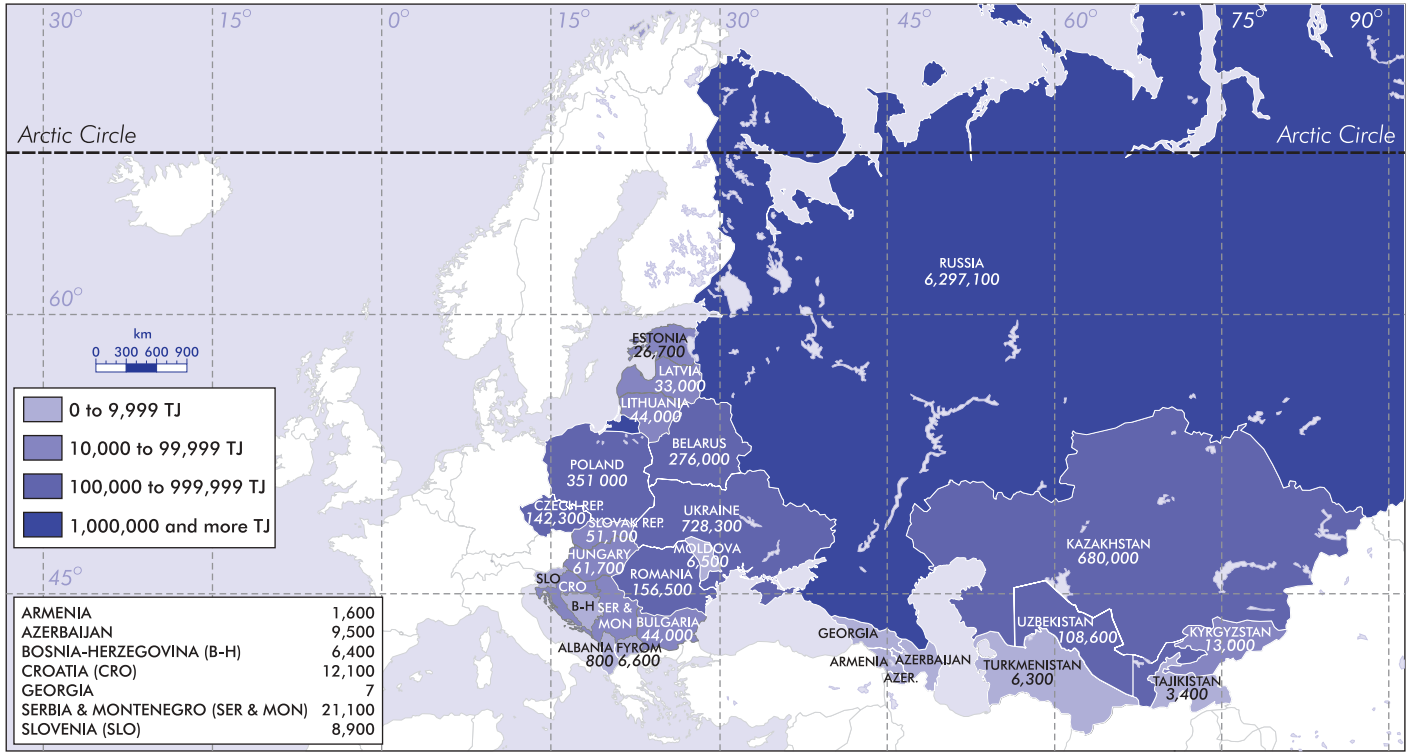
List of Figures

List of Tables

List of Boxes

Map 1

Economies in Transition: Heat Production, 2002

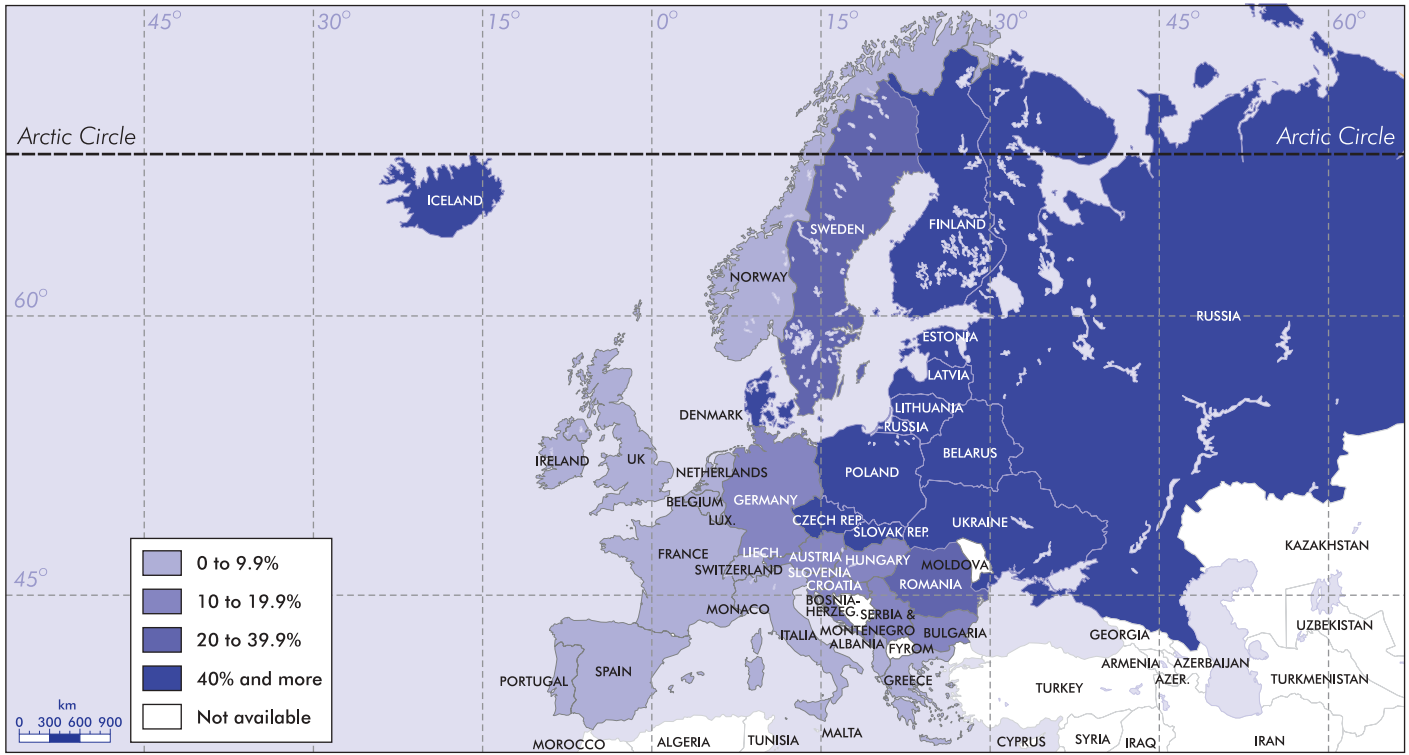


ARMENIA	1,600
AZERBAIJAN	9,500
BOSNIA-HERZEGOVINA (B-H)	6,400
CROATIA (CRO)	12,100
GEORGIA	7
SERBIA & MONTENEGRO (SER & MON)	21,100
SLOVENIA (SLO)	8,900

Source: IEA Statistics.

Map 2

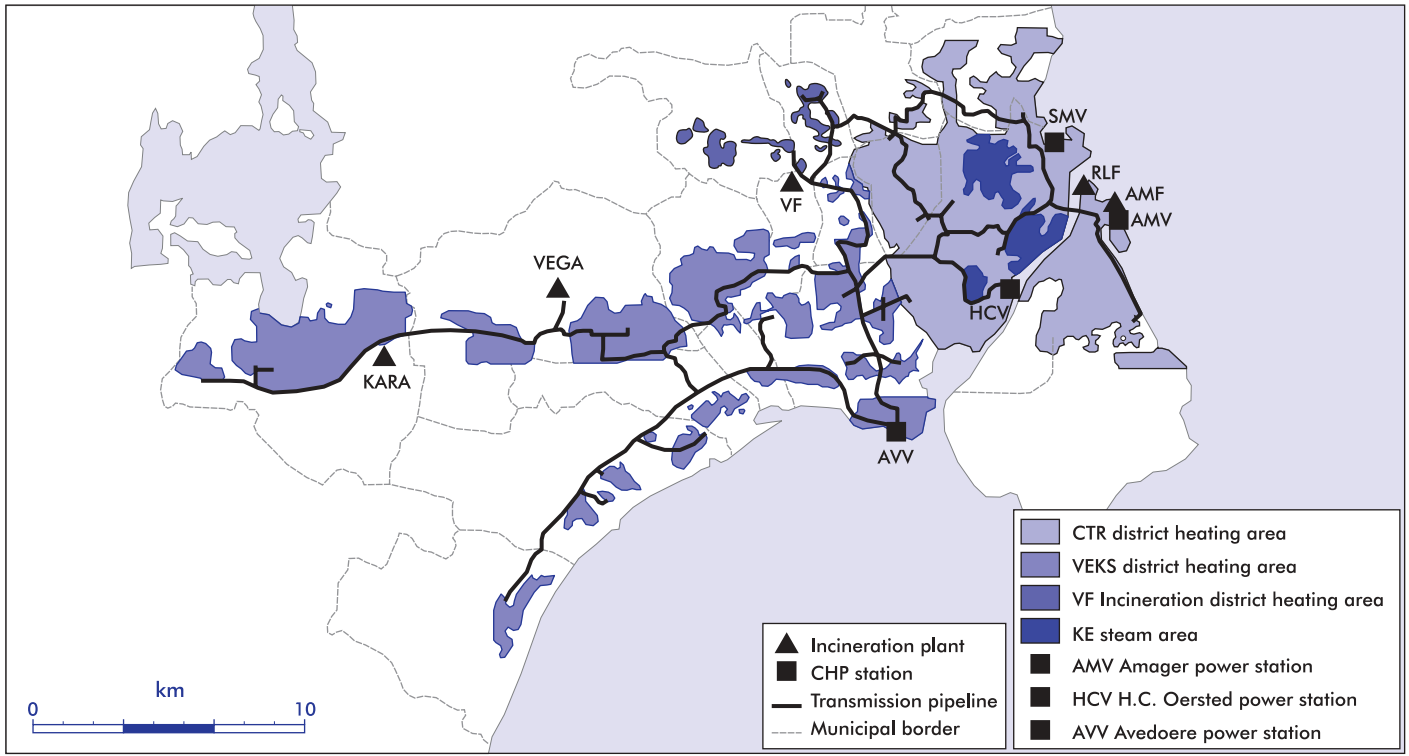
District Heating's Market Share in Europe, 2002



Source: Euroheat and Power; Gochenour.

Map 3

District Heating System in Greater Copenhagen



Source: DBDH, www.dbdh.dk.

EXECUTIVE SUMMARY

District heating can make a substantial contribution to a sustainable energy future in Central Europe and the former Soviet Union. It can save energy and boost energy security, but only if stronger policy measures to encourage wise management and investment are put in place there. District heating covers 60% of heating and hot water needs in transition economies. In Russia, it accounts for over 30% of total energy consumption. Yet some district heating systems face financial and technical problems, largely because of an inappropriate policy framework. District heating in Western Europe and the rest of the world can provide lessons to achieve greater efficiency and profitability in transition economies.

District heating is a system of centralised heat production and distribution typically for urban areas. The systems usually consist of heat plants (which often produce heat and electricity simultaneously) and a network of distribution and return pipes. The heat systems meet residential and commercial needs for space heating and hot water, and often provide heat to industry.

A few facts put district heating in perspective and underline why the International Energy Agency has focused on this issue:

- Because as much as 70% of families in transition economies rely on district heating, efficient management and organisation of heat supply are important to the energy security and social welfare of these countries.
- District heating accounts for 6% of GDP in Russia at current prices.
- With a stronger policy framework, district heating systems in transition economies could save in generation alone the equivalent of 80 billion cubic metres (bcm) of natural gas a year. This is roughly the annual gas consumption in Germany. These savings would also reduce greenhouse gas emissions by 350 million tons of carbon dioxide per year. Improved efficiency in distribution systems and in buildings would yield even greater savings.
- Russia consumes 150 bcm of gas each year for district heating, only 30 bcm less than it exports annually.
- District heating debts threaten to bankrupt many cities in countries where district heating policy has been neglected or where customers don't pay their bills. In Romania, these debts equal about 0.25% of GDP and reducing them has become a condition of future lending from the International Monetary Fund.

- About half of the largest district heating systems in the world are in transition economies. The rest are in Western Europe, North America and Asia. All IEA countries have district heating or cooling systems. District heating is growing quickly in Asia. District cooling is common in North America and growing in Europe.

This publication provides policy makers a guide to key district heating issues, first by demonstrating why district heating is worth pursuing, then why new policies are essential in most transition economies and finally by offering a menu of policy options that countries can adapt to their own needs.

In preparing this book, the IEA held discussions with about 350 policy makers and other stakeholders. Some of these discussions took place during two IEA-sponsored events: a roundtable on district heating policy in Paris in December 2002 and a larger conference on the topic in Prague in February 2004. IEA staff have also visited many transition economies to discuss district heating with national and local experts. And the authors have conducted an extensive literature search covering both transition economies and OECD members. The book has also benefited greatly from the comments of some 30 external reviewers.

The book focuses on former centrally planned countries transitioning to a market economy. Specifically, it looks at countries in the former Soviet Union and Central and South East Europe. Although it focuses on transition economies, the discussion of policy issues can find applications in many other OECD countries. Only a few OECD countries have an explicit district heating policy today. The potential environmental, energy security and social benefits of district heating warrant closer policy attention. Likewise, China has a significant district heating sector that shares many of the same characteristics as systems in transition economies. Thus the book may provide helpful insights to Chinese policy makers on designing optimal district heating policies.

The Long-term Perspective

Policy plays an important role in the long-term sustainability of district heating systems. Well-designed policies can help improve the quality and efficiency of district heating services, simultaneously improving the long-term sustainability of the industry. Many countries have only scattered policies on district heating that can actually undermine the development of the sector. Examples in transition economies include policies that do not allow district heating companies to recover their costs or that put district heating at a disadvantage because of subsidised residential gas or electricity prices.

Long-term sustainability is the key; too often the focus in district heating reform has been on isolated investment or technology fixes without considering the broader need for market reform and policies to support the sector's sustainability. This publication does not prove that district heating is inherently the best option in all cases nor that it should be cut back because it is currently managed in an inefficient way. Rather, it focuses on finding economically sound approaches to capturing the benefits that district heating and cogeneration have to offer. Long-term sustainability requires that district heating companies, policy makers and regulators place greater priority on customer needs and improved quality. In other words, more focus needs to be on the customers, not solely on production.

Benefits of District Heating

The first part of this book looks at why district heating is important and what challenges the sector is facing in transition economies. Chapter 1 provides an introduction to the major benefits and even critical importance of district heating, looking specifically at environmental protection, energy security and economic development in transition countries. Understanding these benefits can help motivate policy reform.

District heating can be very environmentally friendly when well managed. Existing district heating and cogeneration facilities, including industrial cogeneration, reduce the global carbon dioxide emissions from fuel combustion by 3-4% annually compared to a world without them. For comparison, the Kyoto Protocol sets a target for industrialised countries to cut their annual emissions by an average of 5%. Building new district heating systems based on cogeneration and improving the efficiency of the existing ones can significantly reduce carbon dioxide emissions.

District heating can have lower emissions than competing heat sources for several reasons. It provides a heat load that makes cogeneration possible, and cogeneration greatly raises the overall efficiency of power and heat production. In fact, gas-fired cogeneration produces about one-third the greenhouse gas emissions of a conventional coal-fired power plant based on total useful energy output from each; coal-fired cogeneration production is about half as polluting as conventional coal on this same basis. District heating can use energy from many sources, including industrial waste heat, heat from incinerators, geothermal energy and biomass. The Baltic States rely notably on biomass for their district heating. District heating plants are also usually more efficient than standard decentralised heating systems because

of economies of scale; this is particularly true in transition economies given the relatively low efficiency of the local boilers in use. On the negative side, district heating systems in the former Soviet Union tend to have high distribution losses, but the same is true to some extent for the gas or electricity systems that supply local heat sources.

District heating can also improve energy security. Its higher potential efficiency means that less energy is needed. It tends to use local sources or sources that would be wasted otherwise, like cogeneration, industrial waste heat and biomass.[1] Both these features of district heating lead to lower levels of energy imports. Because district heating plants can often tolerate multiple fuels, for example natural gas, fuel oil and renewable fuels, they also provide greater flexibility. District heating is a major source of energy in most transition economies, so it needs to be considered as part of overall energy security. For example, district heating breakdowns during cold Siberian winters caused numerous deaths in the early part of this decade; this spurred the Russian government to take a more proactive approach to district heating policy. Finally, district heating can affect international energy security because of its close link with natural gas. In Russia and Ukraine, where natural gas is the main fuel for district heating, the governments subsidise natural gas prices because of the social difficulty of raising district heating prices. If district heating were more efficient in these countries, such subsidies would not be necessary. Reforming the natural gas systems in these countries would improve international gas security by allowing multiple operators and encouraging needed investment in infrastructure, but this would first require raising domestic gas prices, and hence reforming district heating.

Reforming district heating can also promote economic development both because it is already such a large part of GDP in some countries and because more efficient district heating based on more rational pricing would promote competitiveness and economic efficiency. District heating reforms will also improve service quality.

Increasing energy efficiency in buildings with district heating would also improve social welfare because it would decrease household heat consumption and thus reduce the burden of utility payments on families without sacrificing comfort. In Russia, many families pay a third of their income for utilities. Improving energy efficiency in the district heating systems themselves will also reduce costs, which may help to reduce tariff pressure in some countries.

1. *District heating plants can also run on coal, another typically local energy source. Coal causes higher pollution levels than gas or industrial waste heat. Overall, countries in transition have decreased their use of coal for heating since 1990.*

The Challenges for Transition Economies

District heating systems in transition economies often face financial, technical or managerial problems largely created by an inadequate policy framework. Chapter 2 describes these challenges: lack of customer focus, low efficiency, excess capacity, corruption and an uneven playing field. These challenges are all the more significant because they have implications for investment in the sector.

Lack of customer focus is probably the single largest weakness in district heating systems. Dealing with this requires a cultural shift from a production model to a customer-focused model of management. Such a shift will ensure that customers receive a quality service, which will likely increase their willingness to choose and pay for district heating services. In addition, it will force district heating companies to improve efficiency and better match supply and demand while limiting costs.

District heating can be very appealing for consumers. It frees residential users from the expense, hassle and reliability risks of maintaining individual boilers. In Finland and Sweden, where customers can choose between several heat sources, they usually choose district heating because it is convenient and competitively priced. These advantages develop from effective management (as well as a successful policy and regulatory framework). Yet district heating utilities in transition economies tend to focus more on the production and technical operation of their systems, and less on customer needs. Poor governance in the district heating sector is also a symptom of this lack of customer focus.

Most district heating systems in former planned economies are less efficient than those in the West. This inefficiency starts in the boiler house: transition economies use a much larger share of heat-only boilers for their heat supply than Western countries. Distribution systems can lose up to 30% of the heat they carry, though this is closer to 12% in Central Europe. Finally, buildings tend to be inefficient and often lack the thermostatic controls so important to comfort. Systems in the former Soviet Union and South East Europe tend to be much less efficient than those in Central Europe. This inefficiency raises costs, which puts pressure on households, particularly low-income families.

District heating systems in transition economies are, by and large, over dimensioned. In other words, their supply infrastructure is larger than necessary to meet current demand. This problem can be exacerbated when they lose customers. The balance of supply and demand is quite important: when systems have excess capacity, their costs are greater. Losses are higher

during operation at partial capacity, and maintaining a large system costs more than maintaining a small one. Such systems also have high fixed costs, which makes it increasingly difficult to lower costs when demand decreases. Service quality can also suffer, since systems that are too big are not flexible in adapting to changes in demand: apartments can end up too hot or too cold.

Most new EU members and accession countries have experienced a decline in market share for district heating. Other transition economies have seen total heat demand drop as their economies faltered, even if market share remained steady. Typically, building or apartment-level natural gas boilers are the main competitors. Natural gas prices were subsidised more heavily and longer than district heating prices in several of the countries with the sharpest decline in residential district heating use. In many cases, this has led to distorted investments in local systems that residents regretted once natural gas prices began to rise. However, poor management and service in district heating have also played an important role.

Demand is starting to grow again in many countries in transition. Ukraine saw a 9% growth in district heating demand in 2003, and in Lithuania, heat sales grew by 1% between 2000 and 2002, so the trends are changing, at least in some countries that have been more proactive about reform in recent years. Future demand trends will depend very much on the strength and clarity of district heating policy.

Clear and co-ordinated policy can ensure that district heating is operating on a level playing field with other heat sources and energy sectors. For example, liberalisation or subsidies in other sectors can have important impacts on district heating. Co-ordinated national policy helps ensure that measures are well balanced. Stronger policy can also help in improving governance in the district heating sector.

Policy Options for Meeting the Challenges: Two Paradigms

The second part of this book focuses on issues that are first-order priorities in ensuring the sustainability of the sector. Chapter 3 offers a choice between two paths to better balance supply and demand for heat and thus address many of the key challenges of district heating: better regulation or competition.

While policy makers should clearly select which approach to use to balance supply and demand: heat source competition, or tariff regulation and energy planning, this does not mean that either approach is completely devoid of

regulation or competition. A competitive regime will include environmental and safety regulation, for example, and a regulated regime may use wholesale competition to lower costs.

Getting the balance of supply and demand right is particularly important because so many other policies and challenges hinge on this decision. The right balance will go a long way in solving the problems of poor customer focus, inefficient supply and inadequate investment. The private sector will have much more incentive to invest when the sector is structured so that it can be profitable. Encouraging additional investments in cogeneration and energy efficiency will also be easier. In other words, getting this decision right can make policy making in other areas easier and more successful.

Markets can do an excellent job of balancing supply and demand when competition is fair and there are no major impediments to free trade in the heat market. Competition by nature forces efficiency improvements and provides incentives for companies to improve service quality. When this book refers to competition balancing supply and demand, it means competition between heat sources such as district heating or local gas boilers. Yet when markets are not balanced, for example, because of subsidies or lack of effective product choice, allowing the market to balance supply and demand alone can create major distortions in prices and investments. Thus, regulation can be a good policy choice in many situations, as long as the decision is made deliberately and with adequate consideration of the choices and alternatives.

If a country decides to use regulation to balance supply and demand, coherent energy plans are essential. Energy plans provide regulators with independent information to help ensure that service quality is high, costs are kept to a minimum and investments are justified, balancing the interests of heat supply companies with those of the public. If a country decides to introduce competition, it should monitor the market to make sure competition is fair and the market is balanced.

Table ES.1 summarises recommendations on integrating regulation and competition into policy. The first part of this table describes prerequisites and conditions that are necessary for both approaches.

In general, competition is best able to balance supply and demand in countries that are more advanced in economic reform and have lower poverty levels. Several countries in Central Europe are probably ready to allow the competitive market to set prices provided that the market is monitored. Regulating the balance of supply and demand through tariffs and energy. The

planning is more suitable in countries that still have energy subsidies and high levels of non-payment. In areas with extensive poverty, introducing heat source competition immediately may prove unfair to consumers because large parts of the population would not be able to afford to exercise their market choice.

Table ES.1

Policy Sequencing

Essential Initial Steps

1. Establish independent regulator.
2. Set up social support programmes and eliminate direct heat production subsidies.
3. Insist on good payment discipline through legislation and enforcement.
4. Require meters at interface with all buildings and large consumers.
5. Develop policies to promote demand-side energy efficiency.
6. Establish conditions that allow for full cost recovery.
7. Remove barriers to unregulated wholesale competition.
8. Involve private sector through privatisation or public-private partnerships.

Steps for Better Regulation	Steps for Introducing Competition
1. Prepare realistic demand assessments and least-cost plans for high service quality.	1. Remove barriers like subsidies for competing heat sources.
2. Establish least-cost supply requirements and use competitive licensing to get least-cost new supply options.	2. Establish more market-based tariffs.
3. Move toward more market-based tariff regulation (benchmarking, price caps with efficiency indexes or substitution tariffs).	3. Assess market conditions.
4. In larger cities, require more extensive wholesale competition for long and medium-term heat contracts by unbundling production from transmission/distribution and establishing non-discriminatory transit tariffs.	4. Establish a body that can review and act on complaints about abuse of market power.
	5. Ensure that consumers can disconnect and require district heating companies to process such requests quickly.
	6. Eliminate tariff regulation.
	7. Monitor market annually and establish a clear process for reviewing and acting on this information, when necessary.

The chapter also considers several issues that governments need to address as prerequisites for either better regulation or competition: installing heat meters, enhancing payment collection and improving social protection systems. These measures will improve energy efficiency and give households more control over their bills, thus increasing the attractiveness of district heating.

Regulation

Chapter 4 examines policies on tariff regulation. It starts by highlighting one key condition of effective regulation: the independence of regulators. It then considers different approaches to tariff design taking policy priorities into account.

Regulation itself is not the reason why district heating in transition economies tends to be so much less efficient than elsewhere in the world. Poorly designed regulation, though, makes a significant contribution. This is true not just for district heating. Cost-plus tariffs, which are common in transition economies, allow district heating companies to profit more when costs rise. At the same time, current tariffs do not always allow district heating companies to fully recover the costs of their services, which damages the sector's economic sustainability. In countries with municipal ownership or subsidies for district heating, this creates a drain on municipal budgets. In some cases, tariffs also inadvertently favour individual natural gas heating over district heating.

By choosing to continue regulating prices, policy makers have an obligation to ensure that their regulation is as strong as possible. Ideally, well-designed regulatory approaches and heat tariffs should:

- Cover the full current costs of the heat supply company.
- Include replacement costs and return on investment.
- Allow sound operation and management of the district heating system.
- Be competitive with prices for other heat sources.
- Give the district heating company incentives to reduce costs.
- Give heat suppliers and customers incentives to save energy.
- Be transparent and easily understandable: customers should clearly see from the tariff what they are responsible for and how they can influence the heat bill.
- Protect consumers from unjustifiably high prices.

Better regulation can entail a market-oriented version of energy planning. Market-oriented energy plans take the private sector's role into account and try to ensure that district heating would be competitive (with high quality and low cost) if competition were launched. In other words, continued regulation should not be an excuse for continued poor service. An energy planning process allows policy makers and other stakeholders to decide proactively on how to provide this heat at least cost, even if in some cases this means installing local boilers in remote areas.

Policy makers should be open to several approaches to tariff regulation. Some types of tariff regulation are better at promoting efficiency than others. For example, price capping requires reasonable efficiency improvements over time; this regulatory approach has been used very successfully to improve system efficiencies in many Western countries. Some transition economies such as the Czech Republic and Lithuania now use it too. Benchmarking is another technique that regulators can use. It involves setting tariffs based on costs and prices at a set of peer companies. If the benchmarks are well chosen, they can help boost company efficiency without the need to estimate potential efficiency gains. Finally, substitution tariffs allow regulators to set tariffs at the cost of competing fuel sources, which means that regulated companies cannot charge excessive prices, but still bear the main financial risk of investment decisions. In practice, most countries in transition use cost-plus tariffs that reward district heating companies for low efficiency and high costs by letting their profits rise with costs.

Regulators can also use wholesale competition to keep district heating costs down and ensure least-cost supply (as described in Chapter 5). In its simplest form, this means arranging competitive bids for new supply, which then would entail some degree of wholesale competition between suppliers in a given system. Regulated wholesale competition only occurs in systems with tariff regulation. The most significant example of regulated competition is the greater Copenhagen area, where cogenerators and waste incinerators can sell their heat to two geographically distinct wholesale district heating companies. The sales are based on long or medium-term contracts. Several systems in large cities have unbundled generation from transmission and distribution, which makes it easier to compare supply prices. Wholesale competition is also quite common in unregulated systems, where there are no specific requirements for least-cost supply. In such situations, heat source competition stimulates the district heating company to find the most competitive supply options, including various forms of waste heat. Wholesale competition in the district heating sector will likely expand slowly, but it can bring greater efficiency, particularly because it provides a way to use industrial waste heat and boost heat sales from cogeneration.

Competition

Competition in heating is the norm in IEA countries. It is an essential element of market economies in general because it creates efficiency and better products, both of which could benefit the district heating sector in transition economies. The issue is how to ensure fair competition, since in most cities with district heating, there is only one district heating company. In addition, competition cannot work well when there are across-the-board subsidies for district heating or a competing heat source. Yet just because district heating cannot be liberalised in the same way as electricity, for example, does not mean that competition is impossible.

Competition between heat sources can effectively balance supply and demand.[2] Competition here means that consumers have a choice between different types of heat for their homes and offices. It exists in most countries in transition and it is most prevalent in the new EU member states. In these countries, it has come about not through a new regulatory framework but because of price and other market factors: gas tariffs remained subsidised longer than district heating tariffs, but poor district heating service also played a role in the growth of competing heating fuels. Finland, Sweden, the United Kingdom and several other OECD countries do not regulate district heating tariffs because they feel that competition from other heat sources creates a balanced market. In transition economies, district heating prices are still regulated (as are gas and electricity prices for residential users), but district heating companies can and do lose market share when their prices are too high or quality too low.

In general, countries that do not regulate district heating tariffs have lower prices. For example, Finland uses competition between heat sources to balance supply and demand; its district heating prices average about €30 per MWh. Neighbouring Denmark regulates heat prices based on cost and has made tremendous energy efficiency gains, but prices average just over €51 per MWh (both the Finnish and Danish prices are before value-added tax, to ease comparison). This represents a price difference of over 40%, which is quite striking. More comprehensive but unpublished studies also confirm this finding that heat source competition lowers prices, although obviously there are many factors that affect the final price of heat.

Countries have taken two approaches to heat source competition: competition with regulated prices and competition with unregulated prices. Prices in

2. *Wholesale competition by itself cannot effectively balance supply and demand because it does not give final consumers a choice. Thus, when this book refers to competition balancing supply and demand, it means competition between heat sources.*

countries that do not have tariff regulation are generally lower than in those that do, possibly because tariff regulation reduces flexibility and creates an administrative burden, both of which add to costs.

Governments can ensure that the market is fair by monitoring it and setting up a process to review complaints about abuse of market dominance. Likewise, it is important to examine the market situation before launching heat source competition. These steps can help avoid major problems like those experienced in Romania when large numbers of the most affluent customers switched to subsidised natural gas.

Heat source competition does not work well when there are subsidies for any energy source, when non-payments are widespread, when a large part of the population is too poor to afford the costs of switching to local boilers, or when there are other major barriers to market equilibrium. Thus, regulation can be a better option than competition in Russia or most other countries in the former Soviet Union for now, though these countries should move towards competition by gradually eliminating barriers. On the other hand, many countries in Central Europe, particularly those that currently use more progressive regulation like price caps, should be ready to free district heating prices and allow the market to balance supply and demand. In fact, in some cases, continued price regulation may act like a weight on the district heating industry because companies are already forced to compete but do not have the flexibility to change their prices according to market conditions. Protecting customers is a noble goal, but in the end, if competition creates a stronger incentive to improve services and lower prices than regulation, it may protect customers best.

Chapter 5 also provides a description of wholesale competition, how it is applied today and the areas in which it could potentially grow.

Investment, Financing and the International Community

Chapter 6 highlights the difficulties the sector has faced in attracting sufficient financing for new technology. Underinvestment hurts competitiveness because it leads systems to deteriorate. Better access to financing, therefore, makes district heating more sustainable. This chapter describes different financing mechanisms that can help boost investment. It emphasises the role of the private sector and commercial financing, and discusses policy approaches to facilitate this process. It also describes how governments,

assistance programmes and international financial institutions can ensure that assistance is properly structured to improve policy.

Public and international financing should create favourable conditions for commercial financing and private investments. International and national financing or guarantee schemes can mobilise commercial co-financing by helping to allocate the investment risk between different investors. Generally, if commercial financing is available, grants, subsidies and other forms of direct financial support should be limited as they interfere with commercial investment decisions by distorting market signals. They may, however, be justified as a temporary tool for governments to promote an investment that is in the public interest, for example environmentally friendly technologies.

Commercial financing and private investment are playing an increasingly important role, notably in Central Europe and the Baltics. Other transition countries have some way to go to attract private investors to district heating. Well-designed policies are likely to make district heating more attractive to commercial financiers. Such policies include tariff policy aimed at cost recovery, a stable and predictable regulatory framework for district heating companies, legal mechanisms to enforce payment and policies to involve the private sector in district heating ownership and management.

The role of the international community is not limited to providing financial support. International co-operation can help former Socialist countries build viable district heating policies and integrate them effectively in overall national policy agendas. However, international assistance cannot replace effective national policy making. Rather it supports good policy making by providing national governments with information on the advantages and disadvantages of policies and implementation strategies.

Ownership and Management

The finances and competitiveness of district heating companies are closely linked to ownership and operating structures. Many district heating systems are owned by municipalities or the state, yet private sector participation is growing across the region. There are many ways to involve the private sector: from short-term service contracts to complete privatisation of district heating assets. Private-sector involvement can bring in new management skills and create new avenues for financing necessary upgrades. This is particularly true when involving large, international companies that have access to financing at a lower cost than might be available locally.

In general, there is more private-sector involvement in Central Europe and the Baltics than in the rest of the former Soviet Union or South East Europe. Both Russia and Ukraine, though, have seen a recent increase in leasing in the district heating sector, dominated by one or two domestic companies.

Private-sector involvement can help boost service quality and cost-effectiveness of district heating. Private ownership can also separate local policy decisions on district heating from the business of running district heating companies profitably. However, separating business decisions from political considerations can and should happen in public utilities too. When this is the case, there is no particular reason why a publicly owned utility could not act as a market-oriented, commercial company. Ultimately, the most important thing for a company's effectiveness is not its ownership, but its business culture and the conditions in which it operates. Therefore, an adequate policy, legal and regulatory framework is of utmost importance.

Any changes in ownership or managerial structure should take into account the long-term perspective, given that district heating utilities need large, long-term investments. If restructuring a district heating utility involves a private company, the latter should be invited through an open tender with clearly stated objectives, criteria and responsibilities. The choice of the private investor should be based on solid criteria and careful evaluation.

Cogeneration and Energy Efficiency

Technology is important to the future of district heating. District heating is appealing because of the environmental and economic benefits of efficient heat generation and cogeneration. Chapter 8 focuses on tapping these benefits through policies to promote cogeneration and energy efficiency.

Cogeneration is an essential reason why policy makers are attracted to district heating. District heating provides the demand for the heat produced in cogeneration plants. In many Western countries, one of the challenges of expanding cogeneration is finding a market for the heat. In transition economies, this heat load already exists because of district heating, yet less than half of the district heating comes from cogeneration. Cogeneration's share in district heating in Western Europe is higher than in most transition economies. This creates a significant opportunity for cogeneration in transition economies.

Cost allocation is very important for promoting cogeneration. Until recently, all the economic benefit of cogeneration in Russia and other former Soviet

countries was allocated to electricity, and the heat from cogeneration would actually be more expensive than heat from heat-only boilers. Even today, the split tends to favour electricity, making district heating companies less than enthusiastic about purchasing more cogenerated heat. There are several methods to allocate costs both fairly and simply, and the best choice typically depends on whether there is competition in electricity markets or not.

District heating also holds the promise of higher energy efficiency, which can bring significant environmental and economic benefits to a country. Most district heating systems in OECD countries are very efficient. Energy efficiency is still a challenge for district heating in former Socialist countries, even though it is more efficient than it was ten or fifteen years ago.

Chapter 8 describes the various policy tools that promote cogeneration and energy efficiency. They range from carrots like assistance with financing, best practice programs and tax incentives, to mandatory requirements or standards.

District Heating in the National Policy Agenda

District heating is a national issue in almost all countries in transition because of its economic impact and social importance. The 70% of Russian or Latvian residents who use district heating cannot find a new way to heat their homes overnight. Yet compared to other portions of the energy sector, there have been fewer steps toward reforming district heating. This may be in part because the problems seem too socially explosive to touch and as district heating is rarely a priority in the West, transition economies are not often encouraged to reform this sector in high-level dialogues.

Chapter 9 looks at why and how district heating needs to be integrated into the national policy agenda and then describes the progress of several countries in this regard. The chapter begins by looking at how district heating relates to national energy policy. Heat accounts for a large part of the energy balance in most transition economies. Dealing with heat in isolation from other parts of the energy sector can lead to poorly focused and contradictory policies. Developing unified regulatory methods and eliminating subsidies for more balanced competition are two examples of including district heating in a co-ordinated national energy policy. It is also important to consider district heating when liberalising electricity and gas markets. For example, if district heating competes with gas or electricity and its prices remain regulated after liberalisation in other sectors, the varying degrees of flexibility in setting

prices could create a barrier to balanced competition in the heat market. This is not to say that liberalisation must wait for all energy sources to move forward at the exact same time, but co-ordination and some synchronisation are necessary. Countries need to be aware of the impact that liberalisation in other sectors has on district heating and include the latter in the overall strategy. This task is easier when district heating is an integral part of national energy policy, the same policy that defines the schedule and approach to energy liberalisation.

There is also a symbiotic relationship between district heating and several other areas of national policy making that needs to be acknowledged and embraced to ensure the highest-quality policy. Environmental, housing, social and economic policies are a few such examples. In housing policy, for instance, the interaction of policies on home ownership and district heating can have a profound influence on energy efficiency. The structure of the housing market affects how much influence consumers have with the monopoly district heating suppliers. (In some countries, like Sweden, landlords have significant market power, in others, housing or condominium associations can act as an effective lever on heat markets). In addition, development policies can shape housing density and the cost-effectiveness of district heating. In most countries in transition, as in Russia, social welfare policy is closely linked with district heating policy, so the two issues must be addressed in a co-ordinated way. The size of the subsidies also makes solving these social issues almost impossible at the local level as some towns tend to be more affected by unemployment than others and taxes in most countries are levied primarily at the national level.

Given how important district heating is to so many aspects of national policy, it is surprising that until recently, Hungary was the only country in transition with a law on heat. Heat is mentioned in energy or electricity laws in most countries. Yet these references tend to be brief and often they treat heat like electricity, without recognising some of the fundamental differences between the two (like the highly local nature of district heating). Good policy requires broad discussion and clear representation of ideas. Enacting a heat law is one way to create a broad discussion and reach consensus and clarity. Formally issuing a policy on heat after extensive discussion is another potential way. However, just as important as reaching consensus on a formal policy is what the policy contains.

The lack of a clear policy toward district heating in most transition economies in the first ten to fifteen years of democracy has led to many of the problems of the sector. This is changing as countries recognise the importance of

district heating and good policy making in this area. In the last few years, several countries have worked on heat laws or have issued new secondary legislation on how heat is regulated and managed. Today, Estonia, Hungary and Lithuania have heat laws and at least four more transition economies, including Russia and Ukraine, have such laws under preparation.

Countries that want to promote district heating need to have a clear policy. They need not only to integrate district heating into their energy acts and policies, but also to be aware that district heating has a profound impact on economic, environmental, social, housing and privatisation policy.

Policy does make a difference. Clear, coherent policy can have a very positive impact on the development of district heating. Poor policy and lack of co-ordination can damage or destroy the viability of district heating in fairly short order.

Conclusions

The findings of this book lead to eight key conclusions, summarising the recommendations to policy makers.

First, countries should ensure that they get their policy for balancing supply and demand right, whether they use competition or regulation. They should decide clearly on the mechanism to use: regulation or the market. Heat policy or law should address the idea of investment based on least-cost planning, whether that planning occurs in the government or in companies through competitive pressure.

Second, they should encourage demand-driven business practices. Heat policy or law should also promote greater energy efficiency and customer focus, and outline how it will pursue these goals. If a country decides to regulate tariffs, it should recognise that the most important decision point is not the periodic tariff-setting, but rather investment approval. Tariffs should be structured to reward efficiency, not higher costs. And the potential benefits of competition in boosting quality and efficiency should not be ignored.

Third, there are several important prerequisites and necessary conditions common to both approaches. These include establishing social support programmes, eliminating direct heat production subsidies, instituting legislation and mechanisms to enforce good payment discipline, installing meters and controls, developing policies to promote demand-side energy efficiency and removing barriers to wholesale competition.

Fourth, if a country decides to regulate prices, an independent regulator, least-cost planning and full cost recovery are essential. An independent regulator must ensure impartiality and separate tariff setting from short-term political goals. Least-cost planning is a way to give regulators enough information to ensure that costs are as low as possible and to avoid unnecessary investments, while at the same time providing for investment in new capacity and other improvements over the long term. Full cost coverage means that district heating companies will be able to survive in the long term. Policy makers and regulators should avoid cost-plus regulation. In most cases, other regulatory approaches, like price capping with efficiency indexes, benchmarking, or long-term competitive concession agreements can create stronger incentives for improving quality and efficiency. Also, regulations should include clear rules on allocating costs to heat in cogeneration plants, particularly when electricity markets are liberalised.

Fifth, if a government decides to use competition to balance supply and demand, it should make sure that competition between various heat sources is fair. Fair competition means no producer subsidies for any competing form of energy. It also means that companies should be able to take action against customers in arrears, since non-payment creates an implicit subsidy. If a government decides to liberalise one part of the energy sector, it should seriously consider liberalising district heating as well to avoid market imbalances. High levels of poverty can also create a barrier to a balanced market because of the difficulties the poor face in paying the capital costs of switching to a local boiler. Social programmes, rather than producer subsidies, are a better and more comprehensive way to address poverty.

Sixth, governments should take advantage of competitive bids for new supply to lower costs in a regulated context. In larger cities, a more comprehensive approach to wholesale competition can help lower costs and ensure adequate supply long term.

Seventh, transparency is very important regardless of whether the policy for balancing supply and demand is based on competition or regulation. This starts with policy transparency. Draft regulations and laws should be open for public review and discussion before they are adopted. This can enhance the quality of these documents and ensure that they consider the needs of all stakeholders, not just producers. The same holds true for tariff and investment approvals as well as local energy plans. In addition, governments should actively work to stamp out corruption in all sectors, including district heating.

And finally, countries should be proactive in policy-making. They should not be afraid to touch district heating and to work hard to get the policy right.

PART I:
THE STARTING POINT

DISTRICT HEATING: A PRIORITY FOR THE ENVIRONMENT, ENERGY SECURITY AND ECONOMIC DEVELOPMENT

District heating is a critical energy source for countries in transition, and it can provide a cost-effective, environmentally friendly source of heat and power for cities. Yet an inadequate policy framework means that some district heating systems in transition economies face serious financial and technical problems and do not realise their potential.

This book provides policy makers a guide to key district heating issues, first by describing why district heating is worth pursuing, then why new policies are essential in most transition economies, and finally by offering a menu of policy options that countries can adapt to their own needs. Policy makers must constantly perform a sort of political triage in determining which issues need addressing and which are possible to influence in a positive way. The purpose of this publication is to provide the concise, clear information necessary to facilitate such decisions and enhance the understanding of district heating's importance in energy policy.

This chapter starts with a brief introduction to district heating. It then outlines the benefits of district heating in transition economies. This is an important starting point because understanding the long-term benefits of district heating at the national or local level can help give perspective to the challenges district heating faces and provide motivation for overcoming those challenges. The chapter highlights five benefits of district heating: meeting the energy needs of consumers, protecting the environment, enhancing energy security, stimulating economic development and facilitating broader energy reforms.

The book focuses primarily on the former socialist countries of the Soviet Bloc, also known as countries in transition. Map 1 shows the countries concerned. For certain issues the book considers country groups within this region.[1] Other OECD countries are brought into the picture where this helps to highlight important policy or technical differences relevant to the

1. *These groups are: new EU countries and EU applicants (including Hungary, Slovakia, the Czech Republic, Poland, Lithuania, Latvia, Estonia, Romania and Bulgaria); colder countries of the former Soviet Union (Belarus, Kazakhstan, Russia and Ukraine); and southern tier countries of South East Europe, the Caucuses and Central Asia (specifically, the former Yugoslavia, Armenia, Azerbaijan, Georgia, Turkmenistan, Uzbekistan, Kyrgyzstan and Tajikistan).*

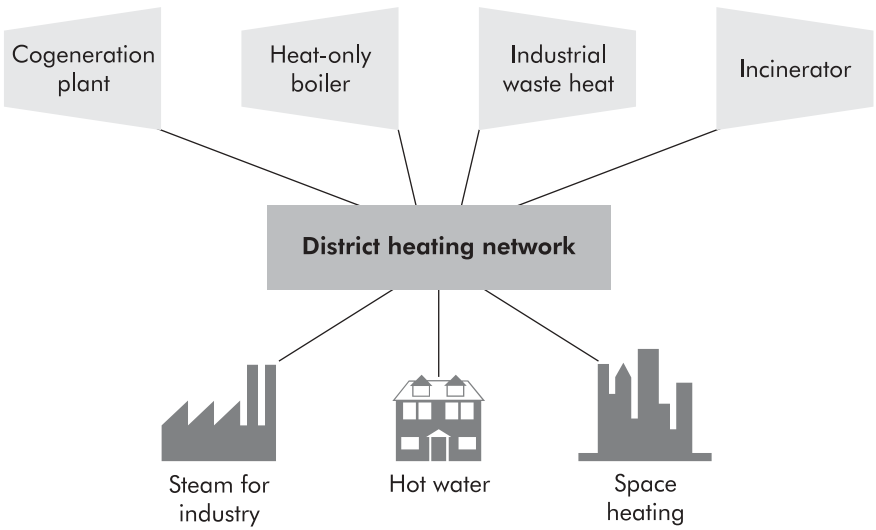
future development of transition countries' district heating sectors. Some of the general issues discussed in the book, such as the environmental benefits of district heating, are also highly relevant to other OECD countries. Likewise, given the breadth of district heating in China, the publication may provide helpful insights to Chinese policy makers on designing optimal district heating policies, though it does not rely on Chinese examples.

An Introduction to District Heating

District heating is a system of centralised heat production and distribution typically for urban areas. A district heating system basically consists of heat production sources, and a network of distribution and return pipes. The heat production sources can produce heat only or simultaneously produce heat and electricity (also known as cogeneration). Industrial processes and municipal waste incineration can also provide waste heat for district heating systems. The heat system can meet residential, commercial and industrial needs for heat. Typically, buildings need space heating and hot water, while industrial companies need steam and hot water. Figure 1.1 depicts the typical supply and demand components of a district heating system.

Figure 1.1

Typical District Heating System



Fuel Inputs, Waste Heat and Renewable Energy

District heating systems can use a variety of fuels and heat sources. Natural gas, coal, fuel oil, and renewable fuels such as biomass and waste products can all serve as fuel inputs for district heating boilers and cogeneration plants, or alternatively district heating systems can recycle industrial waste heat. Some plants can operate on multiple fuels; this is particularly true for heat-only boilers. For example, a heat plant might use biomass with supplemental gas or coal when temperatures are coldest, or natural gas with fuel oil as an emergency fuel. In most cases, district heating systems have multiple heat plants using a combination of fuel and heat sources.

Power generation is the most important source of waste heat; cogeneration captures this heat. Transition economies tend to have a relatively low share of cogeneration in their heat balances compared to the OECD average. This represents a missed opportunity to reduce emissions and cost. In Central Europe, cogeneration accounts for 50 to 75% of total heat production, while in the former Soviet Union (FSU), this figure is just 30 to 50%. Industrial processes like glass production can also be valuable sources of heat for district heating. While there are many examples of industrial waste heat recovery in transition economies, there is a large opportunity for growth.

Most transition economies are expanding their use of renewable energy sources in district heating, though renewables are still a small share of the total. Biomass is the most important of the renewable fuels and it is particularly common in the Baltic Sea region and Belarus. Geothermal district heating is common in several Russian regions, for example the Kurils, Kamchatka and the North Caucasus.

Table 1.1 summarises production by fuel type and region. These data look only at the primary fuel inputs for heat sold, not whether the heat is from cogeneration or industrial processes as countries do not consistently report such waste heat production by fuel.

District Cooling

District cooling is the fastest growing segment of the district energy market worldwide. District cooling is similar to district heating: it provides centrally produced cooling energy to residential and commercial buildings and industry for air-conditioning, refrigeration and industrial processes.[2] District

2. *Correspondence with Mark Spurr, FVB Energy, Inc., Minneapolis, July 2004; Helsinki Energy, www.helsinginergia.fi; DBDH, www.dbdh.dk.*

Table 1.1

Heat Production by Fuel, 2002 (in %)

Region	Gas	Coal	Petroleum Products	Renewable Sources	Other
Transition economy average	61	29	8	2	0
Central Europe average	29	61	8	2	0
FSU average	64	26	8	2	0
South East Europe average	56	14	28	1	0
OECD Europe	36	40	5	17	2
OECD total	41	34	7	17	2

Source: IEA statistics.

energy providers can produce district cooling using hot water or steam from district heating plants to chill water or other carriers via absorption. Thus, absorption technologies and district cooling represent an opportunity for district energy companies to sell heat for cooling purposes when heat demand is low. Chilled water can also be produced at large centralised compressors or using sea water. A single district cooling system can use multiple technologies, for example heat-operated chillers for baseload production and compressors for medium and peak loads. Centralised production of cooling energy is usually more efficient and environmentally friendly than individual cooling options. Additionally, it can allow for more optimal use of installed district heating capacity, including distribution systems in some cases, thus increasing overall system profitability.

That said, district cooling is rare today in transition countries. Most transition economies have a continental climate with cold winters and hot summers, so there is a tremendous potential for expansion. Several district heating systems in Central and Eastern Europe and the Baltics have started to consider district cooling as a viable option, particularly for the commercial sector.[3] Of course, grasping this opportunity will require new investment.

3. *Prague Heat Company, for example, has started to offer district cooling. Source: Euroheat and Power (2003).*

The Case for District Heating: Essential Needs and Major Benefits

District heating accounts for one-third of total energy use in Russia and in several other transition economies.[4] It also supplies up to 70% of homes with heat in Russia and the Baltics, for example. Thus, large numbers of people rely on district heating for their well-being and survival. Understanding the benefits of district heating can help motivate policy reform. It can be very environmentally friendly when well managed. Cogeneration and district heating have reduced global carbon dioxide emissions by 3-4% compared to the alternatives;[5] for comparison, the Kyoto Protocol aims to reduce greenhouse gas emissions in industrialised countries by 5% from 1990 to 2012. District heating can also help improve energy security because of its efficiency, its use of local fuels and its fuel flexibility. Because district heating is such an important part of the economy in transition countries, reforms in this sector can have a significant impact on economic development.

● Meeting Consumers' Energy Needs

District heating is a critical energy source for countries in transition, most of which have long heating seasons because of their cold winters. It accounts for 11% of total final energy consumption in Central Europe and Ukraine, and over 30% in Russia and Belarus. In fact, six of the largest district heating systems in the world are located in Central or Eastern Europe (Table 1.2).

Figure 1.2 shows the importance of district heating in several transition economies and IEA member countries. District heating is either the dominant or a major heat source for residential customers in most transition economies. As most of these countries cannot afford to develop entirely new heat supply systems in the short to medium term, district heating will continue to be vital to meeting their energy needs.

District heating is also an appealing product for consumers. It frees residential users from the expense and complications of maintaining individual boilers. It tends to be safer and more reliable than individual boilers.[6] And it can be highly competitive with other heating sources when

4. *Total energy use here means total final consumption.*
5. *Werner, Spurr and Pout (2002).*
6. *Some countries such as Romania have had numerous fatalities from individual boilers. District heating is more reliable than individual boilers in the West; in transition economies it depends on how the district heating system and individual boilers are maintained.*

Table 1.2

Large District Heating Systems Globally (in petajoules, PJ)

City	Sales
Moscow	281
St. Petersburg	96
Kiev	55
Warsaw	38
Stockholm	33
Seoul	32
Berlin	31
New York City	28
Helsinki	24
Sofia	22
Paris	21
Vienna	18
Munich	16
Prague	15
Copenhagen[7]	15

Notes: Table based on data for the 2001-2002 heating season.; Russia in particular has additional large systems that were not included because of lack of data. Source: Sven Werner, FVB District Energy.

properly managed, as it is in Scandinavia and other OECD regions. For industrial consumers, district heating allows them to buy heat without the capital and operating costs of an on-site plant. In addition, as district cooling grows, district energy systems can provide an inexpensive and efficient alternative to electric air-conditioners. District cooling is expanding across Europe.

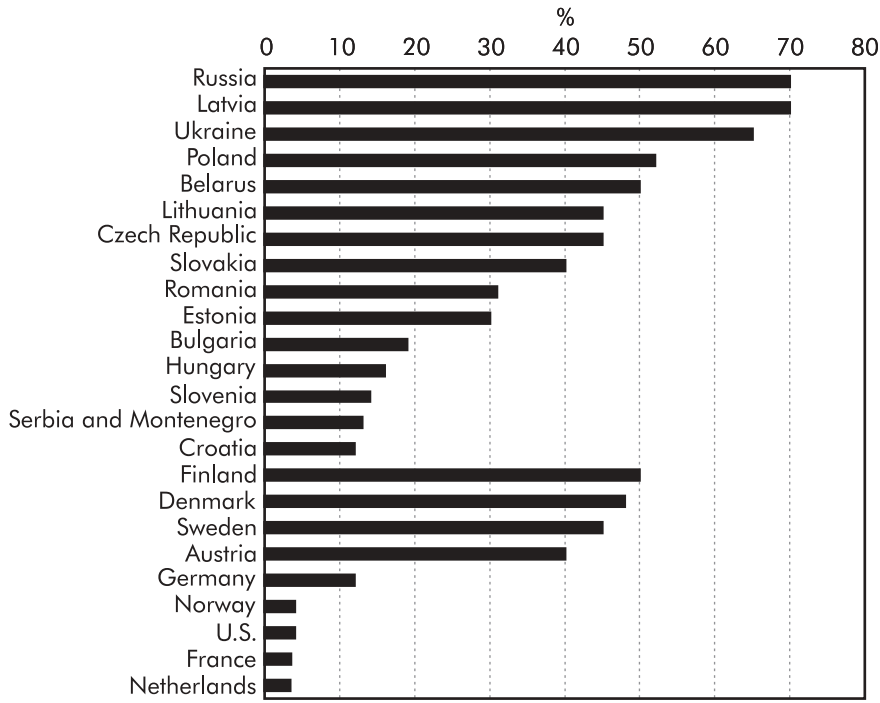
● Protecting the Environment

When well managed, district heating can have significant environmental and economic benefits over building or apartment-level heat and hot water supply. Economies of scale and the efficiency of cogeneration play a key role in creating these benefits.

7. Map 3 shows the district heating system in the larger Copenhagen area.

Figure 1.2

District Heating's Share of the Residential Heating Market



Note: Not all countries collect compatible and regular data on their district heating markets. For the most part, data are shown for 2001, but for some countries only earlier data were available. Sources: Euroheat and Power (2003 and 2001); Gochenour (2001).

Cogeneration, Waste Heat and Other Low-emission Sources of Heat

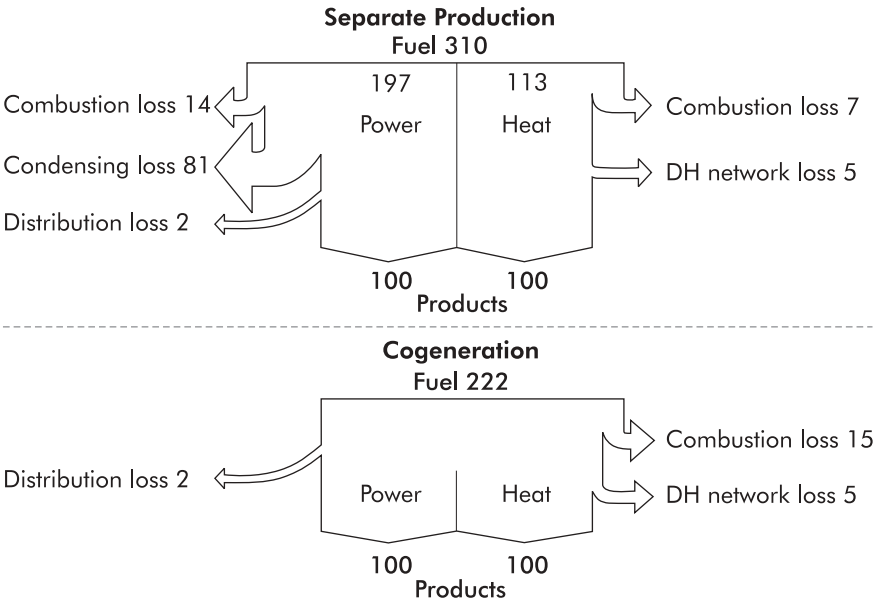
Figure 1.3 describes how cogeneration can significantly improve energy efficiency and thus reduce emissions. Essentially cogeneration reuses the waste heat from power production for district heating or industrial heat requirements.

District heating has a very important environmental advantage over more localised systems because it can use waste heat or burn waste products.[8] In addition to cogeneration, district heating can recover waste heat from industrial processes such as glass and steel making or milk processing. Scandinavian countries have also long used a variety of waste products for

8. Typically it is not economical or feasible to use such low-emission heat sources in building or apartment-level boilers.

Figure 1.3

Comparative Efficiency of Combined Heat and Power vs. Separate Production (units of energy)



Note: Production of 100 units of electric power and heat in this example requires 310 units of fuel at efficiency of 64.5%, when produced by ordinary gas-fired combined-cycle condensing power plants and boiler plants but only 222 units at efficiency of 90%, if produced by a gas-fired combined-cycle CHP plant. Sankey diagram. Source: Nuorkivi (2002).

heat production, ranging from wood chips to municipal solid waste. The Baltic States, Belarus and other transition economies are also increasingly using renewable waste products in district heating.

Put in another way, district heating provides excellent opportunities for carbon mitigation projects under the Kyoto Protocol and the European Emissions Trading Scheme because the emission sources are centralised. This centralisation in turn facilitates ongoing greenhouse gas mitigation because it allows district heating operators to integrate new technologies and sources of waste heat into the network more easily and quickly.

Economies of Scale

District heating plants tend to have higher boiler efficiencies than small, building or apartment-level boilers because of economies of scale. This is true whether the plants are based on cogeneration or heat-only boilers. Small

boilers are increasing in efficiency, but the boilers installed in transition economies to replace district heating tend to have low efficiencies. Likewise, Western experience shows that larger heat plants maintain their efficiency level over years of service because they are more likely to be well maintained than smaller boilers. Maintenance of district heating plants in transition economies is problematic although it has been improving, particularly in Central Europe and the Baltics.

Although district heating distribution losses are an issue in many transition economies, when one considers the main alternatives in Central and Eastern Europe, distribution losses for district heating may actually be lower in some cases. Natural gas distribution losses in some cities of the former Soviet Union exceed 40%, which also creates a major safety hazard.[9] Likewise, electricity transmission and distribution losses are quite high in the same countries that have high district heating distribution losses. In Ukraine, for example, 19.6% of electricity was lost in transmission in 2003.[10]

Local Pollutants

District heating and cogeneration reduce emissions of particulates and other local or regional pollutants such as nitrogen oxides and sulphur dioxide compared to individual heating units because they tend to be much more efficient.[11] In addition, it is usually much less expensive and more practical to reduce or capture emissions at central heating plants than in small boilers in individual homes. District heating also reduces indoor air pollution because it is produced off site. Stockholm provides a good illustration of the local environmental benefits of district heating. The amount of district heating in Stockholm's heat supply increased by a factor of ten from 1965 to 1990; over this same period, local sulphur dioxide and particulate emissions dropped by 95% and 82%, respectively.[12]

Global Implications

District heating can be significantly less polluting than individual heat supply because of these efficiencies, the ability to use low-emission heat sources and opportunities for emissions mitigation at existing sources. An IEA-affiliated study of district heating and cogeneration found that district heating and cogeneration reduce total existing carbon dioxide emissions from fuel combustion by 3-4% globally compared to a world without district heating.[13]

---

9. *It is not uncommon to hear of gas explosions destroying buildings in Russia and Ukraine.*
10. *Ministry of Fuel and Energy of Ukraine (2004).*
11. *Gunnarsdottir et al. (2002).*
12. *While district heating played the largest role in this decline in emissions, the growth of hydro and nuclear energy nationally offset some local emissions as well. Source: Gochenour (2001).*
13. *Werner, Spurr and Pout (2002).*

The challenge for transition economies is to realise the full environmental and efficiency potential of district heating, which will require new policy and management approaches. In this context, it is important not to forget the value of the existing infrastructure. In the United Kingdom, for example, the national government has recently spent £50 million to encourage new district heating schemes because of their environmental and social benefits. The existing heat load (based primarily on heat-only boilers) puts transition economies in an enviable position regarding cogeneration, as lack of centralised heat demand limits the potential for cogeneration in many Western countries.

● Enhancing Energy Security

Energy security is essentially about providing a reliable supply of energy. While most discussions of energy security focus on short-term supply crises, more gradual system collapses can also have a profound impact on reliable supply. When district heating systems break down or foreclose, thousands of households, businesses and public institutions can suffer. Given the market share of most district heating systems in transition economies, it is not feasible or cost-effective in most cases to replace them with individual heating units without major disruption. Low-income families and public institutions such as schools tend to suffer disproportionately when district heating services decline because they cannot afford the initial capital cost of new heating systems.

District heating can make an important contribution to the security issues highlighted in the *Shared Goals* of IEA member countries, which are also relevant to non-member countries. The first goal states that "Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable." District heating can provide significant diversity and flexibility in fuel sources, often within the same plant. This can have important security advantages. As a result, local renewable biomass is becoming increasingly important as a fuel for district heating in transition economies, particularly in the Baltic States. Latvia, for example, has reduced its dependence on imported gas and now produces over 12% of its district heating from renewables. District heating plants can often switch fuels in an emergency.[14]

District heating's benefits closely match the three E's of energy policy contained in the *Shared Goals*: energy security, economic competitiveness and environmental protection. The three pillars of EU energy policy parallel the three E's of IEA's *Shared Goals*; district heating can also help new EU members such as Poland and Latvia meet their EU commitments and energy policy goals.

14. They can switch from natural gas to fuel oil, for example, and they typically maintain a short-term supply of fuel oil on site.

District heating can affect international energy security because of its close link with natural gas in major gas-producing and transit countries.[15] In Russia and Ukraine, where natural gas is the main fuel for district heating, the governments subsidise natural gas prices because of the social difficulty of raising district heating prices. If district heating were more efficient in these countries, such subsidies would not be necessary. Reforming the natural gas systems in these countries would improve international gas security by allowing multiple operators and encouraging needed investment in infrastructure, but this would first require raising domestic gas prices, and hence reforming district heating.

The link between natural gas and district heating is important to energy security in Europe, so it is worth describing step-by-step. In Russia, district heating accounts for about half of total domestic fuel consumption; over 60% of this consumption is gas.[16] District heating tends to be less efficient in Russia and other transition economies than in OECD countries: in transition economies, production and distribution losses are double or triple those in Western Europe.[17] This inefficiency is a significant reason behind the low cost-recovery of district heating tariffs: charging the full price could result in tariffs so high that they harm the economy in the short term. In addition, many Russian families are already paying 30% or more of their take-home pay on utilities. The inefficiency and social welfare issues combined mean that it is difficult to raise district heating tariffs without more comprehensive reform. Instead, natural gas is provided to domestic consumers, including district heating companies, at prices well below those charged for the same gas in Western Europe. This ongoing need for subsidised natural gas in the district heating sector will delay reform of natural gas transportation and distribution in Russia, and hence the development of stronger gas supply security. Gas sector reforms could facilitate exports from the lowest-cost producers, be they oil companies with associated gases or third countries like Turkmenistan, because these producers would likely have greater access to Russian gas pipelines (today such producers have almost no access to gas export pipelines).

At the same time, until natural gas prices rise domestically, there is less incentive to boost investment in gas production (gas output in Russia has in fact dropped since 1991). The end result is less gas available for export and a gas monopoly in Russia. Constrained exports and monopolies mean higher prices for importing consumers and less choice of supply options everywhere,

15. *Another part of the IEA* Shared Goals *emphasises the importance of undistorted energy markets for international energy security.*

16. *Total domestic fuel consumption is different from total final energy consumption because the former does not include nuclear, hydro and most forms of renewable energy. Source: Heat Supply News (2003a); IEA statistics.*

17. *Chapter 2 discusses this in more detail.*

which harms energy security. Reforms both to the district heating sector and the natural gas sector therefore need to go hand in hand. Major gas transit countries, such as Ukraine and Slovakia, have experienced similar market distortions when gas transit revenue cross-subsidises district heating and other forms of domestic gas consumption.

- **Stimulating Economic Development**

  In balancing policy priorities, opportunities for economic development are often a key factor in the political triage that policy makers undertake. At its core, the goal of economic development means improving the welfare of citizens. This can often be achieved through economic growth and job creation. This section discusses several ways in which district heating reforms can have a positive influence on economic development.

  District heating has compelling economic development benefits in that greater efficiency results in a higher gross domestic product (GDP). GDP growth benefits the population as well by increasing standards of living.

  In some transition economies, families pay 30% or more of their take-home pay on utilities, primarily district heating.[18] Such large expenditures for heat put a tremendous burden on families. Reducing this burden by improving the home energy efficiency would allow families to improve their standard of living. Metering is essential to allow families to benefit financially from energy efficiency improvements. Likewise, investments in supply-side energy efficiency would reduce pressure to increase tariffs and, in countries that have already raised tariffs to near cost-recovery levels, energy efficiency improvements usually result in lower tariffs. Yet the initial capital for such investments is often not available.

  Establishing a better policy framework for district heating can facilitate investment in the sector, which is also a form of economic development. And as district heating reforms can have a positive effect on a country's ability to implement broader energy reforms successfully, this would also stimulate investment and economic development.

  In addition, improving the efficiency of district heating, including using waste heat and waste products from industry, will provide new revenue for these industries and boost their competitiveness. For example, a wood processing plant that currently pays to dispose of tons of wood waste could sell this instead to a local district heating company, thus creating a source of revenue

18. *Local salaries are low by international standards, and while energy prices may still be subsidised, they are closer to international levels than salaries. This discrepancy is true throughout much of Russia, Ukraine and northern Kazakhstan, for example.*

that could improve the ability of the plant to invest in its core production and create new jobs. Likewise, a glass manufacturer with large heat losses from its glass ovens could recover this heat and sell it to a district heating company (or use it for internal heating needs). These are not just theoretical examples as thousands of manufacturers in transition economies have already undertaken such steps to recycle their waste for district heating.

● Facilitating Energy Reform

District heating reforms can facilitate broad energy reforms in several ways. First, reforming the district heating sector will make it more sustainable and efficient; effective reforms can and should address the financial, technical, marketing and managerial problems that affect the sector. The results of reforms in several Central European countries such as Hungary and Poland show that wise policies can create the incentives for stable district heating sectors with minimal subsidies. Thus, such reforms can help counter the argument that broader reforms and price increases are not possible because of economic conditions. At times the strongest advocates of slowing such reforms are state-owned companies that benefit from the current system. For example, district heating companies with large distribution losses may be reluctant to allow residents to pay for heat based on actual consumption because this could lower residential bills and force district heating companies to work harder to reduce distribution losses. (At the same time, greater restructuring to ensure that the district heating companies have the funds necessary for such maintenance and upgrades should accompany billing reform.)

Second, district heating is typically a large financial drain on all fuel sectors before a country undertakes reform; this drain then has the effect of sustaining state-owned monopolies, domestic fuel quotas, cross-subsidies and other market distortions. This is still the case today in Russia, Ukraine and Belarus. When district heating companies function well and recover full costs, companies in other portions of the energy sector will also receive higher revenue, which they can reinvest to improve operations or increase production. Fixing the economic problems of the district heating sector through good policy can strengthen the basic viability and sustainability of companies in other energy sectors, which then make comprehensive reforms more feasible. Competition and other market-oriented policies become realistic prospects when financial flows cover costs.

One example of this is the power sector in Russia and Ukraine.[19] Cogeneration plants typically supply heat to local district heating companies, but they may not

19. *The section above on energy security provided another example of how district heating reform could unblock reforms, in that case, natural gas reforms.*

be fully compensated for the heat because of non-payments. At the same time, many countries in the former Soviet Union charge heat production a disproportionately large amount of the combined production costs. This has two effects. First, the power companies run deficits because the expected revenue from district heating is reduced as a result of non-payments. Second, as there is little financial benefit there is little advantage in producing heat from cogeneration under such rules, less efficient heat-only boilers dominate the district heating sectors in both countries, further draining revenue from the power sector. These problems have slowed power sector reforms; specifically, the problems have raised concerns about the potential shock of exposing a financially weak power sector to reform too quickly and about the effect of power sector reform on district heating.[20]

Ukraine has privatised much of its power sector and operates a power pool, but accumulating debts have hampered the effectiveness of the pool. The Ukrainian government has recently rolled back the scale of reform and established a dominant new government power supply company. Russia has announced plans to restructure and break up its main power company RAO-EES Rossii, but has slowed down implementation of these plans on several occasions. Neither country has launched a simultaneous effort to reform district heating on the same scale as these power sector reforms, in part because district heating systems have been transferred to local authorities while the power systems are regulated at a national level and are often managed, at least in part, by majority state-owned enterprises (such as RAO-EES in Russia). Yet the absence of district heating reform will always serve as a brake on power sector reform because of cogeneration. On the positive side, both Ukraine and Russia are now considering draft heat laws that could unleash broader reforms.

Conclusions

District heating can bring many benefits when it is well managed. It is important to consider these benefits when assessing the challenges of the sector. District heating reform can reduce emissions, enhance energy security and promote economic development. These reforms are also an essential component of successful wider energy reforms. Moreover, district heating is such an important source of space heating in transition economies that it only makes sense to have a well-designed policy framework.

20. *District heating provides an alternative to inefficient and costly electrical space heating, which can also have a positive impact on power systems and reforms. In some countries, such as Serbia, electric resistance heating is so prevalent that it dramatically affects the peak power load, which could necessitate large uneconomic investments in new power capacity to serve only brief peaks.*

KEY POLICY CHALLENGES

To capture the full benefits of district heating, policy needs to address the issues that currently slow down progress and undermine the sector's long-term sustainability. This chapter sets out the key policy challenges for the future of district heating in transition countries. They include lack of customer focus, low efficiency, overcapacity leading to an imbalance between supply and demand, poor governance, and an uneven playing field because of poor policy co-ordination. These challenges prevent the emergence of a stronger and more sustainable district heating sector; and they have important implications for investment in the sector. Figure 2.1 shows how these issues are interrelated and create a vicious circle that undermines the finances and competitiveness of district heating companies, jeopardising their long-term sustainability.

In the last ten to fifteen years, countries have dealt differently with these challenges, so today there are significant regional differences. This chapter also looks at how three groups of countries diverge. The groups are 1) the new EU members and applicant countries,[1] 2) "Cold" countries of the former Soviet Union,[2] and 3) South East Europe and southern countries of the former Soviet Union (the Caucasus and Central Asia).[3] It is important to note that this grouping of countries is somewhat arbitrary as it is based as much on climatic characteristics as on district heating policy elements. Some countries discussed within one group may have certain features common to other groups. We briefly mention this when there are significant differences. What is clear is that each country can learn from its neighbours' experiences.

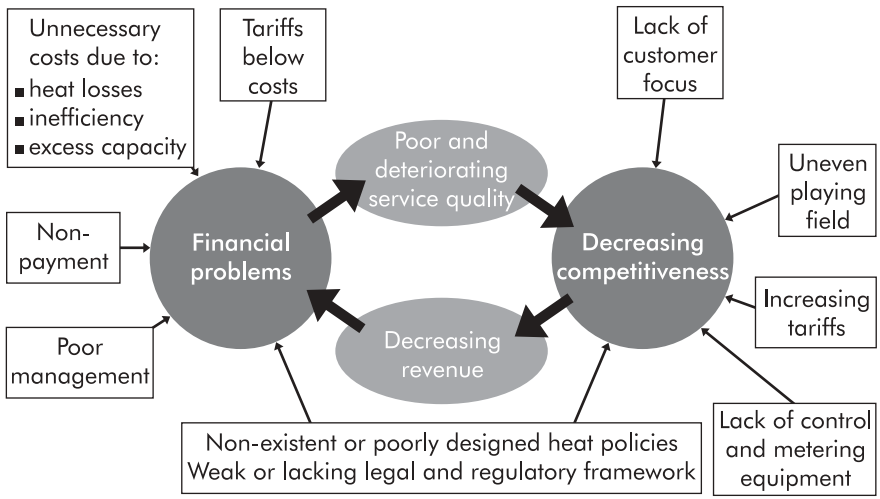
It is also important to consider that this chapter focuses primarily on the difficulties facing district heating and thus is not intended to provide a balanced overall picture of how district heating works in the region. Many times, the challenges focus on the worst cases to better illustrate problems that are significant but in some ways overlooked in the larger region. And of course, many transition economies have already made changes for the better. In the last two years in particular, several transition countries have taken up district heating policy reform with new vigour.

---

1. *The new EU countries discussed here are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. These countries are also referred to as Central Europe and the Baltic States or the Baltics. EU applicant countries are Bulgaria and Romania.*
2. *Belarus, Kazakhstan, Russia and Ukraine.*
3. *The term South East Europe discussed here includes Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Serbia and Montenegro. Albania is also a transition economy in South East Europe, but it has no large district heating systems. The Caucasus and Central Asia include Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.*

Figure 2.1

Key Challenges of District Heating Systems in Transition Economies



Lack of Customer Focus

Healthy business practices are a core issue for the long-term sustainability of district heating in transition countries. However, current business practices in most of them are not driven by customers and their preferences, which is a major weakness of the industry. It does not have to be that way. In Finland and Sweden, where customers can choose between several heat sources, they choose district heating most often because it is convenient and competitively priced, advantages that flow from effective management (as well as an effective policy and regulatory framework).

Production and system operations, not customers, are often the main focus of district heating managers in transition economies. At one level, this occurs because of the poor management skills at companies that do not place customers first, something that would bankrupt most companies in any sector over the long term. Stepping back, it is also clear that the production focus is very much a result of policies that reward the production orientation and give little incentive to improve customer service. For example, a regulatory approach that bases tariffs on costs plus profit with little external review will encourage companies to increase costs and production. Likewise, introducing competition before the conditions are right can lead to district heating companies that abuse monopoly power, again ignoring the importance of customers.

Customers want an inexpensive, simple and reliable product. For industrial consumers, cost is typically the driver, but simplicity is also important in the decision, particularly for small manufacturers or those who want to avoid investments in non-core products. Reliability is essential. District heating's multiple boilers can be more reliable than a single heat-only boiler onsite. In well-run district heating systems, even when there is a change in demand, product quality remains high so industrial processes work smoothly. Residential consumers, on the other hand, tend to put their main emphasis on quality. They want to be able to control the temperature in their home and to choose when heat is available, rather than being restricted to predetermined heating seasons. They also want the ability to resolve service or billing problems quickly and easily. Price plays a role primarily when there are large differentials between heat sources: for example, when gas prices remain subsidised while heat prices rise, or when district heating utilities significantly overcharge to cover their inefficiency (when price differentials are small, switching may be unappealing financially because of the capital investment required).

There are numerous examples of poor customer focus. For example, in the Czech Republic and much of Central Europe, investments in the 1990s were apt to focus on renovating outdated production assets rather than on the service improvements that customers wanted. It is true that today's systems are modern and more efficient, yet system operators are now planning few new investments because sales have dropped as customers have switched to other heat sources. Repaying these investments has put upward pressure on prices and has reduced profitability. Lack of metering can make this worse because companies do not have the data to understand their customers' needs. In Russia, most district heating companies stay at an arm's length from their customers: they do not have direct contracts or contacts with consumers. In most cases, they simply produce heat and charge intermediate housing service organisations on the basis of the total amount of housing stock connected. Industrial customers fare somewhat better in that they have direct contacts with the district heating company and can have a greater influence over planned investments, but keeping prices low may not be the first priority of the district heating company, particularly if it has approval from the regulator for a certain tariff level. Once the tariffs are approved, the district heating company has little incentive to reduce costs, but in the long run, this reduces competitiveness. Customers can and do switch to other heat sources in most cities.

Lack of customer focus is probably the single biggest weakness in district heating systems over the long term. The danger is greatest where customers

are switching en masse to other forms of heating, as in many cities in Romania and the Caucasus.[4] However, the same trend is occurring at a slower pace in virtually every transition economy. This decline could be a temporary phenomenon as customers exercise their relatively new choices and the market rebalances to reach a new equilibrium, but it could also lead to a loss of consumer choice that is difficult to reverse or even irreversible. Ten to fifteen years into the transition, one has to ask if the trend will change without more dramatic policy change to encourage more effective business models. Governments can proactively work to design policy that seeks to capture the benefits of district heating. Policy does matter in this respect and the absence of an explicit policy does not eliminate the effect of the overall policy regime.

This requires a cultural shift from a production model to a customer-focused governance model in district heating companies, regulatory bodies and government agencies. Such a shift will ensure that customers receive a quality service, which will likely increase their willingness to support and pay for district heating services. It will also allow district heating companies to better match supply and demand while limiting costs.

Low Efficiency

District heating in transition economies tends to be less efficient than in Western Europe, North America and OECD Asia. Technical design, poor maintenance, worn out equipment, over dimensioned systems, lack of controls and insufficient insulation on heat pipelines all contribute to the inefficiency. In Central Europe, the heavy reliance on coal also tends to be inefficient, though more and more systems are switching to burning natural gas or biomass.

In countries that followed the "Soviet" model of economic development, heat supply was highly centralised, rather like electricity and gas supply. The existing district heating systems of most of these countries were based on Soviet technology and influence. Box 2.1 sets out the key technical characteristics of these systems.

4. *Unfair gas competition arose through gas subsidies that either still exist or were only recently removed. These subsidies had a significant influence on the decline in Romanian demand, though the situation was exacerbated by poor service. Once demand drops to a critical threshold, district heating systems may have difficulty recovering financially even if the initial market imbalance (like subsidies) is removed.*

Box 2.1

District Heating Systems in Transition Economies: Inefficient Design Features[5]

Most district heating networks in transition economies operate under a constant flow regime, in which heat supply (and consequently the consumption level) is adjusted by manually varying the flow temperature at heat-producing plants, typically in the range of 70-130°C. Heat supply to individual buildings depends on the hydraulic balance of the distribution network. For this reason, heat is often distributed unevenly, which results in indoor temperatures that are too high or too low. Usually with a constant flow regime, only a single source of heat can supply each section of a distribution system, which makes it difficult to dispatch heat based on least cost alone.

The distribution pipes generally transport hot water or steam to substations, which then distribute heat and hot water to individual consumers. Systems in the former Soviet Union are typically based on steam, which is a less efficient way to provide space heating than hot water. Substations are either located within the individual buildings (which is common in Western Europe), or, as in much of the former East Bloc, substations serve a group of buildings. These secondary networks, from the substations to individual buildings, often incur high heat losses, and their operational lifetime is short.

Within buildings, heating pipes supplying radiators are usually vertically arranged one-pipe systems. In this type of system, the hot water flows though radiators, which are vertically connected to each other. Since all apartments are interconnected, heat control at the apartment level is not feasible. Several vertical pipes pass through each apartment. Metering each apartment individually would require multiple meters, which is not cost-effective, but it is possible to estimate consumption with cost allocators. Another consequence of this vertical arrangement is that the temperature at each radiator is lower than at the previous one. In Western Europe, two-pipe systems are more common, and pipes are usually arranged horizontally, so that each apartment is supplied from one loop. Retrofitting heating pipes in an existing building is very costly and rarely pays for itself, but new buildings can incorporate more efficient systems.

Space heating in transition countries is available only during a predetermined heating season, which generally lasts from about October to April. Hot water is provided year-round, except for a 2 to 8 week period in summer, when the system is closed down for repair and maintenance. This is one cause for customer dissatisfaction. In Western Europe both space heating and domestic hot water are available year-round.

5. *Lampietti and Meyer (2002); Meyer and Mostert (2000).*

This technological and planning legacy, together with the historically low cost of energy supplies, gave little incentive to introduce modern energy efficiency technologies. The degree of efficiency does vary from country to country and between regions. For example, the new EU member countries[6] have modernised many district heating systems in recent years using Western technologies.

Nonetheless, there is room for improvement everywhere. The World Bank estimates that typical cogeneration plant efficiencies are around 70-75% in Eastern Europe, compared to 80-90% in Western Europe.[7] The efficiency of older heat-only boilers is estimated at 60-80%. Boiler efficiency levels can be increased to 85% by introducing modern automation and control systems, replacing burners and cleaning boiler surfaces.

Heat losses in production, distribution and end use in transition economies are also high compared to Western Europe as illustrated in Table 2.1. Cumulative heat losses from production through transportation to end use are estimated to be between 35 and 77% in Central and Eastern Europe and the former Soviet Union. In many cases, real heat losses are difficult to estimate because metering equipment is inadequate or non-existent. Heat losses are generally higher in summer, when the district heating systems produce only hot water and thus operate at a lower percentage of their capacity. In winter they produce heat for both hot water and space heating. For example, estimated losses in Poland are 10 to 15% in winter, but in summer they can reach 50%.[8] At the same time, it is important to see these losses in context: the efficiency of natural gas distribution systems can also be very low, with losses of up to 40% in some cities.

Heat transmission and distribution pipes[9] suffer from external and internal corrosion, leading to frequent leakages. Heat losses are aggravated by inadequate pipe insulation, which is often not thick enough or of poor quality. Low-quality heat transmission and distribution pipes increase the cost of heat transportation. In Kazakhstan, for instance, heat transportation costs can be twice as large a percentage of total production costs as in Western Europe.[10]

Heat losses within buildings are much higher than in Western Europe and North America because of permeable windows and doors, uneven heat supply within buildings, non-existent or insufficient insulation, low thermal

6. *The transition economies that joined the European Union in 2004 are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia and Slovakia.*

7. *Gochenour (2001).*

8. *SYNERGY (2001).*

9. *All district heating systems have distribution pipes. Larger systems also have transmission pipes, which transport heat over greater distances and may be of larger size.*

10. *Correspondence with S. Katyshev, the Kazakhstan Electricity Grid Operating Company (KEGOC).*

Table 2.1

Performance Indicators for District Heating Distribution Systems

	Unit	Central and Eastern Europe and the Former Soviet Union	Western Europe
Customer heat consumption (annual energy use/ space heated)	kWh/m^3	70 to 90	45 to 50
Distribution losses	% of heat supply	15 to 25	5 to 10
Change of circulation water (annual make-up water volume/network water volume)	Refills per year	10 to 30	1 to 5
Production losses	% of fuel energy	15 to 40	5 to 15

Source: Meyer and Mostert (2000).

insulation properties of walls, poorly designed ventilation and other factors. Heat losses within buildings in Eastern Europe are usually 25 to 40% higher than the design values, according to World Bank estimates,[11] and standards for design values are typically much less stringent than in the West. On the other hand, improving energy efficiency in buildings is a stated priority in almost all transition economies. Building heat losses are likely to decrease in the future as residents and building owners invest in energy efficiency. District heating companies need to take this fact into consideration in order to avoid unnecessary investments.

Progress in refurbishing and modernising older systems varies significantly from country to country. Many countries, particularly those in Central Europe and the Baltics, have implemented programmes to rehabilitate district heating with private financing or support from international funding organisations such as the World Bank or the European Bank for Reconstruction and Development (EBRD). In most countries, district heating systems still need huge investments to ensure continued operation and to remain competitive with other heat sources. The World Bank estimates that it would cost $25 billion over a five to seven-year period to improve energy efficiency in district heating by 20% in eleven transition

11. *Gochenour (2001).*

countries for which data were available.[12] Total investment requirements would be even higher if remaining transition countries were included.

Overcapacity and the Imbalance between Supply and Demand

District heating systems in transition economies are, by and large, overcapacity. In other words, they have a supply infrastructure that is larger than necessary to meet current demand.[13] This section takes a closer look at the sources of this overcapacity and the implications for the sector's sustainability. The balance of supply and demand is quite important: when systems have excess capacity, their costs are greater. Losses are higher when systems are operated at partial capacity and maintaining a large system costs more than maintaining a small one. Such systems also have high fixed costs, which makes it increasingly difficult to lower costs when demand decreases.

They also tend to be less flexible and reliable. Balancing supply and demand on a daily basis in many systems means reading the weather forecast for the next day and manually setting the burners at the desired production level. If this rough estimate is greater or smaller than actual demand, apartments are colder or hotter than what production managers plan. This lack of flexibility can reduce reliability compared to more modular systems with several smaller boilers and controls. Impaired flexibility and reliability, of course, not only make district heating systems more difficult and costly to run, they also reduce customer satisfaction. Current policy in transition economies often rewards excess capacity by allowing district heating companies to earn more profit when capacity and costs are higher.

● Declining Demand

Demand for district heating has actually declined in most countries in transition since 1990 (see Table 2.2). Russia, for example, saw a 31% drop in district heating consumption from 1993 to 2002. The majority of the decline in transition economies occurred from 1990 to 1994, and many countries have actually seen their heat demand increase in recent years. Yet few systems have taken the net decline in demand into account in their future

12. *Russia, Ukraine, Romania, Poland, the Czech Republic, Hungary, Lithuania, Estonia, Bulgaria, Croatia and Slovenia. Source: Gochenour (2001).*

13. *Overcapacity is a problem that mainly affects transition countries. While individual systems in the West may have overcapacity, the same general problem does not exist.*

Table 2.2

Total Heat Production in Selected Transition Economies, 1990 to 2002 (in terajoules)

	1990	1995	2000	2002
Poland	739,569	420,809	340,684	351,434
Hungary	73,854	60,992	68,864	61,703
Lithuania	97,746	64,422	43,195	43,965
Latvia	85,179*	43,472	31,867	33,048
Estonia	91,925	30,625	26,579	26,688
Russia	9,466,604**	8,052,800	6,486,844	6,297,064
Ukraine* **	1,722,022	1,076,883	794,676	728,294
Moldova* **	28,642	14,881	7,530	6,543
Kazakhstan* **	527	347	274	304

*Notes: * 1991 data; ** 1993 data; *** Statistical accounts that the IEA received from Moldova, Ukraine and Kazakhstan are incomplete, so the data are partially based on estimates. Source: IEA statistics*

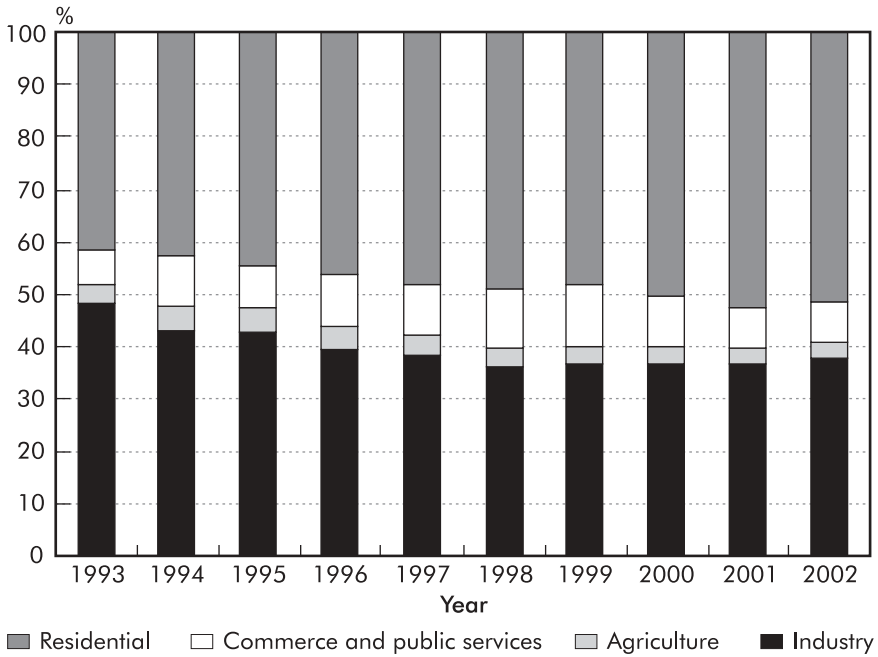
planning. Electricity, gas and other energy sectors in transition economies have also experienced declining demand since the late 1980s or early 1990s. In contrast, district heating demand has actually grown in Western Europe and most of the rest of the world in the last 15 years.[14]

The decline in demand for heat is primarily a result of three trends: falling consumption levels in the industrial and residential sectors, and forced drops in consumption because of supply disruptions. The decline in industrial demand is linked to broader economic and industrial trends. Manufacturers that buy district heating for their process needs find that they need and can afford less heat because they are selling and producing less themselves. Reports from Moldova, for example, show that a decrease in industrial heat consumption initiated a sharp decline in district heat production, which then led to a long-term financial crisis among district heating companies.[15] Industrial consumption of district heat is unlikely to rebound to pre-transition levels in many cases because the structure of industrial production has shifted from heavy to light industries and energy efficiency is improving, even at existing plants. As a result of the decline in industrial consumption,

14. *Euroheat and Power (2003).*
15. *Kalkum and Rajkiewicz (2002).*

Figure 2.2

The Changing Structure of Heat Consumption in Russia, 1993 to 2002



Source: IEA statistics.

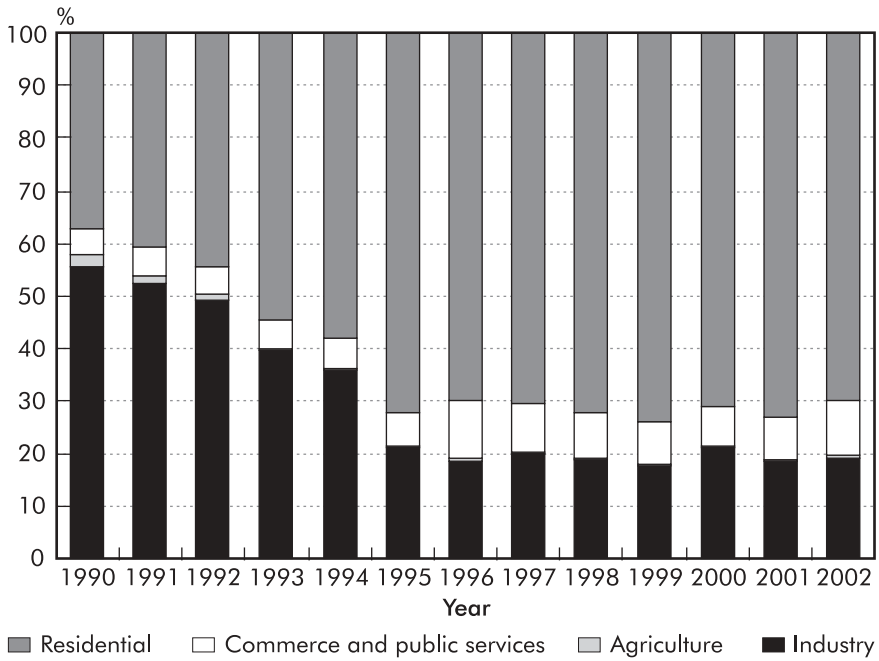
industry's share in total heat consumption has decreased in many countries, while the residential sector has taken over as the main source of heat demand. In Russia and Ukraine, on the other hand, industrial heat purchases have followed industrial output, so industry's share of heat consumption has not dropped dramatically. Figures 2.2 and 2.3 compare the changing structure of heat consumption in Russia and Poland over the last decade.

The second trend is the decline in residential district heating demand, which has occurred because of energy efficiency improvements in buildings, a shift to gas or electric heating and decreases in heat consumption to save money where metering exists. In general, this decline is more prevalent in Central Europe and the Baltics. For example, residential heat consumption has declined by up to 40% in the Czech Republic.[16] Residential heat consumption may in fact decline further as a result of increasing investments in energy efficiency. When economies grow, however, the expanding residential

16. SEVEn (2003).

Figure 2.3

The Changing Structure of Heat Consumption in Poland, 1990 to 2002



Source: IEA Statistics

construction and the growing service sector need more energy, including heat. Demand for district heat in the service and residential sectors has already started increasing in a few countries such as Hungary, Croatia and Ukraine. Preliminary Ukrainian statistics for 2003 show an increase in total heat demand of over 9%. In Lithuania, heat sales have grown by 1% between 2000 and 2002, so the trends seem to be changing, at least in some countries that have been more proactive about reform in recent years.

Supply constraints are the third reason for the decline in demand. In many cases, the disruptions occur because district heating systems cannot afford or cannot obtain the fuel, but in some cases, unscrupulous plant managers may be selling subsidised fuel for a profit. Disruptions have reached critical proportions in some eastern Siberian towns where residents go without heat for long periods in the winter; fuel supplies do not arrive because of non-payment. Physical deliveries are also a problem in areas with political tensions or war. In Central Asia, the Caucasus and South East Europe, the decline in district heating

production has been driven by the physical deterioration of district heating systems. It is hard to assess the precise impact of supply disruptions on total consumption. Disruptions, however, are important enough that they may be generating a permanent change in underlying demand: even if companies were to acquire more reliable equipment or access to fuel, they might find demand levels remaining lower than before the disruptions as customer have invested in other heating solutions in the interim.

The problem of excess system capacity can be exacerbated by new investments. In Bulgaria, for example, heat capacity grew by 32% from 1999 to 2001 but total demand actually dropped over the same period.[17] In some cases, growth in capacity takes place when district heating companies make ill-planned investments, but in other cases, capacity expands through an increase in industrial heat capacity. Industrial companies may increase their heat capacity and reduce consumption of purchased district heating, or they may build new heat capacity for their own needs when they transfer heat generation assets to municipalities (see Box 2.2).

Box 2.2

Enterprise Housing Divestiture

Under central planning, the Soviet government relied on large industrial companies to finance and manage housing and other services for the local population. Enterprises built large apartment blocks and links between the buildings and utility networks. In some cases, they were also responsible for producing heat, hot water and electricity. During Russia's mass privatisation programme of 1992-94, ownership of the enterprise housing stock was transferred to municipal governments, as enterprises themselves were privatised.[18] Many of these companies transferred not only their housing stock, but also their heat generation and transmission assets. Shedding their responsibility for housing services allowed these companies to focus on their primary activities. In some cases they built new heat plants for their own use so as not to be dependent on an external heat supplier. In such situations, their industrial boilers operate at full capacity or close to it, while the district heating plants have much excess capacity.

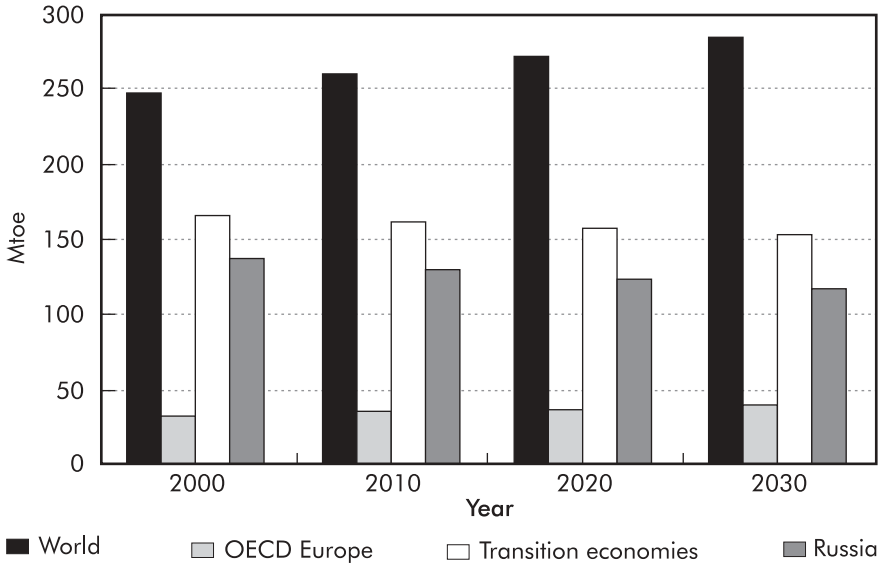
Whether demand continues to decline or not depends very much on policy. Figure 2.4 shows projections for heat demand in the absence of new policy. Industrial heat demand is projected to decline by 18% in Russia and 15% in

17. Euroheat and Power (2003).

18. For more information see FER (2004).

Figure 2.4

Heat Demand Projections without New Policy (Reference Scenario)



Source: IEA (2002).

other transition economies between 2000 and 2030, while residential and other types of heat demand would decline by 13% and 5%, respectively. These projections are based on the business-as-usual scenario, with no new heat laws or policies after 2002 and no major changes in tariff regimes, subsidies, levels of competition or rates of metering and non-payment. In other words, this is what is likely to happen without active reform. Policy reform can have a very important influence on these projections, although economic development and market conditions will also play a major role.

● Problems of Imbalance

The implications of mismatching supply and demand are significant. Problems can arise in the capacity or the actual production of heat. If capacity is excessive, heat production and supply will require more fuel than is necessary because boilers and other system components are not as efficient when operated at partial capacity. Overcapacity also makes it more expensive to respond to demand changes because fixed costs are a higher share of total costs; this is particularly true when only a few large boilers supply the system.

Flexible systems with good controls and numerous boilers of varying sizes can maintain high efficiency even when demand is low because operators turn off boilers instead of running large boilers at partial capacity.

When district heating companies have excess capacity, they have added pressure to sell more to justify and pay for these assets, and likewise they have less incentive to promote energy conservation, either in their own facilities or at end-users'. Generating more heat will increase their revenue because they can show regulators the fuel costs. Profit margins in district heating companies are often predetermined percentages of costs, so the higher the costs, the more the profit. Thus, investments in repairing leaks and in energy efficiency more broadly, even though highly profitable from a system perspective, are less enticing to a company that has excess capacity. District heating companies with excess capacity may also resist moves to give their customers more control over their heat supply, such as allowing them to install meters or flow regulators. The cost of this inefficient generation and wasted energy creates a financial drain on district heating companies and municipalities and puts upward pressure on tariffs. Wasted energy also unnecessarily pollutes the environment.

Poor Governance

Information on poor governance tends to be anecdotal and difficult to confirm, but most experts working in the field can give examples of it. The extent of corruption varies from country to country and city to city. Overall, it is a significant but smaller problem for the viability of district heating in the long term than the lack of customer focus and other challenges described above. It is important to consider, however, that poor governance can also distance customers by making them feel that they are being treated unfairly. A few examples of poor governance include:

- District heating companies that charge customers for more heat than is delivered and resist efforts to meter heating because this would reveal how much heat is actually provided.[19]
- District heating companies that overbill municipalities for heat or production subsidies.
- Regulators who allow district heating monopolies to wield excessive influence in the tariff- setting process. This happens most commonly when

19. Mark Velody, district heating expert working in Romania. Unpublished paper (2004).

municipalities are both tariff regulators and district heating owners, but it can happen in other contexts as well. The key issue is that the interests of protecting a monopoly system take priority over the interests of consumers.

- Extremely complex subsidy schemes that make the transfer and use of funding opaque and hence create opportunities for diversion of funds.

This list is not exhaustive but aims to give a flavour of the way conflicts of interest can arise. Some of these practices are limited to specific countries, others are more widespread. Many are perfectly legal, which again underlines the importance of well-designed policy. Regardless of the motivations, companies, regulators and policy makers that engage in or support such practices harm the sector and specific district heating companies in the long run by making them less competitive and by alienating the customers on which the systems depend.

An Uneven Playing Field and Uncoordinated Policy

Electricity, heat, gas, coal and other energy sectors are undergoing reform in all transition economies, often in parallel with housing sector reform. Changes in one sector inevitably have major impacts on other sectors. Implementation details of gas or electricity reform, however, do not always reflect the possible impact on district heating. The World Bank concludes that "any effort to restructure (transition) countries' energy sector must take into account the interaction between the power sector and the heat sector."[20] This is equally relevant to gas. Participants in EU workshops on renewing district heating in the Baltic region have concluded that "partial liberalisation of the energy market in favour of electricity and gas, in the absence of counterbalancing regulatory measures to ensure the sustainable development of the district heating sector, has a very negative effect on the latter."[21]

For example, in a liberalised electricity market where district heating is still regulated, valuing cogeneration can become a challenge. Electricity companies that own cogeneration plants seek to sell heat at high prices in order to reduce their electricity prices, thus gaining a competitive edge on the electricity market (see Chapter 4). Effectively, they want to cross-subsidise power from heat sales. Well-designed regulations are necessary to ensure that both products of the cogeneration plants – heat and electricity – can be competitive in their respective markets.

20. Meyer and Mostert (2000).

21. SYNERGY (2001).

Gas subsidies have helped gas distribution companies to gain an increasing share of the residential heat market. Such subsidies create an uneven playing field, sometimes even for years after they are removed, because customers do not want to lose their capital investment in the new system once they switch to gas. District heating companies can rapidly run into financial difficulties if large numbers of customers disconnect. The link between the gas and district heating sectors is also very strong because gas is the principal fuel for district heating in many transition countries. For example, gas accounted for nearly 64% of total district heat production in Russia, 65% in Lithuania, over 81% in Belarus and 93.5% in Moldova in 2002.[22] A significant increase in gas prices will inevitably raise district heat production costs in systems where gas is the dominant fuel. When a district heating company already has cash flow problems due to non-payment or tariffs that do not cover full costs, such an increase in fuel costs may seriously harm the company's future solvency. This whole set of issues should be taken into account while proceeding with gas sector reform. A policy that better co-ordinates subsidies and market opening would foster fairer competition.

All these issues demonstrate that there is a clear need to put district heating on the national policy agenda and integrate it into the broader energy policy (see Chapter 9).

The Implications for Finances and Competitiveness

The challenges discussed above are interrelated and create a vicious circle that undermines the finances and competitiveness of district heating companies. Other issues such as the inadequate regulatory framework, tariffs below costs and poor payment discipline also contribute to this vicious circle, as Figure 2.1 illustrates. Well-planned policy reform, on the other hand, can break the vicious circle.

Many district heating companies in transition economies have financial difficulties or had them in the past before reform. Management and regulatory problems are usually the main reason: heat tariffs below cost, non-payment and poor company administration. Technical problems also play an important role, in particular excess capacity and high heat losses due to outdated technologies and obsolete equipment. At the same time, a lack of financial resources prevents district heating companies from improving the technical performance of their systems. Some systems only survive through subsidies and would probably go

22. IEA statistics.

bankrupt without them. Indeed in much of Central Asia, the Caucasus and South East Europe, many companies have already gone bankrupt. For instance, more than 70 of Romania's 250 district heating companies have collapsed.[23] Systems in Central Europe and the Baltics are generally better off, but some still have cash flow or marketing problems that may put them at risk in the future.

The financial difficulties of district heating companies may lead to decreasing competitiveness because of the lack of resources to invest in essential maintenance, modernisation and hence the improvement of service quality. Deteriorating equipment has forced many companies to reduce their heating season or area of service, if not to close down completely. The quality of heat and hot water supply is often low, particularly in South East Europe and parts of the former Soviet Union. For example, the average temperature in Moldovan apartments was reported to be 15°C in the winter of 1999-2000, dropping even to 10°C on the coldest days.[24] There are also frequent leaks and breakdowns. All these factors breed dissatisfaction and encourage consumers to seek other sources of heat. When customers switch to other heat sources, it raises costs and lowers revenues for district heating companies, which further undermines their financial situation.

Thus while poor customer focus and management can aggravate problems with competitiveness, underlying technical factors are also at work in many transition countries. District heating companies that operate large, Soviet-designed systems typically cannot reduce their costs in direct proportion to the reduction in heat demand over the short to medium term. Instead of leading to fuel savings, lower demand leads to generation of excess heat, which is dissipated through heat losses somewhere in the system. Costs remain high and cannot be quickly reduced, so there is pressure to raise tariffs which results in a further loss of customers. Bulgaria, for example, experienced such a situation from 1996 to 1999.

Partial disconnection from district heating within residential buildings can create a "free-rider" problem. Disconnected apartments absorb heat from neighbouring apartments that remain connected to the system. The remaining customers therefore pay higher bills if they are metered or if the supplier raises tariffs to reflect higher costs per user. This may induce these customers to switch as well. If meters are not installed, the district heating company bears the cost of heat technically absorbed by disconnected customers.[25] On the other hand, this problem is not unique to district heating.

---

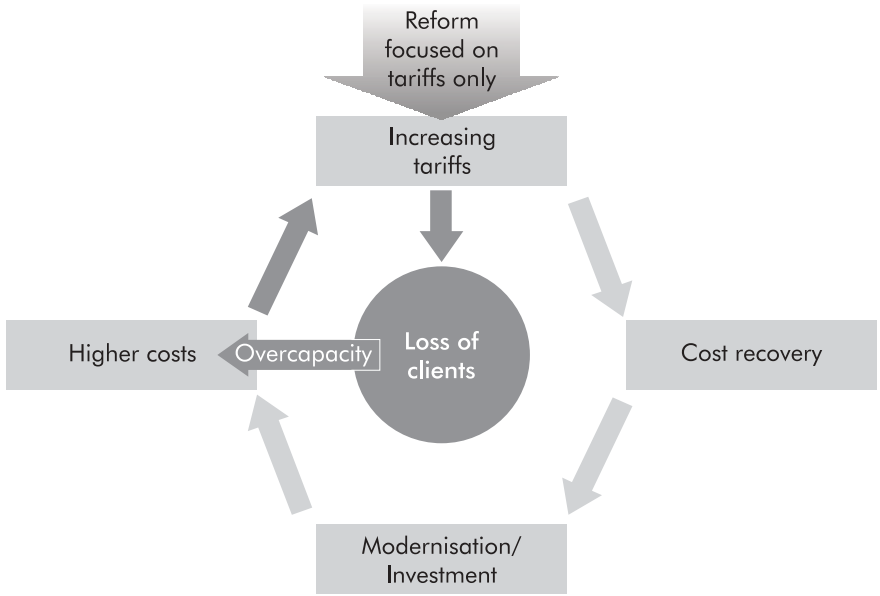
23. Velody (2004).

24. Kalkum and Rajkiewicz (2002).

25. Lampietti and Meyer (2002).

Figure 2.5

Unsustainable Tariff Growth



Reforms, particularly for tariffs, are needed to improve company finances and break the vicious circle of deteriorating competitiveness. Yet policy makers need to design the reforms very carefully if they are not to backfire and make matters worse, as Figure 2.5 illustrates. Higher tariffs allowing full cost recovery are essential to put district heating companies on a firmer financial footing, but they can alienate customers if service quality remains poor.

Countries such as Poland, the Czech Republic, Hungary and the Baltic States have made substantial progress in raising district heating tariffs to cover full costs. In many cases, this has led to significant increases in heat prices. Tariff increases have allowed companies to invest in the refurbishment and modernisation of their systems. Yet tariff increases have led to further losses of district heating market share in some cases. If an improvement in service quality lags behind price rises, some consumers vote with their feet and switch to other heating sources.

Well-designed tariff reforms linked to a rapid improvement in service quality are therefore critical. Another key issue is that district heating companies need to have a realistic view of their actual and potential market before launching into costly and potentially excessive investments which may create

or worsen overcapacity. If they improve production performance without focusing on demand and customer needs, they may make inappropriate investments, which can add to their financial burden by driving up costs. Tariffs may need to be raised to cover the higher costs, driving away even more customers and aggravating the vicious circle rather than breaking through it. When district heating market share shrinks, costs per unit rise, exacerbating the problem of customer switching.[26]

Finances and Competitiveness: the Picture by Region

This section discusses regional differences regarding these interrelated issues: financial problems that lead to underinvestment and system deterioration, on the one hand, and decreasing competitiveness that reduces demand and exacerbates corporate financial woes, on the other.

● New European Union Members and Applicant Countries

The new EU members and applicant countries form a group for two reasons. First, the district heating sectors in most of these countries have experienced similar trends over the last decade. Second, EU membership puts or will put certain obligations on these countries to reform their energy and housing sectors. Of particular note, the European Cogeneration Directive will oblige member states to support cogeneration (see Chapter 8).

Technical Condition, Investment and Financing

Generally, Central Europe and the Baltics have managed to maintain their district heating systems in relatively good operational condition compared to other transition economies. International financial institutions such as the World Bank or the EBRD have financed large programmes to repair and modernise district heating systems. Most of these countries have put in place targeted funds or support schemes to facilitate financing of municipal infrastructure (see Chapter 6). The successful implementation of these programmes has encouraged commercial banks and private investors to provide lending and equity for district heating rehabilitation projects. The benefits of this growing investment have been supported by broader economic and institutional reforms in these countries, as well as an improvement in the general investment climate.

26. Lampietti and Meyer (2002).

Reforms in the district heating sector have also had a positive impact on the financial health of companies. Subsidies and cross-subsidies in most countries have been removed or are being phased out, and tariffs generally cover costs. Non-payment is no longer a problem. Private-sector participation is growing, which is important for modernising district heating systems and improving service quality.

Competitiveness

While industrial consumption of district heating has declined in practically all transition economies since the early 1990s, EU applicant countries and some new EU members have also seen a decline in district heating's share of the residential market. Many households have switched in recent years from district heating to other heat options, usually individual or building-level gas boilers. Countries where the rate of consumer switching has been particularly high include Romania, Bulgaria, Estonia and Latvia. For example, up to 30% of residential consumers have disconnected from district heating in Bulgaria. In the Bulgarian city of Pernik, nearly half of residential consumers had switched from district heating by 1999.[27] In Romanian counties, the average disconnection rate has been between 5% and 100% and the rate exceeded 30% in some 23 of them.[28] On the other hand, in Hungary, Lithuania and a few other countries, the share of district heating in the residential heat market has stabilised over the last few years. Moreover, the Hungarian commercial sector has seen growing demand for district heating.[29]

The major competitors for district heating systems are individual or building-level natural gas boilers. Other electricity and fuels such as wood, oil, coal and fuel oil are also used for heating in several countries. For example, electricity accounts for 24% of the residential heat market in Bulgaria.[30]

In many Central and Eastern European countries and the Baltic States, gas companies were successful in making a rapid entry into the residential heat markets in the 1990s because gas prices were kept low through state control.[31] Following policy changes and reform of the gas sector, gas companies raised their prices, but many households had by then already shifted to natural gas. Switching back to district heating is not easy once an investment has been made in another heat source, and district heating connections have been taken out.

---

27. Lampietti and Meyer (2002); and Meyer and Mostert (2000).

28. Velody (2004).

29. Euroheat and Power (2003).

30. Euroheat and Power (2003).

31. SYNERGY (2001).

One of the main challenges for district heating companies in this region is to maintain or regain their competitiveness with other heat sources. Some countries, particularly Poland and the Czech Republic, have valuable experience in transforming their district heating companies into commercial enterprises that operate on business principles. It is interesting to note that the residential district heating market share has not declined as seriously in Poland and the Czech Republic as in Bulgaria or Romania, where district heating companies have had more difficulty in developing a market-based approach.

- **Belarus, Kazakhstan, Russia and Ukraine**

These four countries are grouped together because of their very cold climate and because district heating plays a particularly important role in energy and heat consumption. District heating in these countries accounts for a large share of total residential heat supply: over 70% in Russia, 66% in Ukraine and approximately 50% in Belarus and Kazakhstan. In Russia, about one-third of final energy consumption is for heating. The availability of reliable and affordable heat supply is extremely important both for social and political reasons because of the severe climate. Heat supply interruptions in winter may lead to death,[32] so an effective policy for heat supply is a priority for policy makers in these countries. Despite their similar climate conditions, significant differences exist between the four countries regarding district heating policy and the pace of reform.

Technical Condition, Investment and Financing

Many district heating systems are approaching or have exceeded their operational lifetime and require urgent modernisation or replacement. In Russia, for example, about 50% of heat generation units and networks require replacement, and at least 15% are at high risk of industrial accidents.[33] In Kazakhstan, up to 70% of heat generation, transmission and distribution assets are obsolete.[34] Urgent investment is therefore needed to keep district heating systems operational. To attract investment, an effective policy framework needs to be put in place, including regulatory and institutional reforms.

The pace of reforms differs among these countries. Kazakhstan started restructuring its district heating sector earlier than its Slavic neighbours and these reforms were linked with broader energy reforms (see Box 2.3). Despite the significant progress achieved, district heating in Kazakhstan still faces some

32. *This has already happened in Russia, for example.*
33. *Russian Ministry of Energy (2003).*
34. *Andreev (2004).*

Box 2.3

District Heating in Kazakhstan

Kazakhstan started liberalising its energy sector in 1996 and over the next two to three years privatised a large share of its electricity and district heating assets. The government also privatised companies supplying fuel to electricity and heat producers, as well as the residential housing stock. So the whole heating sector – from supplier to end-user – is now to a large extent in private hands, and relationships between the different actors are based on commercial principles. Today, 45% of the country's cogeneration plants connected to district heating systems are private, another 35% are joint-stock companies with combined private and municipal ownership, and municipalities fully own the remaining 20%. Restructuring and privatisation have improved the performance of many district heating systems. Heat tariffs have risen significantly, and heat suppliers no longer receive subsidies in most cases. Despite this significant progress, some problems remain. Tariff regulation is one. A cost-based approach to tariff regulation does not encourage operators to cut expenses and invest in efficiency measures. Also the tariff structure does not include depreciation and an adequate return on investment. This means low profitability, which turns away investors and discourages efficiency improvements.

Sources: Correspondence with S. Katyshev, KEGOC and G. Doroshin, UNDP Kazakhstan; and Andreev (2004).

difficulties. Like the other three countries, Kazakhstan continues to regulate its heat prices. Although tariffs cover current costs, they do not include a return on investment large enough to cover the substantial investments required (for example, investment to reduce excessive heat losses). In Russia, by contrast, residential tariffs in most cities are still below operating cost, and subsidies and cross-subsidies theoretically cover the difference.

In all four countries, regulators need to review their tariff regulation to provide stronger incentives for investment, and they need to raise heat tariffs further. Yet the governments do not allow the latter for social reasons: a large share of the population is poor, and existing welfare programmes are not large enough to provide adequate social support to all the needy.[35]

Improving payment collection has had a positive effect on the financial situation of district heating companies. Non-payment for energy services was a major problem until recent years. Non-payments arose primarily from inadequate budget allocations for state heat consumption and subsidies, a

35. *In Russia, households that spend more than 22% of their income on communal services can receive social subsidies. In Kazakhstan and Belarus the limit is set at 25%.*

significant drop in household revenue and a simultaneous, rapid increase in electricity and heat prices, together with a lack of payment enforcement. Progress has been made in recent years: household collection rates have grown to 80-95% in Kazakhstan, and about 90% in Russia. Public institutions in Russia, however, still lag behind somewhat.

Competitiveness

A common feature of these four countries, which distinguishes them from the other transition countries, is that residential consumer switching from district heat to other sources of heat supply has not generated a critical reduction in demand. There have been very few residential consumer disconnections so far and district heating has maintained its market share. This does not mean that customers are satisfied with service quality, which is generally poor compared to systems in Western Europe. The deterioration of district heating systems due to inadequate investment and periodic unauthorised use of fuel exacerbates the problem of poor service quality. In some of these countries, district heating companies receive subsidised fuel, usually gas. Financial audits of some companies show that a certain share of this fuel is not used for heat production but "disappears". Sometimes the subsidised fuel appears to be resold at higher market prices. This creates an artificial fuel shortage for heat plants, so service quality declines: the temperature is too low, or the heating season is too short.

The lack of alternatives is an important factor in the low disconnection rate. In Kazakhstan, where there is no natural gas supply infrastructure in the population centres, district heating companies have no competitive pressure from natural gas suppliers. Conversely, in Russia, there are gas distribution networks, particularly in the more densely-populated European part of the country. Many urban dwellings are connected to the gas networks as households use natural gas for cooking. However, there has not been much competition from natural gas on the residential heat market. This can be explained by the structure of the Russian gas market and existing gas prices. Demand for natural gas in the domestic energy market exceeds supply because of artificially low, state-controlled prices. The state monopoly Gazprom, which dominates the gas market, has few incentives to compete for a higher share of the residential heat market as it can earn more money through gas exports. The situation may change, however, as domestic gas prices rise.

Nonetheless, district heating companies should not be complacent. Service quality in some district heating systems in Belarus, Kazakhstan, Russia and Ukraine has caused growing consumer dissatisfaction. Consumers may start

switching to other heat options if district heating prices continue to grow and quality of service does not improve.

South East Europe, the Caucasus and Central Asia[36]

South East Europe, the Caucasus and Central Asia have a warmer climate than the other transition countries. Consequently, heating plays a smaller role in energy consumption and the district heating sector has historically been smaller than in more northern countries. However, district heating systems do exist in many cities and towns along this southern tier of countries, and these systems deserve to be maintained in operation where they are economically viable.

A key challenge in analysing the heating sector of this region is the lack of reliable information. Heat statistics are often not available, and existing data are often based on experts' estimates rather than statistical surveys. Where statistics are collected, their quality may vary from year to year, which makes it difficult to analyse historical trends. Some countries collect heat statistics only partially (for example heat production only), sometimes without a detailed breakdown by input fuel source. Heat consumption data are often non-existent or incomplete. As might be expected, therefore, different sources often provide very different information.

Technical Condition, Investment and Financing

Many district heating systems in South East Europe, the Caucasus and Central Asia have ceased providing services, fully or partially. For example, in Moldova, district heating systems have closed practically everywhere except in Chisinau and Beltsi and district heating production declined by 86% in just nine years.[37]

The main reason for declining production or the complete disintegration of district heating systems is lack of financial resources, which leads to insufficient investment in repair and renovation. Massive non-payments are a major reason behind the financial problems of district heating companies; state entities are often the worst customers in this respect. Tariffs for the population are below production costs, but even so, many households cannot afford them. The high poverty rate in most of these countries is a brake on reforms in district heating and other energy services. Raising tariffs to cost recovery levels is not politically acceptable and would not make sense unless payment discipline and enforcement are improved.

---

36. The term South East Europe discussed here includes Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Serbia and Montenegro. Caucasus and Central Asia include Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

37. Kalkum and Rajkiewicz (2002).

In many cases, rehabilitating ageing district heating systems is economically viable because district heating generally has comparative advantages in urban areas with cold winters. However, careful, city-specific economic analysis is needed before making new investments. In some countries such as Moldova, rehabilitating existing systems is not always viable because of low heat density.[38] The United States Agency for International Development (USAID) and the Alliance to Save Energy, which are implementing a heat sector development project in Moldova, are making the assumption that in cases where district heating systems are based on heat-only boilers and where natural gas is available, it may not be economically viable to sustain them, but that where systems are supplied from a cogeneration plant they may be worth preserving and modernising.[39]

International financial institutions and bilateral donors will likely continue to provide most financing for restoration and renovation in this region until effective economic and social policies make district heating more attractive to private investors.

Competitiveness

As in Central Europe and the Baltics, many district heating systems in this region have been losing residential market share. However, the reasons and implications of this trend are often different. Switching in Central Europe and the Baltics is usually a matter of choice, as consumers have found other heat options more attractive. In South East Europe, the Caucasus and Central Asia, by contrast, many households are forced to use other heat sources when district heating systems disintegrate.

In Armenia, as a result of deteriorating systems, district heating's share of the residential heat market[40] declined from 35% in 1990 to 9% in 1999.[41] While the richer households are able to install modern technologies such as gas boilers, the poorer ones tend to install stoves and ovens fired with solid fuels (coal or wood). In countries where the population increasingly uses wood for heat (Armenia, for example), illegal wood-cutting aggravates deforestation.

Where gas or electricity prices remain heavily subsidised while heat tariffs are liberalised or receive significantly smaller subsidies, it is difficult for district heating to compete. In Serbia, for example, many individual consumers use electricity for heating because electricity is more heavily subsidised than

38. In terms of connected heat loads to network length.

39. Kalkum and Rajkiewicz (2002).

40. Residential floorspace heated by district heating.

41. World Bank (2003).

district heating.[42] When gas or electricity subsidies are phased out, some consumers may want to switch back to district heating. In some cities in Armenia and elsewhere, it is impossible to reconnect because district heating systems have shrunk or closed with the loss of customers.

Conclusions

Many district heating systems in transition economies face challenges as they work their way past the legacy of central planning. The extent of the challenges varies between countries and cities, but overall, compared to district heating in Western Europe, systems in transition economies are more focused on production than on customers, and they tend to be inefficient and overcapacity. This does not mean that district heating is an inefficient form of heat supply per se. Refurbishment and modernisation can improve efficiency, but this requires significant investments; some countries have already made considerable progress in this area while others are just starting. Financial difficulties of district heating companies and the consequent lack of investment in district heating is (or was) a major problem in most transition countries. Financial stability and competitiveness are interrelated and often form a vicious circle, which in extreme cases may lead to system collapse. Well-designed policy can help district heating companies break this vicious circle and at the same time capture the full benefits that district heating has to offer.

District heating is closely connected to many elements of national policy: energy policy in other sectors, environmental policy, social policy and economic policy, to name a few. Thus, it is important to consider district heating in the national policy context in order to design the strongest and most effective policy possible.

42. Subsidies cover about 80% of electricity costs (and 40-70% of district heating costs). Source: MUNEE (2004).

PART II:
POLICY OPTIONS AND PRIORITIES

MEETING THE CHALLENGES: POLICY OPTIONS

The first two chapters described the benefits and challenges of district heating. The rest of this book focuses on how countries get from the challenges of today to a future with more efficient, environmentally friendly district heating. This chapter starts with a choice of two paths to balance supply and demand and thus meet the key challenges of district heating: better regulation or competition. It then considers several issues that governments need to address separately, regardless of the competition or regulatory framework for district heating: installing heat meters, enhancing payment collection and improving social protection. Balancing supply and demand is an important theme because getting it right can make many other things fall into place: adequate focus on customers, stronger corporate market and financial position, funding for new investments, improved energy efficiency and customer satisfaction. Supply and demand are also important because the policy choice on this matter can have broad implications for many other specific policies relating to district heating.

Two Paradigms

No single policy approach toward district heating can fit all countries. District heating is a localised product, not a market commodity like oil or electricity; this is an important difference for successful policy. The starting point for individual countries and cities varies greatly. District heating can already be part of a competitive market or it can be a monopoly service. This depends on how the sector is structured and on the political environment in the country or city. The two policy paradigms presented here represent the major approaches that countries have taken to balance supply and demand, and ensure efficiency, quality and fairness.

All transition economies currently regulate tariffs; most OECD members let competition and the market set the price of heat, though this is by no means universal. Typically, market economies force companies to focus on their customers through competition. This is difficult, however, when a single company controls the market, and policy makers in this situation tend to favour price regulation to ensure fairness. Clearly separating the policy implications of a competition-based approach to district heating from those of a more regulatory approach can help in making policy more deliberate and

targeted. While there can be some overlap between these approaches, countries need to be very clear about their approach to ensure that the interaction between policy and market conditions does in fact balance supply and demand with the lowest costs and highest quality.

Box 3.1 shows how two Scandinavian countries use regulation and market mechanisms, respectively, to steer their district heating sectors. The differences in terms of the heat prices are actually quite striking. Competition leads to much lower costs. More comprehensive but unpublished studies also confirm this result, although obviously there are many factors that affect the final price of heat.

● Improving Regulation

Transition economies now rely on regulation to balance supply and demand. Regulation in itself is not the reason that district heating in these countries tends to be so much less efficient than elsewhere in the world. Poorly designed regulation, though, makes a significant contribution to inefficiency and this is true not just in district heating. Competition by nature forces efficiency improvements, but it is not always feasible to introduce competition in heating because of a lack of alternatives. Also, introducing competition too quickly and without careful forethought can create more problems than it solves, as the drastic decline in district heating customers in Romania shows; often such quick declines in district heating demand are driven by broader energy market imbalances like subsidised residential gas prices. Regulation can be a good policy choice in many situations, as long as the decision is made deliberately and with adequate consideration of the alternatives.

Box 3.1

Regulation vs. the Market in the Danish and Finnish District Heating Sectors

Denmark and Finland have taken very different approaches to district heating policy. Both have high levels of cogeneration: in Denmark 53% and in Finland 36% of power is cogenerated. District heating accounts for almost half of the heat market in each country. (The very long heating season in Finland compensates for its lower population density, making district heating economical in many locations).[1]

Denmark has a clearly defined national district heating policy. Under its Heat Supply Act, Danish municipalities can set mandatory and separate district heating and natural gas zones where buildings are connected to one or the other heat source. Prices and investments are regulated and district heating companies, which are primarily municipally or communally owned, are legally not allowed to make a profit. The government provides some subsidies to promote district heating and cogeneration and requires that all localities prepare heat supply plans. The localities and district heating companies are legally required to assure reliable district heat supply to all buildings in district heating zones. District heating companies buy heat competitively though medium and long-term contracts with cogenerators and waste incinerators, so there is a market for heat in major cities.[2] The Danish government feels that zoning improves efficiency and reduces unnecessary infrastructure investments; Denmark's total energy intensity is about half that of Finland's though this does not take into account differences in climate and the extent of heavy industry.

Finland, on the other hand, does not have national district heating legislation or regulations, nor does it regulate district heating prices. There are no requirements for local heat plans or district heating zones. Instead, the philosophy is that district heating competes directly against other heat sources so the market can balance supply and demand. In principle, it is expensive for most building owners to switch from district heating to, say, fuel oil or electricity for heating, so there is a risk of unfair prices from private district heating companies, but in practice, the government and district heating association do not feel that district heating companies charge unfair prices. Buildings always have a choice of using electricity, fuel oil or wood, which combined have 48% of the market share for space heating. Almost all new buildings voluntarily connect to the district heating networks, indicating that the price is competitive and quality high. Finland also has lower prices for district heating than many neighbouring countries; on average they are about 40% lower than tariffs in Denmark.[3]

The experience of Finland and Denmark shows that there are many ways to balance supply and demand in the district heating sector, but policy makers should be careful to consider national circumstances. For example, Finland's model might be more problematic in a country with greater corruption; likewise, Denmark's model, which does not allow profits, might cause more serious problems in attracting investors in countries with greater risk.

---

1. *Euroheat and Power (2003).*
2. *The Heat Supply Act of Denmark; Petersen (1996); Minister for Economic and Business Affairs (2003); Manczyk and Leach (1998).*
3. *Kostama (2003); Correspondence with Jari Kostama, Finnish District Heating Association, August 2003; IEA (1999); Ministry of Trade and Industry of Finland (2003); Silvonen and Mäkelä (1997); Finnish District Heating Association (2003); Transparency International (2003).*

By choosing to continue regulating prices, policy makers have an obligation to ensure that their regulation is as effective as possible. Policy makers have a difficult job in balancing regulation to ensure that service quality meets consumers' needs and expectations while keeping prices to a minimum. Effective regulation for all energy sources, not just district heating, should include the following elements.

- The regulatory regime must provide strong incentives for improving efficiency in supply, transmission and end use.
- Investment decisions must take into account the interests of consumers, so that all investments are least-cost and supply is secure.
- Tariffs must incorporate full costs.
- The regulators and regulatory process should be independent.
- Regulators should not own the assets they regulate.
- The regulatory regime should be transparent and understandable.
- Social protection programmes should target low-income households, which should make it easier to eliminate heat subsidies and to ensure higher collection rates.

Better regulation thus entails a market-oriented version of energy planning. Market-oriented because it must take the private sector's potential role into account and ensure that district heating could remain successful (through high quality and low cost) if competition were launched. In other words, continued regulation should not be an excuse for continued poor service. The energy planning process allows policy makers and other stakeholders to proactively decide on what should economically be served by district heating and how to provide this heat at least cost. Policy makers should also be open to different tariff regulation options. Some regulatory approaches are better at promoting efficiency than others, as described in Chapter 4.

The regulatory process has some levers for keeping prices down, in particular through careful review of investment decisions and tariff proposals. It is much more difficult to regulate good service quality, although there are some options. Fines, operating lease provisions and privatisation of municipal companies are a few, but they are all rather cumbersome and blunt compared to the subtlety of competition. The benefits of regulation may nevertheless outweigh those of competition in a particular country at a certain point in time. Rushing into competition before the right conditions exist may not improve service, and it may raise prices and trigger customer defection.

Introducing a Competition-based System

In a competition-based system, the idea is that competition will force district heating companies to minimise costs and prices, and in the end, everyone will benefit. Two forms of competition exist: direct competition between district heating and other heat sources, and competition between heat producers at the wholesale level. Only competition between heat sources, however, can serve to balance the market because wholesale competition by definition does not allow consumers to choose a heat provider.

In most countries or regions that have allowed it, competition comes from other heat sources, like gas or electricity. The challenge for policy makers is to ensure that there is effective competition and that district heating providers are not able to abuse their previous monopoly position when prices are free. Freeing prices and removing subsidies are essential elements of this approach, as unfair subsidies or other market barriers to different forms of heat can distort competition. A level playing field from the outset regarding price regulation and subsidies for different forms of energy is important for fair competition. For example, if heat price subsidies are removed sooner than those on natural gas, consumers may switch to subsidised natural gas for heating, and the unit cost of heat for the remaining district heating customers will rise. When policy makers later remove natural gas subsidies, customers may find themselves with expensive gas-based heating systems and a limited ability to switch back to district heating.

Questions to consider in assessing this type of competition include: is there an alternative source of supply readily available to all consumers in the area? Do the costs of switching to, say, an individual gas boiler present a barrier for low-income families to take advantage of competition? For example, in a country like Ukraine where the government estimates that 70% of the population lives below the poverty line, it is not clear that full-scale heat source competition would be fair to most of the population, as few would be able to exercise a choice. Introducing heat source competition needs to be a deliberate and carefully considered act of policy, rather than a development in a policy vacuum. It is also usually better to introduce competition slowly, giving district heating providers time to adapt so that they can compete with other heat sources on an equal footing.

A second form of competition is between heat producers at the wholesale level. Competition here means the sale of wholesale heat through medium and long-term contracts, not a spot market or retail competition. A spot

market and retail competition are not likely to be feasible in the district heating sector because of the small scale of each market. Thus, regulators would still need to balance supply and demand through tariff regulation and energy planning. Wholesale competition happens automatically in systems with extensive heat source competition and no price regulation: district heating companies have a market-driven incentive to purchase least-cost heat. In systems with tariff regulation, regulations can foster stronger wholesale competition. The Copenhagen region is the best example of a regulated wholesale system (see Map 3). The power utility and solid waste incinerators supply their waste heat to the wholesale district heating providers; they have medium-term supply contracts that define the costs for least-cost dispatch. Buying heat from third parties is not new in transition economies, but it is not the main source of heat. Expanding wholesale transactions has many benefits. First, it should lower the price of heat by allowing manufacturers and power companies with waste heat to sell this product more easily. Second, the environmental benefits would be significant because waste heat produces virtually no new emissions. Third, it would avoid the customer access problems of heat source competition, although fair access for producers requires clear rules and monitoring. Lithuania, Romania, Slovakia, the Czech Republic and Poland have all issued new laws or regulations in recent years requiring district heating companies to purchase least-cost heat, though the extent of such purchases varies. Only the largest cities will likely have good potential for wholesale heat purchases, so it will probably expand slowly and in certain places. Nonetheless, policy makers should encourage district heating companies to take advantage of all heat available at low cost, regardless of its source.

Transparency

Transparency is important to both competition and regulation. In a regulated context, transparency can help ensure that consumers and other stakeholders have a chance to be heard in the regulatory process. Good information on district heating system finances can help indicate if costs are fair. Independent information on potential costs, for example in competitive bids for new heat plants, can provide regulators with balanced information on least-cost options. In a market where district heating competes with other heat sources, transparent information, including financial statements of local operations, can help indicate if companies are using dominant market positions abusively. Such information can also help policy makers assess the overall situation and decide on policy reforms.

Deliberate Decision Making: Using Regulation and Competition to Balance Supply and Demand

Often on questions of competition and regulation, policy makers prefer to continue with the status quo or hold deep beliefs on whether centralised heating, competition and regulation are desirable. A more open and objective approach can result in better policy. This means impartially and proactively examining the pluses and minuses of competition and regulation, taking into account the existing market, institutional, physical and social conditions. Such a review should also consider the relationship with broader energy policy, the impact on the environment and the likely implications for district heating's own long-term sustainability. The Swedish government is undertaking just such an investigation right now to determine whether to increase competition in the district heating sector at the wholesale level, to stay with the existing system of heat source competition or to begin regulating district heating prices.

Deliberate decision making means that policy makers should clearly select which approach to use to balance supply and demand: heat source competition, or tariff regulation and energy planning. This is different from saying that either approach is completely devoid of regulation or competition. A competitive regime will include environmental and safety regulation, for example, and a regulated regime may use wholesale competition to lower costs.

Getting the balance of supply and demand right is particularly important because so many other policies and challenges hinge on this decision. The right balance will go a long way to solving the problems of poor customer focus, inefficient supply and inadequate investment. The private sector will have much more incentive to invest when the sector is structured so that it can be profitable. Encouraging additional investments in cogeneration and energy efficiency will also be easier when the majority of investments are cost-effective. In other words, getting this decision right can make policy making in other areas easier and more successful.

Recommendation

Policy makers should be deliberate in deciding whether to use competition or regulation to balance supply and demand. They should ensure that all aspects of national energy policy are consistent with this decision to the extent possible. More consistent and focused policy can promote improved business practices in district heating.

Regulation, Supply and Demand

Many countries have sought to regulate the heat market to promote least-cost, environmentally friendly heating options. The most common options are district heating zones, tariff regulation and energy plans, including integrated resource plans.

● District Heating Zones

District heating zones establish geographic boundaries within which virtually all buildings must be connected to the district heating system. The idea is that, just as it does not make sense to have two competing district heating networks, it does not make economic sense to develop two competing heating systems such as parallel gas and district heating networks. Thus, the argument goes, it is better to specify areas where district heating is the least-cost option and other, less densely-populated areas where gas or other heat sources offer the lowest cost. Denmark, Korea, Lithuania and Estonia allow such zones and leave it to local governments to decide if they want to define and implement district heating zones in their jurisdictions. Other countries, like Germany and the Netherlands, do not ban heat source competition but effectively restrict it because of the way companies decide to build the networks (in Germany, a single company usually supplies both gas and heat; in the Netherlands, district heating typically only serves new developments and gas is not usually extended to these areas when district heating is available).

Obviously, zones eliminate the possibility of retail competition in the heat market, but proponents consider that this is justified by a lower total cost, which is in the interest of consumers. This lower cost reportedly comes from economies of scale: elimination of duplicative investments, which combined with the purchasing power of larger district heating companies, allows these companies to produce or buy heat at the cheapest price.[4] One of the problems with zoning is that, in practice, it does not seem to lower costs as well as competition. While experiences in Denmark have been quite positive for efficiency, this may in part arise from the fact that there is a fairly vibrant wholesale trade in district heat, particularly in the main market, Copenhagen. Thus, this model might not work as efficiently in places that do not have a variety of independent heat suppliers.

It is possible that zoning can be an effective tool for initially establishing district heating in areas of new development, even if the international

4. Elleris (2003).

evidence indicates that zoning does not result in lower costs when it is mandated over a long period. Besides Denmark, the only other well-established example of a country with district heating zones is Korea, where zones have worked quite well in expanding district heating. All new developments near major Korean cities must be connected to district heating. Requiring district heating zones in areas that are already built up is more complicated because in many cases, gas networks already exist: buildings connected to gas will remain connected to gas, and the only effect of zoning is to restrict future switching to gas. The lower cost and added efficiency benefits of avoiding investments in both gas and heat are therefore lost. In Estonia and Lithuania, municipalities can now mandate district heating zones as a means of preventing the decline in district heating sales. The logic in these cities is that district heating is the least-cost option in the long term, but that rapid shifts in market share could cripple the industry in the meantime.[5]

- **Tariff Regulation**

Regulating district heating tariffs is a common approach to protecting consumers and ensuring that investments are least-cost, which relates closely to balancing supply and demand in the absence of a market. Balancing energy supply and demand through tariffs can either involve scrutinising investment costs to ensure they are not inflated (without directly assessing the need for investment) or co-ordinating tariff regulation with more comprehensive energy planning. Chapter 4 discusses tariff regulation in more depth.

- **Energy Plans**

Energy plans can help local and national governments assess options for developing their heat sectors and ensuring reliable supply at least cost and with minimal environmental impact.[6] The planning process can provide an objective and open framework for evaluating the trade-offs between various goals. It is difficult for regulators to be sure that costs are not in fact inflated without reviewing investment proposals. Investment decisions have a large impact on future costs. Seeking alternative bids for wholesale heat supply can also help to ensure that investments are least-cost. Planning is important given the huge investments in the sector over the past decade, and the larger ones needed to restructure the sector.

---

5. *Estonia and Lithuania enacted laws that allow such district heating zones in 2003.*
6. *Energy plans in this context would focus on the heat market, meaning that they would include district heating, but also other energy sources in areas that do not have district heating.*

Denmark and several other IEA member countries require local energy plans. Denmark's Heat Supply Act, for example, requires that localities prepare heat supply plans in collaboration with heat suppliers and that every new heat plant meet several criteria aimed at ensuring reliable heat supply, efficient energy use and cogeneration at all larger facilities.[7] Poland also requires all localities (*gminas*) to prepare local energy plans, though in many cases municipalities are ill-prepared for this task. The three Baltic States now require such plans by law and have prepared many local energy plans with EU assistance. Many other cities in transition economies have also developed local heat supply plans as part of programmes to modernise their district heating systems. In some cases, local energy plans are prepared with the sole aim of meeting regulatory requirements before new investments, which diminishes their comprehensiveness and quality.

On the other hand, when there are no such requirements, energy planning is often de facto left to the district heating monopoly, which is not a good way to balance supply and demand. The lack of independent regulators in most transition economies exacerbates this problem, and even when there is independent regulation, it is rarely based on local energy plans. Rather, many transition economies set tariffs based on utility-driven proposals or short-term political calls for price relief. This is changing, though.

There are several important issues to consider in making energy plans effective. First, the plans must make realistic assessments of future demand. Second, they must assess different options on comparable terms. Third, the plans should be objective and consider the broader interests of the community, not just those of the supply company. Fourth, the government must have the means of implementing the plan. The implementation plan can and should rely on other actors, limiting the government's role to stimulating and regulating the sector with a well-designed framework.

Integrated resource planning is a form of energy planning that allows for a balanced comparison of different supply and demand options. It does so by levelising costs to assess different supply and demand-side options for meeting future demand based on lifecycle costs and common financial calculation methods.[8] If it is less expensive to invest in demand-side measures than in new heat plants, then regulators should require such

7. *The Heat Supply Act of Denmark, dated 2000, at http://www.danmark.dk/portal/page?_pageid=34,214601&_dad=portal&_schema=PORTAL; the Heat Supply Act of Denmark, dated 1990, as translated at www.energy.rochester.edu/dk/hsa.htm.*

8. *Specifically, levelising costs means comparing costs on equal terms, typically net present value of total lifecycle costs per unit of energy produced or saved. This means that energy efficiency investments will be counted based on their ability to save energy just as new supply will be counted on its ability to produce energy.*

investments, adding a fee onto the tariff to pay for them if necessary (much as the costs of supply investments are included in the tariff). Integrated resource planning began as a means of assessing potential investments in electric utilities. It can play an important role in ensuring least-cost investments in regulated markets, though as in the power industry, it can also later be phased out as competition takes hold. The motivating idea is that when utilities are guaranteed captive customers, they do not bear the standard market risk involved in investments. They will tend to over-invest to the extent that they can recover these investments through the tariff structure. To counter this bias, integrated resource planning provides a framework for evaluating investments based on objective, system-wide assessments of what is least-cost. It also helps ensure quality heat supply through this same review process.

Typically, where integrated resource planning exists, legislation or regulatory documents require such plans on a regular basis, possibly every three to five years. In general, the plans are more objective when a regulatory body (not a government) co-ordinates them. The regulator usually hires one or more outside companies with expertise in such assessments to prepare the actual supply and demand-side investment calculations. Ideally the regulator seeks public comment on a plan before taking final decisions on the options included. Public comment helps ensure accuracy and feasibility and also helps balance the interests of various stakeholders (district heating companies, consumers and others). In practice, most transition economies with energy planning requirements place the responsibility for plan preparation on local governments, which may not result in as objective an analysis. Even more importantly, it separates the planning process from tariff setting, licensing and other aspects of implementation.

Assessing Demand and Supply

This section attempts to provide guidance on assessing demand and then comparing options to meet that demand. It is based roughly on the integrated resource planning approach.

The first step in preparing an effective energy plan is to assess demand. Realistic projections are critical. Past trends can help in judging future demand, but they should be used with care in transition economies for two reasons:

- Past demand may be based on subsidised energy prices and as subsidies are removed, energy demand may decline in ways that are difficult to predict based on price alone. Most such projections use price elasticity,

a measure of how responsive consumption levels are to price, in order to estimate future demand. In economic terms, price elasticity calculations are valid only when a market exists and is in equilibrium.

- Structural shifts in the economy can have a large impact on potential heat demand as well.

Targeted market research can also help in preparing demand assessments. Discussions with major customers such as factories and hospitals should reveal their plans for heat purchases (or if they are planning to install their own boiler). Building trends and discussions with construction companies can help in developing heat demand projections for residential and commercial building. The demand assessment should consider peak and baseload demand in winter and summer, as installed heat capacity needs to reflect this. Carefully documenting assumptions can help to check the validity of data and projections.

Recommendation

Reliable energy demand assessments are essential to good energy plans. Market research, information on major consumers and building and construction trends can help in developing quality assessments.

Meeting the Demand

The next step is to develop a plan to meet this projected demand. The plan should look first at existing supply and costs per unit and then at potential new or replacement supply. In some cases, existing supply may exceed projected demand, in which case the regulator or local government may want to consider whether it makes sense to consolidate production facilities to increase load and efficiency. In other cases, existing costs may be so high that it makes sense to consider restructuring, either to replace inefficient supply, and/or by considering whether certain customers might be better served with local boilers or other forms of heat supply.

It may be cheaper to obtain supply from other producers, such as industrial facilities, cogeneration plants or waste incinerators. Thus, the review of supply options should not be limited to capacity that the district heating company could build or operate. Seeking competing proposals for new supply can help in providing objective cost data and potentially low-cost heat supply.

Importantly, the plan should look at demand as well as supply-side options to identify least-cost solutions. The World Bank and other organisations have

conducted a number of studies that show that integrating demand and supply-side options achieves better results than isolated optimisation of supply or demand.[9] Table 3.1 describes some potential supply and demand-side options (this list is by no means exhaustive).

Table 3.1

Sample Supply and Demand Side Options for Meeting Heat Demand

Supply Options	Demand Options
• Existing heat supply by plant. • New cogeneration unit. • New heat-only boiler for peak heat demand (for example using wood waste). • Waste heat recovery from a local industrial plant or incinerator. • Individual boilers for remote customers.	• Upgrades to distribution network to reduce losses. • Rebates for efficient windows or radiator reflectors. • Metering. • More energy-efficient building codes for new buildings.

For each option, the plan developers should ideally consider the volume of heat produced or saved, the price per unit of heat based on lifecycle costs, as well as the timing, feasibility, and environmental and social impact. This will allow district heating companies, regulators and policy makers to identify the least-cost and most beneficial options. Ranking can help in reaching wise and objective decisions on investments and on raising tariffs to pay for these investments. This information could also be useful in deciding whether to close down inefficient boilers or in prioritising dispatch based on least-cost.

When a government decides to use competitive bids and wholesale competition to select new supply, the energy planning process would be much the same until the final step. The plans would include demand assessments, options for demand-side measures, potential supply-side measures (possibly based on expressions of interest from potential heat suppliers) and analysis of the lifecycle costs, feasibility and impact of each option. Before selecting the final measures, the regulator would ask potential new suppliers to bid on heat production licences, and the proposed costs would allow the regulator to make a final ranking of the options.

9. *Meyer and Mostert (2000).*

Recommendation

Least-cost plans should consider both demand and supply-side options for filling any gaps between projected supply and demand. It is important to consider each option on an equal footing, which means calculating the net present value of lifecycle costs for each option.

Energy planning is, in short, a tool that can help regulators, policy makers, district heating companies and other stakeholders to create reliable, low-cost and environmentally friendly heating systems.

Competition, Supply and Demand

Competition is ultimately the most efficient way to balance supply and demand. The challenge is that district heating companies are often monopolies in their local areas, and creating a balanced and competitive market can be difficult. Competition between heat sources is the most realistic option for using the market to regulate supply and demand as it provides incentives for building adequate capacity, yet removes incentives to produce excess heat. In a regulated district heating market, the incumbent company typically has incentives to increase heat costs and total heat sales. These incentives are particularly strong when heat tariffs are based on costs rather than on alternative sources of heat supply. When the district heating company no longer has a monopoly on heat supply but must compete with other heat sources, it has an incentive to keep costs (and prices) as low as possible, and it will not be motivated to build excess capacity. Also, under competition the district heating company takes on the investment risk of its supply investments. This can bring down prices, as seen in Finland and Sweden, although in the short term, district heating companies can abuse their market power. Thus, it is essential that competition or anti-monopoly authorities monitor the market to ensure fair competition.

An overly hasty or ill-considered policy decision to open the heat market to competition can backfire on district heating and its viability. To date, no transition economy has stopped regulating district heating prices, though many allow heat source competition. In some countries, this has put district heating at a competitive disadvantage as district heating companies lack flexibility to respond to the market. Policy makers should decide to open the heat market only after carefully assessing the costs, benefits and risks for consumers as a whole. At a certain level of customer defection, systems may no longer be viable or may be so expensive to operate that the remaining

customers must pay excessively high prices. In addition to considering the relative costs and benefits, such an assessment should also consider how district heating would need to be restructured to remain viable if large numbers of customers switched. Likewise, once competition begins, policy makers should consider whether price regulation is still necessary and, in any event, monitor the heat market to ensure its fairness. Such monitoring is a less labour-intensive activity than price regulation and energy planning.

Essential Conditions for Both Paradigms

Billing, metering, collection and social protection deserve policy makers' close attention regardless of the general approach to district heating (competition or regulation). Transparent and sustainable billing practices based on metered consumption are vital for improving energy efficiency and increasing customer satisfaction. Ensuring that consumers pay for services is important for securing adequate revenues and hence the financial health of district heating suppliers. If low-income households cannot afford the full price of heat, governments should address this through adequate social policy and welfare support, not blanket producer subsidies. Addressing these issues is a prerequisite for improving regulation or launching competition.

- **Billing and Metering**

There are two basic billing options: one based on living space and the other based on heat consumption. In much of the former Soviet Union, consumers still lack heat and hot water meters, Instead, the district heating company attributes heat supply costs to a whole residential district (or, in some places, to each single building) based on that district or building's estimated heat consumption, then the company divides the costs among households. Household heat bills are therefore established according to the size of the dwelling (usually per m^2); and hot water bills are usually based on an established "norm" of water consumption per person and thus depend on the number of inhabitants. Bills for consumers with heat meters can either consist entirely of measured consumption, or consist of a fixed space-based fee and a consumption fee. Heating companies can also bill consumers without meters according to the two-tier principle, but in that case the company measures the energy consumption (or the variable fee) instead of estimating it.

Unmetered billing for heat based on living space is neither transparent nor sustainable in many cases. It removes incentives for households to save

energy: they cannot regulate heat consumption, and efforts to reduce heat waste (e.g. by improving insulation or installing modern, double-glazed windows) do not reduce heat bills. This creates incentive for many households to switch to other heat options. Also, with cost-plus tariffs, heat suppliers have no economic reason to decrease heat losses: without measuring heat consumption, it is impossible to know the exact amount of heat losses during transmission and distribution. District heating companies usually estimate the amount of heat consumed by a building and base the tariff on these estimates. In most cases they overestimate consumption and underestimate real heat losses.[10] This means that consumers have to pay for losses that the regulator might otherwise consider the responsibility of the supplier.

Heat metering is by far the better approach and it is essential for consumption-based billing. Tariffs based on heat metering are more transparent and encourage both consumers and suppliers to be more energy-efficient.

Recommendation

Policy makers, regulators and district heating companies should eliminate estimated billing and replace it with metered consumption-based billing to promote energy efficiency and cost reduction, improve transparency and give consumers more control over their heat bill.

Consumers can monitor and influence their heat bills only when they have controls and meters. Heat controls can be at the building level or in individual apartments. Apartment-level controls include manual or thermostatic radiator valves and central thermostats. There are basically four heat metering options in use in the residential sector worldwide (see Box 3.2).

While all four options enable consumers to be billed according to their consumption, their costs vary significantly, along with the degree of precision and simplicity in determining heat consumption in each apartment.

Box 3.3 sets out progress on installing metering and control equipment in transition countries. In most of these countries, meters are being installed at the building level, as it is the lowest-cost option. Installing meters at the apartment level requires more significant investment and in many cases is not technically feasible. Cost allocators, which are less expensive and easier to install, are probably a more advantageous option in many cases.

10. *Installing basement heat meters in most cases demonstrates that district heating suppliers have been significantly overestimating real heat consumption for years.*

Box 3.2

Heat Metering Options in the Residential Sector[11]

Option 1. Building-level heat meter. A heat meter measures the heat consumption of an entire building. The meter is installed at the heat entrance point (i.e. the connection with the secondary network, the heat exchanger or the boiler plant, which exclusively provides the heat for the whole building). The entire building receives a bill based on the metered heat consumption, which is then allocated to individual apartments based on floorspace or on the readings of individual heat cost allocators (see option 2). It costs approximately $3,000 to install a building-level meter, though this can be less where labour costs are lower. Thus, these meters cost just a fraction of a building's annual heat expenses.

Option 2. Heat cost allocator (or distributor). In addition to metering the heat consumption of the entire building (as in option 1), the heat emissions of each individual heat radiator in an apartment are "measured" with evaporative or electronic devices. Electronic allocators are more accurate and less susceptible to falsified readings. The total cost of the heat consumption of the building (including billing costs) is allocated to the individual apartments partly according to the floor area and partly based on the readings of the allocators. Heat allocators cost $5 to 10 each.

Option 3. Hot water flow meter. A flow meter measures the amount of hot water circulating through the radiators of individual apartments. This measurement serves as the basis for distributing the building heating costs (metered as in option 1) to the individual apartments. This option implicitly assumes that water temperature at the entrance of each apartment is the same for all apartments in the building.

Option 4. Apartment-level heat meter. A heat meter measures the heat consumption of each apartment; this is a scaled-down version of the building-level heat meter (option 1). The apartment-level heat meter can serve to allocate heat expenses to an individual apartment (as in option 2), but more often it is used for direct billing based on the heat supply contract. This option is usually prohibitively expensive and technically difficult to install.

To speed up the transition to consumption-based tariffs, many countries such as Poland, Hungary, Romania and Bulgaria have required heat metering equipment (usually at the building or substation level). For instance, the Polish Energy Law and further secondary legislation obliges district heating

11. *World Bank (2002); Correspondence with Thomas Secrest, Pacific Northwest National Laboratory, Richland, WA, USA, July 2004.*

Box 3.3

Installing Metering and Control Equipment in Transition Countries

New European Union Members and Applicant Countries. Central Europe and the Baltics have made considerable progress in installing metering and control equipment. Many countries such as Poland, Hungary, the Czech Republic and Bulgaria have introduced mandatory metering at the building level, with a transition period. By law, all buildings connected to district heating systems in Hungary and Poland are now metered; and the metering rate is close to 100% in many cities of the Czech Republic.[12] There is also a growing trend in these countries to install individual valves or controls and heat meters or allocators at the apartment level. Romania, on the other hand, still has a lot of progress to make in this area.

Belarus, Kazakhstan, Russia and Ukraine. Relatively few buildings are equipped with meters. In Russia and Ukraine, for example, less than 1% of residential buildings had meters in 1998.[13] Today 10-15% of buildings in Russia are reportedly equipped with heat meters.[14] Policy makers in these countries should prioritise installing heat regulation valves, controls and meters, and introducing consumption-based billing. Still, the lack of financial resources makes this a significant challenge. Other factors may also deter progress. For instance, according to the Municipal Network for Energy Efficiency (MUNEE), district heating companies in Russia often create barriers to installing meters by delaying approval.[15] This also happens in Ukraine and other transition economies. District heating companies are obstructive because they fear the loss of revenue that installed meters may cause: they would have to charge their customers only for heat delivered and would no longer be able to include unlimited distribution system losses in their charges.

South East Europe, the Caucasus and Central Asia. Progress in installing heat metering and regulating equipment varies throughout the region, but generally remains slow. In Uzbekistan, for instance, there is a legal obligation to install meters, but it is not implemented in practice; most district heating systems still lack controls and metering equipment, and consumers are charged according to established norms. The experience in Croatia and other countries shows that installing individual heat meters has a positive psychological effect, stimulating consumers to use energy more rationally, although it does not guarantee energy savings. Major energy savings result from installing and using thermostatic valves or controls; this has reduced energy consumption by up to 32% in many cases because consumers can reap a direct benefit by changing their behaviour.[16]

12. *Lampietti and Meyer (2002).*
13. *Meyer and Mostert (2000).*
14. *Heat Supply News (2003b).*
15. *MUNEE, www.munee.org.*
16. *Euroheat and Power (2003).*

companies to install heat supply measurement equipment in substations. By the year 2000, thousands of substations had been equipped with meters, which required a considerable financial and organisational effort. Some countries like Germany also require individual meters.[17]

Consumers are generally in favour of meters, but often cannot afford them. District heating companies often do not support and may even oppose meters because they fear that metering may lead to revenue losses. Indeed, introducing meters in most cases reveals that real heat consumption is much lower than the estimates used over the years by district heating companies. Moreover, building-level heat meters are normally considered to be part of the network, so the district heating company, rather than the consumer, has to pay for the equipment and installation. District heating suppliers may not always be willing to voluntarily make such investments because their revenue could drop while they incur cost. Suppliers are also aware that once a basement meter is in place, households may choose to install heat cost allocators, which may lead them to consume less heat. As monopolists, some companies go to great lengths to prevent this from happening. Market-oriented operators, however, appreciate that metered consumption is in their interest because it makes district heating more attractive to customers and so helps to sustain and increase their market share.

Recommendation

Obligatory installation of metering equipment and the necessary incentives and/or enforcement measures will facilitate the transition to consumption-based pricing.

Policy makers should adopt a balanced approach in the transition from an area-based to a consumption-based tariff. In most cases, district heating companies install heat meters over several years, a period during which the regulator should carefully review costs and gradually adjust tariffs. In no case should bills for end-users increase as a result of metering, which underlines the importance of carefully designed tariff regulation aimed at limiting costs. One option is to require the district heating company to allocate a decreasing amount each year for losses and to build the cost of upgrades into tariffs, an investment that could be covered by the money saved from reduced losses. This might enable companies to invest in major improvements over a period of years.

17. *A German decree of 1981 (Heizkostenverordnung, HKVO) requires that all apartments in multi-family buildings be equipped with individual heat metering devices and billed based on consumption. If the building owner does not install individual metering devices, the tenants can reduce the bill by 15%, the average estimated level of savings due to metering.*

Collection and Non-payment

District heating companies in transition economies apply various types of collection procedures. They often use sub-contractors or third parties. The third party can be, for example, a municipal service company (such as in Belgrade), which collects payments for heat and hot water along with payments for several other utility bills. Or it can be a special, nominated agent, such as the "heat agent" in Bulgaria.[18]

Some companies bill individual final consumers, others bill building owners or housing associations, if they exist. In many countries such as Russia or Ukraine, final consumers (households) usually have neither a contract nor contact with their supplier. They cannot negotiate the tariffs and terms of their heat supply and, in most cases, they have very limited or no influence on the heat supplier. This is one of the main reasons for customer dissatisfaction.

District heating companies, on the other hand, often also have little influence on their customers' payment behaviour. In many transition countries, utilities are not legally allowed to disconnect customers in arrears or use other payment enforcement measures. Some countries, however, are making progress in this area. Polish regulation allows companies to deduct heating debt directly from the pay checks of customers in arrears.[19] In Lithuania, district heating companies can prosecute customers who do not pay for more than six months, and the court can decide to expel them from their dwelling.

Non-payment for energy services was a major problem in transition economies in the 1990s, particularly in the former Soviet Union and South East Europe. Its origins lay in the significant drop in household revenue and a simultaneous rapid increase in electricity and heat prices, together with a lack of payment enforcement. The problem has decreased significantly in recent years. However, outstanding debts remain from this period, which inhibits system development. In many countries, utilities cannot write off this accumulated bad debt.

In 1996, the full cost of heat and hot water supply for a typical apartment accounted for between 20 and 40% of average household income in the former Soviet Union.[20] Heat bills account for about 33% of average monthly salaries in Serbia, despite subsidised heat prices.[21] The share of energy costs in an average household budget is about 11% in Poland (reaching 40% for the

18. Kalkum and Rajkiewicz (2002).

19. MUNEE, www.munee.org/go.idecs?i=9.

20. Meyer and Mostert (2000).

21. MUNEE, www.munee.org/go.idecs?i=8.

poorest families). For comparison, an average EU household spends less than 8% of its total expenditure on telecommunications, water and domestic energy combined. Many households in transition economies are therefore unable to pay the full cost of their heat and hot water supply. Others are able but unwilling to pay[22] because of low service quality or simply because they cannot be legally forced to pay. In Armenia, for instance, customer arrears to district heating companies are estimated at about $10 to 12 million a year, and local governments ultimately have to cover these debts.[23] A survey of 701 Armenian households[24] shows that in areas without district heating the population pays almost as much for alternative energy sources such as wood or electricity as it would have paid for district heating. By contrast, the "privileged" households connected to district heating often do not pay, but continue to receive subsidised heat.

Cutting off individual non-paying consumers is often technically impossible in cases where distribution systems within buildings involve vertically arranged one-pipe systems (see Box 2.1 in Chapter 2). Bulgarian companies have dealt with this by removing radiators, which proved to be an effective method of changing non-payers' attitude. In some countries, regulations do not allow utilities to disconnect non-paying consumers; in others, disconnections are permitted by law but rarely take place in practice because of the bureaucracy involved.

District heating companies use different methods to improve payment discipline. In Russia, for example, some utilities hire private collection agencies, others create lotteries for consumers who have paid on time, introduce "amnesties" for paying past bills without penalties or publish the names of customers in arrears in the local press. Installing meters generally improves payment discipline as consumers know that they pay only for heat consumed.

The collection rate has improved significantly in recent years in most of the Central Europe and the Baltic countries. In Estonia, for example, non-payment in big cities has been reduced to 2-3%. However, in some small systems, up to 20% of households still do not pay for district heat while the average national non-payment rate is 4-5%.[25] Non-payments were always a bigger problem in the rest of the former Soviet Union although the collection rate has improved in Russia and Ukraine over the last two to three years.

22. *For a discussion of "ability to pay" and "willingness to pay" see, for example, FVB/SwedPower (2001).*
23. *World Bank (2003).*
24. *UNDP/GEF (2000).*
25. *Correspondence with the Energy Department in the Estonian Ministry of Economy.*

Recommendation

The legal and regulatory framework should support utilities in enforcing payments. Every consumer should pay for the services supplied. At the same time, countries should introduce effective social schemes to protect low-income and poor households.

● Social Protection[26]

In either the competitive or regulatory framework, district heating prices should fully cover costs. In most transition countries this means that companies and regulators should raise prices to a level that is beyond what a certain part of the population can afford. Thus, governments face the challenging task of setting the right balance between allowing companies to cover costs (which is essential for investment) and protecting the most vulnerable households. Transition economies use a wide range of support mechanisms, but not all of these are equally effective in reaching this balance. This section briefly compares the different types of subsidy that are most often used in transition economies. Subsidies in this context mean direct government payments to heat consumers or producers, and any other measures that have a similar direct or indirect effect (for example, keeping the price of district heating for households below market levels).

Direct Subsidies to Utilities

Until recently, many transition countries kept heat tariffs for households below cost and compensated the difference to utilities from state or municipal budgets. Central Europe and the Baltics have already eliminated direct subsidies to district heating companies with cost-based pricing. But many other countries, including Armenia, Bulgaria, Romania, Russia, Serbia, Ukraine and Uzbekistan, still subsidise suppliers directly. In Romania, for example, the National Energy Regulatory Agency (ANRE) sets a national reference price (NRP) for district heating sold to residential consumers. If production and distribution costs are higher than the NRP, the national and local budgets subsidise the difference. A very high disconnection rate in Romania demonstrates that subsidies to producers have not been effective in improving the sustainability of district heating systems as they do not encourage service quality improvement and cost reduction. ANRE reports that the tariff for heat generated by Termoelectrica, which produces about

26. *Unless otherwise stated, this section is based on UNEP/IEA (2002); OECD (2004); World Bank (2000); and IPA Energy Consulting (2003).*

40% of the country's district heating, fully covered estimated costs for the first time in 2002.[27] In Serbia, subsidies reportedly cover 40 to 70 % of district heat costs (and about 80% of electricity costs).[28]

Subsidies to producers cushion them from competitive market pressure and tend to reduce their incentives to minimise costs. This results in less efficient operation and can lead to uneconomic investments. Producer subsidies also mean that all residential consumers (not only the poorest) pay reduced heat tariffs, which provides no incentive for end-use energy efficiency and energy savings. The richer households also generally benefit more from subsidised prices than the poorer ones because they usually have bigger dwellings and consequently consume more heat. In most countries, recent policies are designed to gradually eliminate producer/supplier subsidies.

Cross-subsidies

Cross-subsidies still exist in several countries, particularly in former Soviet republics and in South East Europe: low, below-cost tariffs for households are cross-subsidised by higher tariffs for industrial consumers. Cross-subsidies are a very unsustainable approach to social protection and should be eliminated. As already noted in Chapter 2, high industrial tariffs because of cross-subsidies reduce the competitiveness of district heating: many industrial consumers have disconnected and built their own heat sources.

Poor Enforcement of Payment

Poor enforcement of payment for utility services is like a type of cross-subsidy because one group of consumers in effect pays for the non-payers. As already noted, utilities should be allowed to disconnect non-payers or use other forms of payment enforcement in order to protect their financial situation.

Price Discounts for Privileged Groups

In much of the former Soviet Union, utilities have to set reduced tariffs for electricity, heat, water and some other services to certain households selected based on occupation (e.g. military personnel), medical history, age or merit. This category of subsidy is a legacy of the old Soviet administrative system. Eliminating it is difficult. Privileged groups are usually established at the national level, so local authorities cannot modify them even if they wished to. The disadvantages are significant. First, the criteria for privileges are not directly linked to beneficiaries' income; the system can thus favour relatively rich households who could pay the full service price. Second, the system

27. ANRE (2003).

28. MUNEE, www.munee.org/go.idecs?i=8.

distorts heat prices. To recover losses from providing discounts to privileged consumers, companies have to raise tariffs for other consumers. This increases incentives for the latter to disconnect. If utilities are not legally allowed to cover the costs of the system in this way, they will face a revenue shortfall. Some countries pay utilities a subsidy that covers the cost of discounts to privileged consumers. This means that utilities have to maintain an appropriate database, adding to the costs. Moreover, utilities often have an incentive to inflate the costs of serving privileged groups. Governments should eliminate discounts to privileged consumers, given the important disadvantages they carry.

Lifeline Tariffs

Lifeline tariffs can contain two or three "blocks". Two-block lifeline tariffs have a lower rate for heat consumed up to a certain limit, usually set quite low, at a level of "basic need" or "lifeline" heat consumption. Heat consumed above this limit is paid at a higher rate. Three-block lifeline tariffs introduce a third, even higher tariff rate for heat consumed over a third limit to discourage waste and extensive use. Lifeline tariffs are better suited for services with metered consumption, but can be applied without metering. For example, Moldovan households paid a heavily subsidised heat price for the first 12 m^2 of living space per capita in the winter of 1998/99.

Lifeline tariffs have the advantages of being transparent, predictable and relatively easy to administer. They cover a large number of consumers, as everyone who is connected benefits, which means that they can be an effective energy efficiency measure. On the other hand, the wide coverage also means that they are not well targeted to protect the poorest consumers, and in terms of benefit per poor household they can be very expensive.

Burden Limit (or Housing Subsidy)

Belarus, Russia, Ukraine and many other countries have established a targeted aid scheme to reduce the communal services expenditure of low-income households. If a household's utility expenditure exceeds the notional burden limit (set as a given percentage of monthly household income), the municipal or national budget compensates for the rest. In Russia, for example, if housing and communal services bill exceeds 22% of a household's income, the family is eligible for a budget subsidy.[29] This measure is more targeted than the previous ones. However, it can be administratively complex and open to abuse. To be really effective, it requires reliable information about households in need. For example, it cannot work

29. Some cities have set lower limits: for example, 13% in Moscow and 14% in Cherepovets.

in societies where a large share of household income goes undeclared. If reliable information on income is available, the cost of providing the benefit per poor household can be much lower than with other schemes. Another disadvantage of this approach is that it does not encourage energy conservation because the subsidy is linked not only to household income, but also to the level of consumption of electricity, gas, heat and other utility services.

Non-earmarked Cash Transfers

Governments may pay non-earmarked cash transfers to all poor households that fulfil certain eligibility criteria. The transfers are not linked to a household's actual consumption of heat or other communal services, and recipients can choose how to allocate the benefit (for example for food purchases or medical expenditure). This approach therefore does not guarantee that low-income households will pay their district heating bills if they have other priorities, but it also does not distort energy price signals like many other types of subsidies.

Reducing Heat Demand

Energy efficiency measures can be more effective than energy subsidies, often at a lower cost. Reducing the energy demand of poor households by improving end-use energy efficiency can have the added benefit of reducing any energy subsidy paid to low-income households. Energy efficiency measures such as installing radiator reflective shields, window weatherisation, insulation, thermostatic valves and controls and individual heat cost allocators can reduce energy bills by 20-40%. Governments should consider setting up special funds and support programmes and a regulatory framework to facilitate end-use energy efficiency investments by both consumers and utilities.

In many countries, different subsidy mechanisms coexist. In Russia, for example, municipalities pay direct producer subsidies to housing and communal service companies (HCS) that supply district heating and targeted subsidies to low-income households (which are also paid to HCSs). The federal government pays subsidies for specific categories of consumers with privileges.

The Way Forward

Given the high social importance of heating and relatively low household incomes, it is clear that governments in transition economies will want to continue to support poor households with their heating expenditure over the short to medium term. Support mechanisms should be carefully chosen

because of the many negative consequences of poorly implemented subsidies. Some types of subsidies benefit mainly richer households and heat producers, and they may not reach the poorest households at all. Subsidies may also lead to higher heat consumption and waste, with negative consequences for the environment. They can be excessively costly, which puts a burden on state and municipal finances, weakening economic growth. Finally, they can distort markets and lead to uneconomic investment decisions.[30] There is no universally perfect subsidy mechanism. The effectiveness of particular subsidies depends on national and local circumstances, policy objectives and priorities. However, policy makers should apply the following basic principles when designing or reforming social subsidies for district heating:

- *Targeting*: Subsidies should benefit only those who really need it, i.e. poor, low-income households.
- *Economic soundness*: Subsidies should be justified through a thorough cost-benefit analysis. Their total cost, including the cost of administering them, should be reasonable and should not undermine the finances of the public institution responsible for providing them. Administrative simplicity is important in reducing the overall cost of subsidies.
- *Coverage:* Subsidies should reach as many people in need as possible.
- *Efficiency*: Subsidies should not undermine incentives for suppliers and consumers to provide and use heating services efficiently.
- *Transparency*: Governments should disclose information on public funds for subsidies and on subsidy targeting.
- *Side effects*: The subsidy mechanism should seek to minimise price distortions and other unintended side effects.
- *Time limit*: Ideally, subsidies should be designed with sunset clauses to avoid overdependence by recipients. As far as possible, they should be gradually reduced and eliminated.

As with tariffs, policy makers should consider their main priorities when designing subsidies because one mechanism usually cannot meet all criteria simultaneously. The World Bank has analysed different types of utility subsidies, including district heating. It recommends that policy makers adopt an objective methodology to evaluate the performance of different subsidy mechanisms using several of the criteria set out above.[31]

30. *UNEP/IEA (2002).*
31. *World Bank (2000).*

Recommendation

In countries where direct subsidies to utilities and cross-subsidies still exist, governments should phase these out and introduce schemes more targeted at low-income households. They should replace discounts to privileged groups that are unrelated to income with other schemes. Over the longer term, as economies stabilise and household incomes grow, governments should gradually reduce and phase out all subsidy mechanisms as far as possible.

Taking Regulation and Competition Forward

Box 3.4 below summarises recommendations on integrating regulation and competition into policy. Chronological order is important. In most cases where heat markets are subject to competition, district heating should not be

Box 3.4

Policy Decision Chart for Balancing Supply and Demand

Do you want to use regulation or the market to balance supply and demand and ensure least-cost supply?

Regulation

Recommendations:

- Require local energy plans, including realistic demand forecasts.
- Conduct least-cost planning, assessing both demand and supply-side measures.
- Eliminate subsidies, make sure collection rates are high.
- Favour tariff structures that encourage efficiency (substitution tariffs, price caps with efficiency indexes or benchmarking, not cost-plus).
- Use wholesale competition to ensure that new supply is least-cost (based on competitive bids).

Market

Recommendations:

- Introduce market-oriented tariff regulation (substitution tariffs, price caps with efficiency indexes or benchmarking).
- Eliminate subsidies, make sure collection rates are high and address any other barriers.
- Assess market conditions before launching competition to ensure no major barriers.
- Require district heating companies to allow customers to disconnect on request.
- Let market set prices.
- Monitor the market periodically.

regulated (particularly if competing heat sources are no longer regulated). In a competitive market, monitoring the market for fairness takes the place of energy planning. Several of the steps are common to both approaches, indicating the need for certain basic conditions.

Conclusions

This chapter lays out two paradigms for balancing supply and demand. The first focuses on better regulation. The second involves the use of competition. Both options are viable and each has its pluses and minuses. In general, competition is best for countries that are more advanced in economic reform and have lower poverty levels. Several countries in Central Europe are probably ready to allow the competitive market to set prices as long as the market is monitored. Regulation is more suitable for countries that still have energy subsidies and high levels of non-payment. In areas with extensive poverty, heat source competition at this stage may prove unfair to consumers because large parts of the population would not be able to afford to exercise their market choice.

In both cases, governments should put an effective social policy in place to protect the most vulnerable people. Requiring control and metering equipment and introducing consumption-based billing should also be government priorities. These measures will improve energy efficiency and give households more control over their bills, thus increasing the attractiveness of district heating.

If a country decides to use regulation to balance supply and demand, energy plans are essential. Energy plans provide regulators with independent information to help ensure that costs are kept to a minimum and that investments are justified, balancing the interests of heat supply companies with those of the public. If a country decides to introduce competition, it should monitor the market to make sure competition is fair and the market is balanced.

REGULATION

Energy planning and district heating zones are both forms of regulation. Energy planning, combined with tariff regulation, can allow regulators to balance supply and demand when the market does not create a level playing field by itself. This chapter starts by highlighting one key condition of effective regulation: the independence of regulators. It then considers several approaches to tariff design taking policy priorities into account.[1] Other important aspects of regulating district heating are addressed elsewhere: Chapter 5 looks at introducing wholesale heat competition in a regulated context, and Chapter 8 mentions environmental regulations.

Regulatory Bodies

- **Current Situation in Transition Countries**

All transition economies have established regulatory bodies to oversee district heating companies and heat tariffs. These can be at the national, regional and/or municipal level. In many countries, including Latvia and Romania, municipalities act as the regulator for heat produced from heat-only boilers, while a national regulator[2] regulates heat produced from cogeneration. This "double" regulation makes running district heating companies more complicated and may cause problems. Where municipalities are simultaneously the regulator and owner of district heating companies, they may have conflicting interests: as regulators, their interest is to keep tariffs low in order to avoid social and political problems. As owners, their interest is, or should be, to set tariffs at a level sufficient to recover costs and invest in modernising assets. When separate entities regulate tariffs for heat from different sources, this can lead to distorted price signals: municipalities may set tariffs for heat from heat-only boilers lower than tariffs for cogenerated heat, even if this tariff structure does not reflect the economic reality.

Regulators usually have several missions that include encouraging efficiency, protecting consumers and ensuring adequate capacity to avoid supply disruptions. Other missions may include ensuring compliance with environmental, safety and land use regulations. Regulators usually have several tools to help implement these missions. In addition to their work on

1. *For more detailed discussion of district heating regulation by country, see WEC (2004) and Euroheat and Power (2003).*
2. *The national regulator in Latvia is the Public Utilities Commission; in Romania it is the Romanian Electricity and Heat Regulatory Authority (ANRE).*

heat tariff regulation, they issue licences and performance standards, and monitor how these standards are used. As with tariff regulation, both national and local regulators can be responsible for licensing and performance control. In Hungary, for example, the national regulator, the Hungarian Energy Office (MEH), issues construction and generation licences for cogeneration plants exceeding 50 MW, as well as supply licences for cogenerators that operate district heating networks. Municipalities issue other types of construction, generation and supply licences for district heating facilities.

● Independence

Independent regulators are an important, if not essential, element of an effective regulatory and policy framework for managing the district heating sector. For tariff (and other) regulation to be unbiased and fair vis-à-vis both suppliers and consumers, the regulator should be independent in two ways: from stakeholder interests and from short-term political pressures.[3] The former is important to ensure that regulated parties have limited influence on regulatory decisions, which is necessary to prevent regulation from favouring one group of stakeholders over others. Measures to support independence from stakeholders may include prohibiting any financial interest by the regulator or his family in the industry and restrictions on working for the industry during or for several years following their terms as regulators.

Political Independence

Political independence serves three goals. First, it reduces the influence of short-term political pressures on regulation. Regulatory policies should not generally depend on short-term political circumstances. For instance, district heating prices should not be used as a tool to influence voters in elections. Second, political independence may reinforce the independence of the regulator from special interest groups. And third, when district heating companies are state-owned, political independence is essential to avoid conflicts of interest between the state as owner and as regulator.

An IEA study of regulatory institutions in electricity markets notes that complete political independence is difficult to achieve both in principle and in practice.[4] However, the degree of political dependence can and should be reduced. Several IEA countries have well-run independent regulators, and some transition economies have made significant progress in enhancing the

3. *For a more detailed discussion, see IEA (2001b).*

4. *IEA (2001b).*

independence of their regulators. Regulation is by nature subject to some political control and influence: the regulator is nominated by a political institution and operates within the existing policy and legal framework. In practice, the regulator's independence (and the quality of its expertise) is often weakened by budgetary constraints. At the same time, complete independence may not be desirable, at least in certain circumstances, because of the potential danger of regulatory capture (notably, by the entities that it regulates) and also because there is a need to ensure the regulator's accountability for its actions, which works through the political process in a democracy. The issue of political independence is therefore one of degree. Regulatory independence from short-term political pressure promotes effective regulatory performance. However, some political control (and, thus, influence) over regulatory structures is both necessary and unavoidable.

Recommendation

Political independence of regulators should be enhanced through measures like irrevocable mandates for regulators (mandates that cannot be removed under any circumstances during a guaranteed period) and other measures such as separate budgets, autonomy in managing human resources and salaries, and non-renewable appointments.

Separation of Ownership and Regulation

The separation of ownership/management and regulatory functions at the municipal level (as well as the national level if that is relevant) is another important structural objective for establishing effective regulators, although it can be difficult in practice, as utilities often start out as a department of the municipal council. Solutions to this conflict include privatisation or the involvement of private operators through leasing or concession agreements. If the utility remains under municipal ownership/management, it should be established as a commercial company separate from the municipal council and subject to the same regulations as other commercial companies.

Recommendation

Ownership/management and regulatory functions of regulators should be clearly separated. To keep at arm's length from the companies they regulate, regulators should be subject to constraints on their relationship with the regulated parties during and after their tenure.

Heat Tariff Regulation

Different Approaches

Countries will adopt different approaches to district heat tariffs depending on whether they are broadly following the regulation or competition paradigm. In most OECD countries, including Finland, Sweden, Canada and Germany, the state does not regulate tariffs, and market forces set district heating prices. Non-regulated district heating tariffs are, by definition, competitive and provide customers with affordable, reliable heat. However, there are circumstances under which regulated tariffs may be necessary: where there is no effective competition to district heating, where competition does not create a well-balanced market, or where it would be politically difficult to move to full competition in the short term. In most transition economies, where energy markets are still undergoing reform, the most common approach is to regulate tariffs in order to protect consumers against monopolistic prices, while enabling district heating companies to cover their costs.

Whether they are regulated or freely set in a competitive market, balanced and fair heat tariffs are vital to ensure both customer satisfaction and system sustainability given the particular relationship between the district heating supplier and its consumers. The interdependence between supplier and consumer is probably greater than in other energy markets. Most district heating systems are natural local monopolies for district heating. There is generally only one district heating supplier in a given zone:[5] consumer switching to alternative heat sources requires substantial investment and is not affordable for everybody; in some cases, disconnecting is not technically possible for individual customers. Captive customers, dependent on one monopolistic heat supplier, are likely to need protection from abuse of monopoly power and unjustifiably high prices. At the same time, district heating systems depend heavily on their local customers because they cannot transmit heat over very long distances. Thus they cannot sell it in other areas if their original customers disconnect. To discourage switching, heat tariffs should be affordable. Yet to avoid putting district heating finances under pressure, they should not be too low either.

The Current Picture in Transition Countries

The structure and level of heat tariffs differ significantly from one country to another and often from one district heating system to another in the same

5. *This is not always the case: in Sweden, for example, competing district heating facilities (including networks) can be built and operated where there is an existing system. This has been done in several cities, including the fourth largest Swedish city, Uppsala; Source: Correspondence with Peter Dahl, Svensk Fjärrvärme, Sweden.*

country. An important common factor, however, is that until recently, heat prices did not fully cover costs in most transition countries. Low heat tariffs did not provide enough revenue for district heating companies to repair and modernise their systems. Nor did they encourage consumers to invest in energy efficiency measures. Over the last decade, transition countries have moved toward tariff regulation based on cost recovery for different types of energy services. However, district heating tariffs in many countries do not yet fully cover the costs of supplying heat to all consumer groups. In most cases, industrial heat tariffs now cover current costs, but still often fail to provide an adequate return on investment and may not cover the cost of asset replacement. The picture for residential tariffs is mixed. Many countries of the former Soviet Union and South East Europe still keep residential tariffs below cost and make up the difference with subsidies or cross-subsidies.[6] Many countries in Central Europe and the Baltic region, as well as Kazakhstan, have already introduced or are gradually phasing in tariffs that cover full costs for all consumer groups, including residential consumers.

● Options for Tariff Regulation

Ideally, a well-designed heat tariff should:[7]

- Cover the full current costs of the heat supply company.
- Include replacement costs and return on investment, taking into account the need for adequate capacity.
- Allow sound operation and management of the district heating system.
- Be competitive with prices for other heat sources.
- Give the district heating company incentives to reduce costs.
- Give heat suppliers and customers incentives to save energy.
- Be transparent and easily understandable: customers should clearly see from the tariff what they are responsible for and how they can influence the heat bill.
- Last but not least, protect the consumer from unjustifiably high prices.

It is often difficult to meet all these criteria fully at the same time. Tariff policy design therefore needs to be based on a prioritisation of policy objectives. It should also reflect the government's general energy policy. If, for instance,

6. *Not only are subsidies keeping tariffs below cost, but they may not be achieving their primary objective of making heat affordable to poor consumers. In some countries, including Moldova and Azerbaijan, most of the population can hardly afford even the subsidised prices.*

7. *Based on Nuorkivi (2002) and World Bank (2002).*

the country's strategic objective is to reduce energy consumption and greenhouse gas emissions, district heating tariffs should be designed to provide strong incentives for energy saving. If the strategic objective is to refurbish and modernise existing district heating networks, heat tariffs must include replacement costs and a return on investment (and the social issues related to higher tariffs should be addressed separately through social policy rather than energy policy).

A key objective of tariff regulation is to protect consumers from unjustifiably high prices. In practice, however, the effect can be the reverse. Poorly designed tariff regulation that does not provide incentives for cost reduction may result in unnecessarily high tariffs for consumers. By contrast, open competition in balanced markets generally encourages efficiency improvements and cost reduction, and results in lower prices. Thus, competition is in principle a more effective tool for consumer protection. Where competition cannot be introduced, the role of regulation should be to mimic the effect of a competitive market by creating effective incentives for cost reduction. Not all approaches to tariff regulation can achieve this. The approaches include cost-plus regulation, substitution-based regulation, price cap regulation and benchmarking (or yardstick) regulation. The last two approaches are often called incentive regulation, as they encourage utilities to improve cost efficiency. Another approach that provides incentives for efficiency is linked to concession agreements, where the tariff structure is designed to encourage cost reduction. The cost-plus approach, however, does not encourage efficiency. Cost-plus regulation is the most common approach in most transition economies, although countries such as the Czech Republic, Estonia, Hungary, Lithuania and Poland have introduced some form of incentive regulation. In Western Europe, companies usually set their prices using a combined cost and substitution approach: district heating tariffs cover costs and are adjusted close to, but lower than, the next alternative cost of supplying a particular customer with heat.[8]

Cost-plus Regulation

Cost-plus regulation allows companies to include in their tariffs those costs that the regulator considers necessary to ensure an adequate level of service to end-users. The regulator periodically reviews the company's expenditure and approves its tariffs based on the total heat production, transmission and distribution costs that it deems appropriate. The regulator also estimates an appropriate profit margin; in some countries, the allowed profit margin is specified in legislation (e.g. 10% in Poland).[9] In practice though, the profit

8. *Gochenour (2001).*

9. *In Denmark, district heating suppliers are considered public service companies and are not allowed to make a profit.*

often serves to cover business expenses like worker bonuses and capital investments (as in much of the former Soviet Union). The regulator often approves the profit margin only if the company has made investments.

Cost-plus regulation has significant drawbacks. First, there is no incentive to reduce costs, but rather an incentive to overspend or overstate costs: if a company reduces its costs, its profits also go down. Thus, a company has no incentive to optimise investment and may overinvest, leading to overcapacity. Second, if poorly designed, cost-plus regulation may deter cost-effective investment in energy efficiency measures. For example, Polish tariff regulation greatly discourages even cost-effective utility investment in demand-side management because it does not include such investment in the list of capital expenses that can be recovered through the rate base. Finally, as applied in transition economies, cost-plus regulation allows companies to cover operational costs only. It often does not include asset depreciation and a return on capital. Thus, over time, there is little or no money and incentive for new investment. In the past, special government allocations often covered capital investment, but that rarely if ever happens today.

Cost-plus regulation applied in most transition countries is somewhat different from cost-of-service or rate-of-return regulation common in Western countries. In New York City, for example, where district heating tariffs are regulated based on cost of service, the district heating company, Con Edison, must prepare detailed data justifying its costs in compliance with the existing tariff regulations and cost rules. The regulator reviews these data and approves the costs as well as a negotiated return on investment for capital investments. The major differences between cost-plus regulation and cost-of-service regulation are two fold. First, cost-plus regulation in transition economies tends not to provide adequate allowances for capital investments. Second, regulators calculate the profit in cost-plus regulation based on total costs, while with cost-of-service regulation, they calculate return on the basis of investments only. Therefore, cost-of-service regulation is more effective at ensuring that necessary investments take place. Moreover, it tends to promote efficiency slightly more than cost-plus regulation because the utility's profit does not grow if its operational costs grow (for example, if the utility consumes excess fuel).

Substitution-based Regulation

Under the substitution-based approach, the regulator allows a district heating company to set tariffs no higher than the price of competing heat sources, such as individual gas boilers. Substitution-based tariffs are market-

oriented and have no direct relationship with costs. They should therefore encourage cost reduction, which allows the company to increase profits. However, fair consumer protection is difficult under this approach. If the price of an alternative energy source is very high, district heating suppliers can also charge unnecessarily high prices, even if their supply costs are relatively low, thus generating extraordinary profits for themselves. If alternative fuel prices are low, the danger is that heat prices will be set below cost, thus generating losses for the company. Substitution-based pricing can work well where the costs of both district heating and alternative heat sources are reasonable, but the two do not directly compete in a given market.

Price-cap Regulation (RPI-X)

International experience in the electricity, heat, gas and water supply sectors shows that price-cap regulation (also known as RPI-X, where RPI stands for retail price index) can be a viable and better alternative to cost-plus regulation. This form of incentive regulation restricts changes in the price that the regulated company can charge and allows it to temporarily retain some (or all) of the benefits from efficiency improvements. This gives the company an incentive to reduce costs but allows prices and revenues to exceed costs temporarily. Prices are set to cover historical costs, including a return on investment, minus a given fraction, X, of this cost with a view to encouraging efficiency gains. If costs are reduced by more than X, the company is allowed to retain the additional profit. Yet if costs are reduced by less than X, it must bear the losses. A typical example of this approach is the RPI-X regulation of utilities in the United Kingdom where it has generated significant utility cost reductions. Many other countries use it now as well, including some transition economies. In the Czech Republic, for instance, price-cap regulation is common in district heating (see Box 4.1).

Experience in Western countries shows that one difficulty of this regulation is the calculation of X to set the price cap, as this requires an estimate of future productivity improvements, which may be difficult. The higher that X is set, the tighter the constraint. In order to set a suitable price cap, the regulator needs to be familiar with the industry, including its current efficiency and potential for efficiency gains, as well as likely future market developments. The calculation may be easier in transition economies because of the large sector-wide potential for efficiency gains. The regulator needs to determine a reasonable rate of progress in efficiency based on experience in the country and abroad. Concerns about the fair distribution of productivity gains among stakeholders (investors, the workforce and consumers) is another potential problem.[10]

10. *Based on IEA (2001a).*

Price caps should be distinguished from revenue caps. The first restrict change in the quantity-weighed average of prices, while the second restrict change in a company's revenue.[11] Revenue caps do not provide the same incentives for cost reduction as price caps. Price caps should be also distinguished from indexation formulas; both concepts can be combined in tariff regulation, but their objectives and nature are different. Indexation formulas are intended to facilitate regulation: they automatically adjust the tariff to fuel price fluctuations and other changes in variable costs. That said, they do not necessarily provide incentives to improve productivity.

Box 4.1

Heat Tariff Regulation in the Czech Republic

In the Czech Republic, the Energy Regulatory Authority (ERU) regulates heat tariffs. The level of tariffs differs from one municipality to another because tariffs are based on each district heating utility's costs. The regulator can apply price-cap or cost-plus regulation. In general, it applies the price-cap approach (RPI-X) and sets caps for the maximum annual price increase allowed. These caps were formerly specified as a percentage of the retail price index. The percentage was lower than inflation (retail price index minus an efficiency index X, i.e. RPI-X). Yet the cap defined in these terms led to increasingly large tariff differences between companies: utilities that initially had higher tariffs (because of higher costs) were allowed a bigger tariff increase in nominal terms than utilities with lower initial costs. The system was therefore modified, and the cap is now defined as an absolute amount in Czech crowns. The price differential is now decreasing: utilities with lower prices are allowed higher caps than those with higher prices. Exceptional price increases are allowed for utilities that undergo major reconstruction such as fuel switching or refurbishment of the heat distribution system.

Source: SEVEn (2003)

Several transition economies, including Lithuania, Estonia, the Czech Republic, Hungary and Poland, have introduced forms of incentive regulation. Applying price caps in practice, however, often does not provide the desired incentive for cost reduction and investment. In some cases, the operator can only keep the savings for a period that is too short (one to two years), which minimises the incentive to make improvements. In other cases, the regulator uses ambiguities in the price-setting system to reduce the benefits of savings to the operator. For example, an operator in a particular year makes a saving

11. Albon (2000).

relative to a RPI-X target of 20, but at the same time seeks to increase prices to end-users by 30, using an index formula in the tariff which allows energy cost increases to be passed through. The regulator will use his power to enforce a price increase of only ten, arguing that the savings achieved by the operator should be used to offset the tariff increases related to energy cost.

Benchmarking

Another approach to incentive regulation is benchmarking (or yardstick) regulation. A utility is allowed to set tariffs that are related not only to its own costs but also to the costs incurred by other companies in providing the same service. This "competition by comparison" approach induces utilities to compete with one another for cost savings even when they are not operating on the same local market. It also provides a benchmark that is not influenced by the regulated company. Another advantage is that it reduces the scope for large price differences between companies and areas unless these differences are justified by different costs of production: companies are assessed against their peers. That said, uncontrollable factors such as climate, terrain, population density or network size may justifiably influence costs in different areas, particularly in large countries with varying conditions such as Russia. In theory, the impact of these factors on costs can be measured and taken into account in the benchmarking, but in practice this is difficult.

Table 4.1 provides a comparison of different approaches to tariff regulation. These assessments are theoretical, based on best cases worldwide. In reality, much depends on implementation details and the actual situation in each transition country. Moreover, only two options – cost-plus and price-cap regulation – have been used in transition economies for regulating heat tariffs; so assumptions regarding the other two options are based on experiences in other countries or other sectors. Consumer protection is certainly a major objective of the regulation but we intentionally do not include it in the table. As highlighted earlier, the best way to protect consumers is to reduce tariffs, which can be achieved through cost reduction. Chapter 3 addressed other, more targeted schemes for protecting low-income consumers.

Recommendation

Given the numerous disadvantages of cost-plus regulation, regulators should consider using other approaches, for example price caps or benchmarking. Incentive regulation should be robust and predictable to ensure that the operator has sufficient motivation to improve efficiency and that it can keep the benefits of its efforts for a relatively long period. Substitution-based tariffs can be effective when the energy market is balanced.

Table 4.1

Comparison of Different Approaches to Tariff Regulation

Priorities	Regulatory Options			
	Cost-plus	Substitution	Price-cap	Benchmarking
Covering operational costs	+	?	+	+
Covering capital costs	+	?	+	+
Improving competitiveness	–	+	+	+
Encouraging cost reduction	–	+ (but not necessarily price reduction)	+	+
Encouraging energy efficiency	–	+	+	+
Simplicity of implementation	+	?	–	–

Notes:

+ : Tariff meets the priority.

-: Tariff does not meet the priority.

?: It depends on the implementation details or the situation. For example, cost-plus tariffs usually favour investment, but only if return on capital is included in the tariff structure.

● Tariff Structure

Heat tariffs can have a one or two-part structure. One-part (or one-tier) tariffs have only one component, which is either consumption-based or, conversely, is fixed regardless of actual consumption (it is usually based on the heated area). Two-part (or two-tier) tariffs, as the name implies, have two components: a variable (or consumption-based) charge and a fixed (or capacity) charge. A one-tier tariff system fully based on consumption gives households a strong economic incentive to save energy. By consuming less heat and weatherising,[12] households can reduce their heat bill significantly, which is particularly important for poor households. Installing heat meters is essential for introducing consumption-based tariffs.

12. *Weatherisation is a set of measures designed to reduce heat losses (or heat gains in case of air-conditioning or district cooling). Measures include: sealing window and door frames with caulking or gaskets, installing storm doors and windows, and increasing insulation.*

District heating companies, however, usually have significant fixed costs that need to be covered regardless of the level of heat consumed. Regulators in many countries therefore opt for the two-part (or two-tier) tariff with a fixed and a variable charge. The fixed charge is unrelated to actual heat consumption and is based on fixed costs that include capital, permanent staff, other administrative charges and the fixed part of operating and maintenance costs. The fixed charge is often called a capacity charge as it is determined by the heat-generating capacity made available by the supplier. It can be based on the contracted heat load or the size of the heated area. Some companies introduce a special charge for reserved capacity for temporarily disconnecting consumers who may want to be reinstated later: the Estonian company Tallinna Küte, for instance, has set a reserved capacity charge of 7,191 Estonian crowns (460€)/MW per month for customers who disconnect for more than six months but wish to keep the option of being reconnected.[13] In addition to the one-tier or two-tier tariff, new users are usually charged a one-time lump sum connection charge to cover connection costs.

It is often argued that both components of a two-tier tariff should reflect the corresponding costs: the fixed charge should be based on capital and other fixed costs, and the variable (energy) charge should be based on fuel and other variable costs. Opponents argue that the shares of fixed and variable components should not necessarily correspond to the real cost structure, but rather should reflect the priorities selected in the original tariff design. In any case, the tariff as a whole should cover all costs. Modern or modernised district heating systems are generally very capital-intensive. In old systems, where initial investments have already been paid back, variable costs may be higher. In both cases, however, it might be better to set the proportion of fixed and variable components in the tariff based on the potential impact on consumer behaviour rather than on the share of costs alone. Thus if the majority of the bill is based on the energy charge not the capital charge, consumers can reduce their bill by saving energy. In the reverse case, consumers have much less flexibility and control over their bill, which makes district heating less attractive than individual heating options.

For example, the Budapest district heating company Fotav charges an average 70% fixed charge and a 30% variable charge. Consumers who install heat meters or cost allocators[14] and reduce heat consumption by 50% therefore reduce their heat bill by only 15%. This tariff structure reduces the incentive for households to save energy. Tariffs with a high fixed component also create

13. *Soosar (2003).*

14. *See Chapter 3 for the explanation of different metering options.*

incentives for many households to disconnect from district heating. Conversely, tariffs with a high variable charge and low fixed charge discourage consumers from disconnecting as they are more compatible with the principle "I pay for what I consume". Thus, given that Fotav's tariffs in Budapest are reportedly the highest in the country and consumers have very little influence on their heat bill, many of them would prefer other heat options. It is legitimate that consumers who need very little heat or use their apartment only occasionally do not want to pay a 70% capacity charge. In Budapest, such consumers are obliged to stay with district heating because disconnection can take place only if the whole block votes for it. In cases where district heating companies are under greater competitive pressure from other heat options and consumers are free to disconnect, companies may prefer to set a lower capacity charge to keep their market share.

Some companies in Poland also used to set fixed charges at 70% of total customer charges. To prevent this, in 2000 the government adopted special amendments to the 1997 Energy Law. These amendments stipulate that fixed production, transmission and distribution costs in district heating systems may constitute only 30% of total heat charges, even if real fixed costs amount to a higher share.

Tariff structure may depend on the type of consumer. A tariff with a relatively high capacity charge can be justified or even optimal for industrial customers with large heat consumption. Giving customers the choice between a one-part tariff based on consumption and a two-part tariff with a capacity charge seems to be a sustainable approach. Customers with low and/or changeable heat consumption would opt for consumption-based tariffs, and customers with high and predictable consumption would opt for the tariff that includes a capacity charge. Experience in Lithuania and several OECD countries where customers have such a choice shows that they exercise it, though not all customers pick the same option. Residential customers often prefer a consumption-based tariff, while industrial customers usually choose a two-part tariff with a charge for guaranteed heat capacity. District heating companies may argue that this regulation is favourable to customers but unfair to suppliers. Giving customers a choice of tariff structure, however, may increase their satisfaction and reduce their incentives to switch, which is positive for the companies.

An alternative to the fixed or capacity charge can be a minimum charge, or a fixed floor below which a household heating bill may not fall.[15] This means that the household has to pay a certain amount even if it does not

15. *Mark Velody, district heating expert working in Romania. Unpublished paper (2004).*

consume any heat or consumes very little (e.g. when using an apartment only occasionally). The rest of the heat bill, if any, is based on consumption. The minimum charge ensures that the district heating supplier's revenue does not fall below a critical level, and it removes most of the negative effects that a fixed or capacity charge may have. Nonetheless, a minimum charge should be set very low to avoid becoming a de facto fixed charge and to provide energy efficiency incentives for consumers with small needs.

Table 4.2 compares the effect of the four tariff models on five residential consumer categories. The *non-saver* has all radiators turned on at maximum all the time. The *average customer*, with thermostatic radiator valves and heat cost allocators installed, reduces consumption by 30% by turning off radiators when away, lowering temperature in some rooms, weatherising, etc. The *aggressive saver* reduces heat consumption by 60%. The *weekender* uses the apartment occasionally (e.g. for long weekends or skiing holidays) so uses up to 85% less heat. And the *empty apartment* consumes no heat at all.

Table 4.2

Comparison of Four Tariff Models for Five Consumer Categories

Type of Customer (Consumption, Compared to that of the Household that Makes No Effort to Save)	Amount that the Household has to Pay Compared with the Non-saving Household			
	Fixed Charge Only	Consumption-based Charges Only	Fixed Charge of $30/Month, with Consumption-based Balance	Minimum Charge of $30/Month, Otherwise Consumption-based
	$ or %	$ or %	$ or %	$ or %
Non-saver (100%)	100	100	100	100
Average customer (70%)	100	70	more than 79	70
Aggressive saver (40%)	100	40	more than 58	40
Weekender (15%)	100	15	40.5	30
Empty apartment (0%)	100	0	30	30

Note: For ease of comparison, the baseline cost of heating an apartment is assumed to be $100, so $1 and 1% can be used interchangeably; Source: Mark Velody, district heating expert working in Romania. Unpublished paper, 2004.

The table shows that a 100% consumption-based tariff promotes energy efficiency and gives low-income households an opportunity to reduce bills by saving energy. A 100% fixed charge, as noted earlier, is unsustainable, as it removes the economic incentive for households to save energy. The combination of a fixed charge with a consumption-based charge is more appealing as it guarantees certain revenue to district heating companies, while allowing consumers some control over their heat bill. However, from the point of view of energy efficiency and consumer protection, the minimum charge is more effective. It provides a stronger incentive to save energy and gives the household more control over its heat bill. This is true as long as the minimum charge is set at a relatively low level. If it is too high (say, above 50%), it may push aggressive savers and occasional users to switch from district heating to other heat options that offer more flexibility.

Recommendation

The district heating tariff as a whole should cover full supply costs. Tariff structure, however, should depend on the policy priorities as well as on the type of customer. To provide incentives for energy efficiency and give residential and commercial customers more control, thus discouraging them from switching, preferable options are a one-part consumption-based tariff or a two-part tariff with a relatively small minimum charge. Tariffs with a capacity charge can be a better option for large industrial consumers.

● Pricing Cogenerated Heat and Electricity

Balanced price-setting for power and heat produced at cogeneration plants is extremely important as it determines the competitiveness of the products on their respective markets. If both are liberalised, the market will balance prices (assuming that both electricity and heat have to compete with other sources). If both markets are regulated, the regulator can balance tariffs by setting a viable cost allocation methodology. Cost allocation becomes a particularly important issue when the electricity market is liberalised but district heating is still regulated. To make electricity more competitive, cogeneration producers are likely to opt for allocating most costs to heat. However, excessively high heat prices can lead to increased non-payment or consumer switching to alternative heat sources. Moreover, if electricity is cross-subsidised by higher heat prices, this may distort electricity markets and lead to cogeneration investments that would not otherwise be cost-effective.

Approaches to cost allocation differ today from one country to another. It is difficult to determine accurately which shares of common costs of a

cogeneration plant are attributable to each of its products. Several different methods of cost allocation between power and heat may be used, including but not limited to:[16]

- *Energy (or physical) method:* variable costs are allocated to electricity and heat in relation to the produced energy products, or power-to-heat ratio. This method is easy to apply, but it tends to discriminate against heat.
- *Method of alternative heat production:* the costs of cogenerated heat are fixed at the level of separate heat production costs (at heat-only boilers); the remaining costs are allocated to electricity.
- *Method of alternative electricity production:* same principle as in the previous method, but using electricity costs as the basis.
- *Benefit distribution method:* fuels used in cogeneration are allocated to electricity and heat in proportion to the amount of fuel consumption that would be necessary for alternative forms of heat and electricity supply (heat-only boilers and condensing power plants) to produce the same output as the cogeneration plant. This is a relatively new method. It is quite simple to use and tends to allocate benefits of cogeneration fairly in most circumstances.

Some countries have a standardised methodology, so all producers are required or recommended to set heat and electricity tariffs according to established cost allocation rules. For example, the Latvian methodology is based on the alternative heat production method, allocating all benefits of cogeneration to electricity. Other countries have no specific rules and each company sets tariffs for electricity and heat according to its own methods of allocating costs to the two products. For instance, three of Lithuania's cogeneration plants use the energy (physical) method, and one uses the proportional method of cost allocation.

Cost allocation between power and heat production discriminates against heat in much of the former Soviet Union, particularly in Belarus, Kazakhstan, Latvia, Russia and Ukraine. All (or most) benefits of cogeneration are allocated to electricity, therefore heat produced at cogeneration plants is sometimes more expensive than that produced at heat-only boilers. This contributes to the financial problems of district heating companies. The defects of such cost allocation principles have been recognised in many countries, including Russia, which is now actively seeking to improve its heat tariff regulation, as well as its cost allocation methodology for cogeneration.

16. *These methods are discussed in detail in Gochenour (2003).*

The World Bank study on cogeneration regulation concludes that the most suitable methods of cost allocation for economies in transition are the method of alternative heat production (with a modified efficiency factor) and the benefit distribution method.[17] Cost allocation methods can be modified to take into account the distortions in these countries arising from cross-subsidisation between consumer groups and gas price distortions, and to secure the competitiveness of district heating. For example, in the method of alternative heat production, a higher efficiency factor can be used compared to actual efficiency for the calculation of the alternative heat production costs. This would allow the allocation of a larger share of variable costs to electricity, making district heating more competitive. The efficiency factor can gradually decrease as cross-subsidies and price distortions are phased out. The competitiveness of electricity, however, should not be neglected.

If both electricity and heat markets are regulated, cost-allocation regulation can maximise fairness. Any change in the existing methodology will have a significant impact on the power side, so both the heat and electricity markets should be taken into account. Transition to another cost allocation method can be painful in the short term, but may be worthwhile if long-term benefits are obvious. Adopting a cost allocation methodology should be a transparent process: it is good policy to have a broad discussion between different stakeholders and to review regulatory options before they are adopted. Also, the changes should not happen overnight but should be phased in.

If the electricity market is liberalised while heat is still regulated, electricity prices are set by the market, but the regulator can still apply compulsory cost allocation for setting heat tariffs. Electricity prices will vary according to market conditions, while heat tariffs will reflect the share of costs allocated to it. If electricity prices exceed the remaining costs, the producer will make a profit, just as any other power plant in a competitive market. If prices do not cover costs, the producer will make a loss. The producer in these circumstances will have to reduce overall costs or reduce its profit margin because the regulation will prevent reallocating costs to heat. That said, countries may have a policy to promote cogeneration, in which case other support mechanisms may be introduced (Chapter 8 discusses these).

If both markets are liberalised, government authorities should still monitor cost allocation at cogeneration plants, as well as the general functioning of both markets, to protect captive and semi-captive heat customers from

17. *Gochenour (2003).*

monopolistic pricing. If a cogeneration producer uses a methodology that clearly discriminates against heat (so that cogenerated heat is more expensive than heat from heat-only boilers), the regulator should intervene.

Recommendation

Making sure that cost allocation is fair can go a long way to reducing district heating costs and improving the efficiency of the sector. Policy makers should make this a priority in regulatory reform.

● Simplifying Heat Tariff Regulation

Given the inherited monopolistic structure of district heating sectors, and the strong social and political importance of a stable and affordable heat supply, many transition economies have opted for detailed and inflexible command-and-control regulation, particularly in the first years of economic transition. Excessive bureaucracy and costly, complicated procedures for tariff approval have often characterised the regulatory process. The World Energy Council argues that as the macro-economic conditions improve and the scope for competition increases, the density of district heating regulation should decline.[18] Some countries have already taken steps to establish more flexible and less bureaucratic regulation.

In Estonia, for instance, many companies are introducing index-based formulas for tariff calculation that allow heat tariffs to be adjusted to fuel price fluctuations and other changes in variable costs. These formulas, which have to be approved by the Energy Market Inspectorate (EMI) or by the local municipality for district heating companies producing less than 50 GWh per year, dispense with long pre-notification periods for setting new prices.[19]

Well-designed pricing formulas should be attractive for both district heating companies and regulators because they are simpler to manage. An index-based tariff is negotiated and approved only once and set for a relatively long period. The price may be adjusted under specified conditions such as relevant external changes (to fuel costs or inflation, for example) over agreed periods of time.

The concession model, which is discussed in more detail in Chapter 7, is a way of reducing regulation while providing incentives for cost reduction. Under this approach, operators bid for a concession quoting a tariff below actual

18. *WEC (2004).*
19. *Soosar (2003).*

costs, but reflecting expected future efficiency savings. The operator profits if it exceeds expected savings and makes a loss if savings are lower than expected, as the tariff does not change under these circumstances. The main difference with the price-cap model is that the concession model is not formally regulated, but negotiated and governed by a contract established at the outset between the municipality and the operator. The contract generally includes detailed rules on service quality, required investments, the initial level of tariffs, an indexation formula for variable costs outside the operator's control, an escalation formula for fixed costs and profits, etc. This model, therefore, combines most of the benefits of price capping, but without the regulatory complexity.

If a concession is signed for a long period (over ten years), improvements in technology and other factors that are difficult to foresee can lead to cost reductions significantly below the level originally planned. Concession agreements in some Western countries therefore contain a clause allowing the parties to review the conditions of the contract after a certain period.

Recommendation

Governments and municipalities should consider the following approaches to reducing the complexity and improving the quality of tariff regulation:

- Setting transparent tariff rules.
- Using incentive regulation instead of cost-plus regulation.
- Replacing frequent tariff approvals by indexation formulas that would adjust tariffs to variable cost fluctuations.
- Allowing greater competition.
- Using the concession model.

Conclusions

Governments should carefully consider how they can improve regulations to better promote efficiency, fairness, least-cost supply, full cost recovery and transparency, and then act diligently to make these improvements. To make regulation as effective as possible, policy makers should take several issues into account. First, regulatory independence is important as it helps ensure that tariffs are based on the long-term economic health of the district heating system, rather than short-term political agendas. Second, cost recovery should include provisions for necessary investment, depreciation, bad debt

and other costs of operating a sustainable business, as well as a reasonable rate of return. Third, regulators should avoid cost-plus tariffs because they are a major disincentive against energy efficiency investments (in other words, investments that can lower costs and hence tariffs). Fourth, regulators should make sure that cost allocation at cogeneration plants does not discriminate against either heat or electricity.

The complexity of regulation can be reduced gradually as the economic situation stabilises and the market becomes more balanced.

COMPETITION

Competition can take on various forms. District heating is unlike most other commodities, particularly other energy commodities, in that it is very much a local product. Given the current state of technology, it is not cost-effective to transport heat hundreds or thousands of kilometres. Most district heating systems limit transmission to 10 to 15 kilometres. A few systems, such as Copenhagen's, have been able to cost-effectively transport heat further because of very efficient transmission and distribution lines, but never beyond 50 kilometres or so.[1] District heating systems are also more integrated than most other energy networks in order to optimise efficiency and performance: the water or steam used to carry the heat returns to its source for reheating. This means that competition in the district heating sector will have to be different from that in electricity, gas or oil markets, which creates a challenge because it limits the role models. It also makes it easier to ignore the issue of competition because it seems technically improbable.

However, just because district heating cannot be liberalised in the same way as electricity, for example, does not mean that competition is impossible. Rather the opposite. Competition in heating is the norm in IEA countries. It is an essential element of market economies in general because it brings efficiency and better products, both of which could benefit the district heating sector in transition economies. The issue is how to ensure fair competition, since in most cities with district heating, there is only one heating company. In addition, competition cannot work well when there are across-the-board subsidies for district heating or a competing heat source. This chapter outlines experiences with competition in the district heating sector, drawing attention to issues of monopoly power and ways of fairly addressing this.

Types of Competition

For the sake of simplicity, we have grouped the potential forms of competition as follows:

1. *Copenhagen's system has 54 kilometres of transmission pipelines and additional distribution lines (see Map 3). Total distribution lines can be much more than the lengths quoted here, but a single molecule of hot water or steam does not travel through the entire length of the distribution lines.*

Competition in sales

- Competition between sources of heat, often gas, electricity and district heating.
- Wholesale competition between heat generators in an otherwise regulated system.[2]

Competition for assets

- Competitive sales of operating licences or district heating assets.

Competition between heat sources is by far the most common type of competition for the district heating sector. Competition here means that consumers have a choice between different types of heat for their homes and offices. It exists in most countries in transition and is most prevalent in the new EU states. In these countries, it has come about not because of a changed regulatory framework but because of price and other market factors: gas tariffs remained subsidised longer than district heating tariffs, but poor district heating service also played a role in the growth of competing heating fuels. Finland, Sweden, the United Kingdom and several other OECD countries do not regulate district heating tariffs because they believe that competition from other heat sources creates a balanced market. In transition economies, district heating prices are still regulated (as are gas and electricity prices for residential users), but district heating companies can and do lose market share when their prices are too high or quality too low relative to competing heat sources.

Wholesale competition between heat generators is less common, but it has important implications for expanding the use of cogeneration and waste heat. This typically takes place through long and medium-term contracts between the district heating company and, say, an incineration plant. Wholesale competition tends to happen naturally in systems with heat source competition. In such situations, heat source competition stimulates the district heating company to find the least expensive supply options, including various forms of waste heat. Regulated wholesale competition only occurs in systems with regulation of prices for final consumers and of investments in new supply. The most significant example of this type of competition is the greater Copenhagen area, where cogenerators and waste incinerators can sell their heat to two geographically distinct wholesale district heating companies (see Map 3).[3] The sales are based on long or medium-term

2. *By wholesale competition, we do not mean retail competition or a spot market, but companies other than the main district heating company supplying heat to the network. This can include cogeneration from an electric utility or waste heat from a manufacturer or incinerator.*

3. *CTR (2003); VEKS website http://www.veks.dk/Om%20VEKS/Varmeproduktion/Fjernvarme.aspx.*

contracts, though retail pricing is still regulated. Several systems in large cities have unbundled generation from transmission and distribution, which makes it easier to compare supply prices. Wholesale competition in the district heating sector will likely expand slowly,[4] but it can bring greater efficiency, particularly because it provides a vehicle for using industrial waste heat and boosting heat sales from cogeneration. By itself, wholesale competition cannot balance supply and demand because it does not give end-users a choice of suppliers.

In the third option, competition enters into play during the bidding process to own or operate a large citywide district heating system with numerous customers. Government officials can review the plans and qualifications of the bidders and select the one that seems best qualified at the lowest price. Privatisation and licence sales do not increase competition once the assets are sold.[5] In fact, the cost of purchasing the assets will drive heat costs up in the short term, although presumably the assets are being sold because private owners will have greater experience in lowering costs and increasing service quality. If this is the only form of competition, it is not likely to be sufficient to ensure fair prices and an optimal supply-demand balance as there are no ongoing incentives to keep prices down. Thus, governments would probably want to continue to regulate prices and to ensure that investments are in the best interest of rate-payers, playing a more active role in developing a least-cost supply strategy than would be necessary under heat source competition. Competition for assets, however, can effectively create a balanced market when combined with competition between heat sources.

Regulators can also require competitive bids for new operating licences when they want to expand capacity. This can help ensure that new supply is least-cost. We cover this in more depth in the discussion of wholesale competition because such an approach by nature launches some degree of wholesale competition.

Because the third competition option alone does not provide adequate protections against monopoly power, this chapter does not describe it in more depth.[6] That said, it is important to note that in many countries in transition, after the district heating networks were privatised or leased to

4. *This is because expanding wholesale competition more broadly will generally require new rules; it is not just a matter of economics.*
5. *Meyer and Mostert (2000).*
6. *Chapter 7 does discuss ownership and privatisation in their own right.*

private entities, national government officials took the sector off their priority list. Also, there was a sense that once the sector was in private hands, it could and should compete with other forms of heat, but without a serious effort to consider the implications of this competition or the possibility of eliminating district heating regulation (assuming that the competition was balanced).

Competition between Heat Sources

Competition between heat sources can be a very positive force if it stimulates greater efficiency and lower prices.[7] Most countries have some form of competition between heat sources, though countries that allow zoning for district heating restrict this competition (the same is true in countries and cities that require approval from the district heating company for disconnections). There is some evidence that countries with more competition between heat sources have lower heat prices, and studies in other sectors make it clear that competition can reduce prices, though very few studies have considered this question explicitly for the heat sector. Table 5.1 provides price, market and policy information for several European countries where district heating is prevalent. Countries where there is no price regulation are those that allow the market to balance supply and demand, and hence competition is the best developed. At the other extreme, countries with zoning have limited competition.

Recommendation

International evidence indicates that heat source competition can reduce heat prices when the heat market is balanced. Governments should actively consider this option.

● The Competition and Regulatory Picture in OECD and Transition Countries

Finland and Sweden have open competition for heating: district heating must compete against all other forms of heat. The governments of these countries do not provide district heating subsidies nor do they regulate prices. Two or more companies compete in the heat services market in each city. District heating prices are relatively low. Anti-monopoly regulators have the ability to

7. Grohnheit and Gram Mortensen (2003).

Table 5.1

District Heating Prices, Market and Policies in Selected Countries, 2001

Country	Average Price (€/MWh excluding VAT)	DH Share of Space Heat Market	Price Regulation?	DH Zoning Allowed?
Austria	37.64 to 69.10	16%	Yes, cost-based	No
Czech Republic	40.03	45%	Yes, cost-based or price cap	No
Denmark	51.24	48%	Yes, cost-based	Yes
Estonia	26.00	30%	Yes, cost-based	Yes (since 2003)
Finland	27.00 to 33.00	49%	No	No
Germany	49.18	12%	No	No
Hungary	26.00 to 45.00	16%	Yes, cost-based	No
Lithuania	30.14 to 44.62	45%	Yes, cost-based	Yes (since 2003)
Netherlands	53.45	3.4%	Yes, substitution tariffs	No
Sweden	38.60 to 43.70	38%	No	No

Note: the market share information refers to residential space heat; in many countries, a higher percentage of commercial space is heated with district heating, but the data are not systematically available; Sources: Euroheat and Power (2003); IEA Country Reviews; Danish District Heating Board; District heating associations from Finland, Sweden, the Czech Republic and Lithuania; SEVEn (2003).

ensure that the district heating companies do not abuse their monopoly power, but in practice, they rarely need to intervene. Most other OECD countries also allow open competition between heat sources and many do not regulate heat prices (the U.K., Canada and most systems in the U.S. are other examples). Germany also allows consumers to freely choose their type of heat, but there is relatively little competition per se because most cities have a single municipal company (typically called a *Stadtwerke*) that provides heat, gas, electricity and other services. However, customers in Germany can choose heating oil, which is not supplied by the *Stadtwerke*. Also, some German cities have private companies that supply district heating. Denmark has a specific policy to use municipal energy planning and zoning to select the most cost-effective form of heat supply in each area. All transition economies regulate heat prices and, until recently, all allowed

competition between heat sources. Regulated prices may not always be at cost-recovery levels in transition economies, and continued regulation of this type makes it difficult to assess the effect that competition may be having on tariffs.

Taking Competition Forward: A Checklist

When a government decides to allow competition between heat sources or to stop regulating the price of heat because of this competition, the challenge for policy makers is to ensure that the competition is fair and the market is balanced. In doing so, policy makers can assess how open their heat markets are currently. Some indicators of market openness include:

- *Choice of heat source*: Are gas or other heating options freely available in each district heating market?
- *Choice of company*: Does more than one company provide heat and gas in each city or region?
- *Affordability of options*: Can the majority of heat consumers afford the cost of switching to another heat source and is the alternative priced competitively?
- *Subsidies and tax breaks*: Do any sources of heat receive subsidies or preferential tax breaks?
- *Scale of competition*: Are the alternative heat sources well developed with sufficient market share to compete more broadly?
- *Regulation of competing heat sources*: Are consumer prices for alternative heat sources like gas or electricity regulated? Does such regulation skew the market through lower efficiency or higher prices for the competition?
- *Transparency*: How strong is corporate governance? How transparent is the sector and does corruption have a presence? Is there potential for abuse of market power?
- *Permits and unbalanced regulations*: Do environmental or other regulations discriminate against one heat source over another because they are not applied equally? For example, are small boilers allowed in a city, but district heating plants are only allowed outside the city regardless of the respective emissions rates (or vice versa)? Do small boilers have more or less stringent safety requirements than district heating plants relative to their respective risks? Note that such regulations may be in the best public interest, but policy makers should consider their impact on competition as part of this analysis.

As district heating is a local commodity, some of these questions need to be answered on a local basis. For example, some cities may have well-developed gas networks while others will not. Some cities will have a higher level of poverty and unemployment, making the affordability of switching heat sources more problematic. Because district heating is a local commodity, it makes sense to leave some of the decision making on competition to the local level. Otherwise, a district that has no real access to competition might be faced with abusive monopolistic prices for district heating.

Box 5.1

What Does a Balanced Market Mean?

A balanced market is one in which supply and demand are in equilibrium in the short and long-term. They match each other because pricing balances the volumes bought and sold. Companies compete for sales in part by minimising their costs and prices. As a result, prices are low and incentives are strong for efficiency on both the supply and demand sides. Suppliers bear the responsibility and risk for their investment decisions, not consumers; so if an investment is too expensive, another supplier will capture that share of demand by offering a lower price. Long-term equilibrium leads to sustainability.

When regulators set prices of one or more competing heat sources, the market may fall out of equilibrium or the supplier whose prices are regulated may lose market share. That is why simultaneously regulating district heating prices and allowing or promoting heat source competition may create undesired results.

The indicators in the checklist above are designed to help create the right conditions for a balanced market. Thus, they are both prerequisites and ongoing requirements for market equilibrium.

Subsidised prices for competing heat sources clearly distort the market and can result in uneconomic decisions. They can have a double impact when lenders see that consumers are switching to subsidised local energy sources and decide not to lend for district heating improvements. Barriers to accessing other heat sources also create market imbalance. This is particularly important if district heating companies make it difficult for people to disconnect. Some barriers are inevitable because switching heat sources usually means buying and installing new equipment. In countries where the cost of switching equals a large portion of the average household income, the barrier probably stops the market from balancing properly. For example, if a family who earns the equivalent of $4,000 per year must spend $1,000 to install a new gas boiler and heat system in their apartment, they will not be

able to switch to gas without significant hardship. This is one of the reasons why natural gas has gained more market share in Central Europe than in Russia or Ukraine. Moreover, boilers need proper maintenance. While maintenance for district heating is included in the price, building and apartment owners must pay for individual boiler maintenance every year. Some families do not factor this in when they buy a boiler, so they economise on proper maintenance. This can significantly raise the safety risks, especially when boilers are not properly installed in the first place.[8]

Recommendation

Governments should carefully examine the market situation before launching heat source competition. Once competition begins, they should periodically review the market for balance and transparency.

● Competitive Approaches to Balancing Supply and Demand: The Details

Heat Source Competition: To Regulate or Not?

Countries have taken two approaches to heat source competition: competition with regulated prices and competition with unregulated prices (a third policy option, zoning, allows localities to exclude customer-level competition, though zoning proponents argue that there is de facto competition in the energy planning process used to define the zones). Prices in countries that do not have tariff regulation are generally lower than in those that do, possibly because of how tariff regulation reduces flexibility and creates an administrative burden, both of which can add to costs.

Recommendation

Governments that want to use heat source competition to balance their heat markets should consider eliminating tariff regulation to lower the costs of district heating. Many countries in Central Europe, particularly those that currently use more competitive regulation like price caps, are probably ready to free district heating prices and allow the market to balance supply and demand. In fact, in some cases, continued price regulation may act as a drag on the district heating industry because companies are already forced to compete but do not have the flexibility to adapt their prices to market conditions.

8. *In Romania, there were numerous explosions and fatalities because of poorly installed, low-quality boilers. Many of these boilers still exist, although recently the Romanian government has stepped in to establish basic safety standards for individual boilers and their installation.*

Launching Competition on a Local or National Scale

There are benefits to launching competition broadly: economies of scale, ability to share expertise, greater interest for foreign investors and clearer rules for companies operating in multiple district heating markets, to name a few. One option is for national policy makers to set the direction and criteria for market opening and then to work with local decision makers to determine how quickly to open a given market. For example, policy makers could develop a market opening threshold at which prices should be liberalised, and then work to open the market to that point. National and local policy makers would need to co-ordinate closely. In most countries, subsidies, tax breaks and regulation of competing heat sources are in the national jurisdiction, while ensuring that district heating companies allow consumers to switch is more a local question. In this way, the degree of market openness can help guide policy makers in deciding how best to ease regulation to enhance competition.

Regardless of whether a country decides to launch heat source competition in one step or in a phased way, depending on local conditions, policy makers should have a plan and schedule for proceeding. This can help speed up the transition and assist in co-ordinating policy between sectors and regions.

Recommendation

While there are important benefits of having a national approach to heat source competition, in some cases, liberalising heat prices in a targeted way, depending on local conditions, may allow countries to reduce the risks of liberalisation and eliminate tariff regulation more rapidly. Policy makers can speed up the process of liberalisation and ensure better co-ordination by having an overall plan for liberalisation.

Monitoring the Market for Fair Competition and Balance

Governments can ensure that the market is fair by monitoring it and setting up a process to review complaints about abuse of market dominance. Finland, for example, allows consumers to file complaints about unfair prices and market activities with the Finnish Competition Authority. In recent years, this body has investigated two such complaints but decided that no wrongdoing took place based on the available evidence, so it issued no sanctions or fines.[9] The very existence of such a complaint investigation system along with sanctions or fines can encourage market players to act fairly, even if no complaints are ever lodged. Swedish officials are concerned

9. *Peltola (2004); Correspondence with Paivi Peltola, Univeristy of Joensuu, Finland, May 2004.*

that there is no such provision in Sweden, although Sweden does have an excellent system for monitoring the market overall. The Swedish Energy Agency, for example, considers the price changes, ownership, fuel type and use, and the overall situation in its annual reports on the market. To help in ascertaining whether market players are abusing their position or not, it is helpful to require transparent information. The Swedish government has recommended that all district heating systems submit financial statements, clearly separating system-specific costs from those for a company as a whole, as well as separating costs for electricity and heat production. The Lithuanian Energy Institute has also made similar recommendations about market monitoring and information transparency.

● Prospects and Challenges for Heat Source Competition

What are the prospects for heat source competition? Except in cities with district heating zones, heat source competition already occurs and will likely grow in the future. In most countries in transition, this has occurred despite a specific policy choice, not because of it. Thus, the heat source market in many cities is far from equilibrium, which creates problems for district heating companies, consumers or both. Gas subsidies, growth of multi-utilities and imbalances in which heat sources are regulated are three of the most important barriers to effective heat source competition.

Natural gas has made major inroads into the heat market in many transition economies, in part because of subsidies. In Romania, for example, several district heating systems have lost over 90% of their customers to gas. When enough customers switch, removing the subsidies alone may not be enough to stabilise the situation because of the financial damage that they have already inflicted in district heating systems. Resolving such situations requires careful, tailored solutions and, at a certain point, loss in market share may cause irreversible collapse. The best solution is thus to make sure that there are no such subsidy imbalances before heat source competition grows to a large scale.

Another challenge as the sector evolves is the growth in multi-utilities. While having power companies own district heating assets helps promote cogeneration, it can create problems in one of two ways. If electricity prices are liberalised but district heating is still regulated, cogenerators will have incentives to put more of the costs on the heat side of their books. On the other hand, if power is a major alternative to district heating, joint ownership and management of power and heat assets inhibits the effectiveness of

competition, allowing prices to rise. The same is true for multi-utilities that supply gas.

If one heat source is regulated and others are not, the price of the non-regulated heat sources may be shaped as much by the regulated competition as by pure market forces. This would argue in favour of careful review when liberalising prices of one heat source before liberalising those of other heat sources.

Rapid changes in market share can destabilise one or another heat source. District heating companies may need time to adjust to competition. To limit the risks of such rapid change, policy makers need to decide carefully before promoting competition between heat sources and then monitor the situation and ensure that competition is in fact fair. Such careful monitoring represents a measured and proactive approach and as such can help avoid rapid, destabilising disconnections. Since most countries in transition have some degree of heat source competition, this monitoring is particularly important and should include periodic and thorough investigations, as in Sweden, of whether the competition is working properly. This is particularly important before and immediately after major policy changes, like price liberalisation or opening gas and electricity markets to competition.

Heat source competition can bring significant benefits to the majority of stakeholders when the market is balanced. Importantly, competition can bring just the types of changes to district heating that the sector will likely need to survive: efficiency, better service and low costs. That said, there will always be winners and losers in liberalisation in part because there will always be some market barriers, even small. Determining how fast to open the heat market to competition is a balancing act, but inhibiting competition when the total benefits may be significant is not necessarily the best decision in the long term for any of the stakeholders. Careful analysis and broad public discussion can help in making balanced decisions.

Wholesale Competition

Wholesale competition is another option for liberalising the district heating sector. It can be done in combination with heat source competition or not. It is important to emphasise that by wholesale competition, we do not mean spot markets or retail competition but rather the ability of third parties to sell heat to the main district heating company, typically through negotiated, long

or medium-term contracts. The most extensive example of such contracts is in greater Copenhagen, where there is no heat source competition.

Given the small size of district heating networks compared to power grids, for example, it would not make sense to have retail competition in which customers pick between district heating providers. Moreover, the way that most systems in transition economies are designed limits the ability of suppliers to reach all customers in a network, which is another reason that retail competition should be avoided. Thus, wholesale competition is not adequate by itself to balance a district heating market. Systems that use heat source competition to balance the market tend to have vibrant, unregulated wholesale competition for heat because district heating companies have an incentive to limit costs. When tariffs are regulated, district heating companies may have less motivation to buy heat from other sources even if it is least cost; thus regulating the competition can increase its scope. In a regime with regulated wholesale competition, energy planning and tariff regulation can help to ensure that investments are wise and supply and demand balance without monopolistic pricing (see Chapter 3 for more information on how wholesale competition and energy planning can complement each other). If policy makers want to provide retail competition, heat source competition is the most feasible and tested approach.

● The Rationale for Wholesale Competition

In Western Europe, cogeneration and waste heat are typically used as the baseload generating capacity for district heat. Heat-only boilers supplement this during peak demand. In many countries in transition, the opposite is true: heat-only boilers provide the baseload and cogeneration is used mainly for peak demand. This is one of the reasons why district heating tends to be so inefficient in transition economies. It is also a reflection of the irrational way power and heat costs have been divided traditionally in cogeneration plants in those economies. Wholesale competition helps district heating companies to rely more heavily on cogeneration and industrial waste heat. It also gives manufacturers an incentive to collect and sell more of their waste heat.

When tariffs are regulated based on the cost of producing heat, district heating companies have an incentive to increase costs to boost their revenue and profit. Thus, regulators must scrutinise costs to try to ensure that they are reasonable. This is difficult because the district heating company has better access to cost data than the regulator. It is hard for a regulator to know what is least cost without independent, external information on costs. Allowing or requiring some wholesale competition can make the job of the regulator

easier by bringing forward independent information on possible costs. This is most feasible and productive in large systems that are more likely to have the potential for multiple sources of supply. Such wholesale competition can be formally required and regulated, or it can involve informal and voluntary purchases of heat from outside producers. The distinction between the two is usually one of degree, not black and white. Most large district heating systems already buy heat from cogenerators or waste heat producers, but there is much scope for expansion. The environmental and economic benefits of cogeneration and waste heat are the reason why most people care about promoting district heating.

Some would argue that wholesale competition is not technically possible in transition economies because of system design. The numerous examples of such competition serve to counter this argument.

Recommendation

In general, regulated wholesale competition is most appropriate in those countries that still want to regulate their district heating sectors, including retail tariffs. It can be used as a mechanism to bring costs down and improve service quality. Likely candidates include countries in the former Soviet Union and the Balkans. Unregulated wholesale competition is already a common feature in countries where heat source competition is used in place of tariff regulation.

● Three Models for Wholesale Competition

There are three models under which third parties can sell heat. The first is in a system with heat source competition. The next two both relate to ways of enhancing least-cost requirements in a regulated district heating system by encouraging the use of waste heat. Specifically, the second and third models use informal or formal access rights to district heating networks for producers of waste heat like cogenerators. The latter model is primarily applicable in larger systems.

The power industry uses the terms negotiated and regulated access, which have some similarities to the informal and formal access rights described here, but this book does not use the more familiar terms – negotiated and regulated access – for two reasons. The first is to avoid confusion, since these terms are normally used in systems with retail competition and spot markets; this discussion is about wholesale heat supply competition in a regulated system. The second is that in electricity policy and legislation, the difference

between negotiated and regulated access is often much more codified than what exists today in district heating.

- **Wholesale and Heat Source Competition**

Wholesale competition can be very effective where there is heat source competition and district heating prices are not regulated. Under these conditions, a district heating company has an incentive to find the least-cost heat supply, so it logically seeks contracts from cogenerators and waste heat providers when these are least-cost.[10] The competition, however, is not regulated; it just happens as a result of competitive pressure on the heat source market. District heating in Sweden and Finland is based on such a model and waste heat plays a large role in heat supply. Finland has the highest rate of cogenerated electricity today and most of its district heating comes from cogeneration and, to a lesser extent, waste heat. Sweden also uses a large share of cogeneration in its district heating, along with heat from waste incineration.

There are significant differences of opinion on whether regulating wholesale district heating competition is necessary when there is heat source competition. The arguments in favour are that 1) district heating customers are semi-captive because of the high costs of switching, so that a district heating company might be able to abuse its market power in the short-term, and 2) waste heat providers can only sell their heat to one buyer, so they are not getting a competitive price for their product. The Swedish government is currently debating the idea of requiring wholesale competition in its largest district heating systems. Likewise, the Lithuanian Energy Institute notes that competition between heat producers would benefit district heating in Lithuania. The institute considers that in large systems, where the share of each single producer would be under 25%, it may even be feasible to have retail competition.[11] This is an intriguing idea, but it has never been tested. Opponents of such regulation instead believe that heat source competition is already creating incentives to bring costs down and that costs may rise because of regulatory requirements. Industry studies in Sweden show that unbundling when the heat market is balanced may raise costs.[12] Unbundling can also make it harder to optimise a system for efficiency, and efficient district heating systems are usually highly integrated. Given the lack of concrete experience to draw from and the potentially negative effects, it is

10. *Correspondence with Anders Dyrelund, Rambøll, Denmark, April 2004.*

11. *Gatautis (2004).*

12. *Correspondence with Peter Dahl, Swedish District Heating Association (Svensk Fjärrvärme), May 2004; Correspondence with Sven Werner, FVB, June 2004; Communication with Goran Lagerstedt, Swedish Ministry of Industry, May 2004; Westin and Lagergren (2002).*

difficult to recommend regulating wholesale district heating competition in competitive heat markets today.

- **Informal Access Rights**

  There are many examples of third parties selling heat to district heating companies, including in countries in transition. Many Russian and Ukrainian district heating systems buy heat from cogeneration plants owned by large power companies; the Russian power company RAO-UES is in fact the largest heat producer in Russia. In Debrecen, Hungary, the district heating company now buys waste heat from a local manufacturer (Alföldi letterpress) and pays a lower price than it used to pay for heat from the Debrecen Power Plant. The Debrecen system is also noteworthy for its good overall management.[13] The district heating system in Mažeikiai, Lithuania is another example: it buys heat from the oil terminal there.

  Informal access works more or less in an ad hoc way, allowing least-cost heat providers to sell heat to a district heating network but without imposing requirements or rules for such competition. Significantly expanding the use of industrial waste heat will probably not happen without some more specific requirements to purchase this heat and ensure that purchases are more transparent from a market perspective. Thus, informal access combined with least-cost planning can provide opportunities for waste heat from third parties to enter the system, but informal access does not take away the main district heating company's incentive to use its own heat first, regardless of whether it is least cost. Formal access rights, by contrast, establish requirements for such least-cost heat purchases and provide a transparent mechanism for doing so.

- **Formal Access Rights**

  The greater Copenhagen systems served by CTR and VEKS are the most important examples of formal access rights for heat supply. CTR and VEKS are wholesale transmission companies serving two separate but connected geographic areas; these companies purchase heat, transmit it to the localities in their service areas, and sell it to distribution companies covering each locality. Municipal waste incinerators, cogeneration plants (owned by the power utility Energi E2) and VEKS sell heat to the CTR system; dispatch is based on negotiated prices so that the cheapest heat is put on line first, which also creates an incentive for keeping costs down. (VEKS also buys heat from cogeneration plants and incinerators and sells it to local distribution

13. *DHCAN (2003).*

companies in its own service area, operating a parallel but geographically distinct system with a transmission interconnection with CTR.) By law, heat producers cannot make a profit in Denmark, so they sell the heat at prices that are based on cost alone. The size of new heat capacity in greater Copenhagen is calculated in municipal energy plans. CTR procures medium and long-term heat supply contracts with cogenerators as well as waste incinerators, although actual dispatch is based on real-time demand according to least cost. CTR also owns peaking capacity made up of heat-only boilers; these boilers supply less than 1% of the total heat generated annually.[14] This capacity is used to ensure reliability of supply, though if the wholesale company were private, it would have greater incentives to use this peaking capacity for additional income even if such use were not economical from a system perspective.

This section first looks at the policy and regulatory tools that could bring fair competition to a wholesale district heating market, given the right conditions (such as adequate market size): least-cost supply and merit order dispatch, unbundling, and transparent network charges preferably based on the cost of transport. Many of these policy tools could also be applied individually to enhance competition, so they should be of interest to policy makers even when a more comprehensive form of formal access rights is not feasible or desirable. The section then looks at additional examples of formal access rights as they exist and concludes with some remarks on the prospects of wholesale competition more broadly. It is important to emphasise that this discussion relates to systems where tariffs are regulated: introducing wholesale competition can help regulators apply least-cost principles.

Least-cost Supply and Merit Order Dispatch

The first step in opening regulated district heating systems to wholesale competition is requiring least-cost supply, competitive bids for heat supply contracts and merit order dispatch. In other words, the lowest-cost heat enters the system first. In practical terms, this occurs through medium or long-term contracts, and the heat is dispatched based on the price accepted in the contract. Retail tariff regulation would be based on the supply contracts and their price formulas.

Many countries require least-cost supply, particularly for environmentally friendly sources of heat like heat from biomass, small-scale cogeneration and industrial processes. In the Czech Republic, the district heating companies

14. *CTR (2003); CTR, www.ctr.dk; interviews and correspondence with Inga Thorup Madsen, managing director of CTR, Denmark, May 2004; News from DBDH, 2/1999, 2/2000, 3/2000, 4/2001, 3/2002, 2/2003; Danish Board of District Heating (2003).*

have an obligation to purchase heat from cogeneration as long as these purchases do not hurt them financially. The Slovak Republic has similar requirements. Lithuania has a broader requirement that district heating networks purchase least-cost heat from any source as long as the competition is "reasonable". In many of these countries, the secondary legislation limits the extent of real competition because it requires new market participants to produce heat at a cost lower than the variable costs of the existing production. This is true in the Czech Republic and Lithuania, for example.

Industry pressure may have forced such requirements in Lithuania.[15] Some experts in the region, though, feel that such requirements help protect the industry more broadly by protecting otherwise stranded assets. The argument is that if competition were broader, it would be hard for all producers to obtain financing for new plants because they could not be sure that there would be demand and the market is limited geographically. The same argument about stranded assets also, incidentally, applies to heat source competition, yet heat source competition has not led to major financing barriers unless the market is poorly monitored. One of the main problems with district heating that this book highlights is the inefficiency of existing assets; thus, if there are new entrants who are willing and able to finance more competitive plants, it may be a very positive development.

One option governments have for dealing with this dilemma is to use the licensing process to limit the total amount of supply. The amount can be limited to what is foreseen under the energy demand forecast and least-cost plan, with licences competitively awarded to the proposed least-cost suppliers. To ensure that cost estimates are realistic, the regulator could limit how much the wholesale prices could change in the initial period of operation if actual start-up costs varied from the estimate. If start-up costs were significantly below estimates, on the other hand, the supplier would profit.

Recommendation

Regulators can use the licensing process to ensure that new supply is least-cost by requiring potential suppliers to bid competitively for the licences based on estimated costs. The volume of new supply licences would correspond to the amount of new supply foreseen in the least-cost plan.

The challenge for competition is that simply requiring least-cost supply and wholesale competition does not guarantee that the least-cost suppliers will get fair access. A vertically-integrated district heating monopolist can distort

15. *Gatautis (2004).*

wholesale competition in a number of ways. For example, discrimination in access conditions, access charges or decisions on where to extend the district heating network may put competitors at a disadvantage.[16]

Unbundling

To ensure fairness and thus for wholesale competition to be most effective, generation needs to be unbundled from network operation and sales. If a single company both generates and purchases heat to sell to end-users, it has an incentive to sell its own heat first, even if it is legally required to dispatch heat in merit order. As retail competition is unlikely in the district heating sector and district heating networks are small with few transmission assets, in most cases it would probably be sufficient to unbundle generation only. Assets for transmission (made up of large pipes leading directly from the heat plants) and distribution could remain integrated.[17]

The electricity sector provides several well-developed models for separating generation from transmission and distribution: ownership separation, operational separation and functional or accounting separation. Ownership separation requires divestiture of assets so that there is no significant common ownership between generation and transmission/distribution. Operational separation means that an entity independent from the generation companies operates and makes investment decisions about the district heating network, even though network ownership remains with the heat generator. Accounting or functional separation means that the district heating company would need to keep separate accounts for its generation and network activities, charge itself the same price for network access as it charges other suppliers, and separate employees into generation and network groups. Ownership separation is the least discriminatory because it reduces incentives as well as the ability to discriminate. The other forms of separation make discrimination more difficult, but they do not eliminate the incentive to discriminate outright.

Unbundling may seem complicated, but many district heating systems in transition economies are already partly unbundled. Cogeneration facilities are usually owned by companies other than the district heating company. In many countries of the former Soviet Union, companies responsible for heat sales are separate from the main district heating companies. In Kiev, the district heating company, Kievenergo, is divided into several subsidiaries that deal with cogeneration, production from heat-only boilers, waste

16. *IEA (2001a).*

17. *Greater Copenhagen, however, has separated transmission from distribution, as have a few other large cities.*

incineration, transmission and distribution (though there is some overlap between these functions in the subsidiaries depending on location). The Warsaw district heating system is unbundled, with privately-owned heat generation assets and municipally-owned heat transmission and distribution lines. Lithuania takes a similar approach: heat generation assets can be privatised but not the networks, although the distinction can be blurred in practice because both can be leased to private companies. The efficiency gains from unbundling can be significant in large systems, as seen in Copenhagen and in liberalised power sectors. However, policy makers and regulators should also be careful to assess the costs and benefits because many systems may be too small to see net benefits from unbundling.

Recommendation

Policy makers should consider unbundling to improve the fairness and functioning of wholesale competition. Larger systems are the best candidates as they are most likely to see major efficiency gains from unbundling.

Fair and Transparent Network Charges

The third element of formal access rights relates to network charges (also called transmission tariffs). Having non-discriminatory and transparent charges makes it easier for heat suppliers to sell their heat to the network. Not all manufacturers, moreover, can cost-effectively provide waste heat for district heating systems. Much depends on location. Given how important network losses are in the total cost of heat, district heating regulators need to address network charges if wholesale competition is to become more prominent. Such charges are important in calculating and incorporating the economic benefit of competing plants. Even without wholesale competition, separating network charges from generation charges can help clarify losses and provide progressive incentives for district heating companies to reduce network losses. In Copenhagen, the transmission tariffs are non-discriminatory in that all heat is charged the same transmission tariff; the economics of location are factored in during the planning process.[18] Since no profit is allowed in heat production in Denmark (it is based on cost alone), charging more for transmission according to distance might not provide an adequate incentive for efficiency.

18. Correspondence with Inga Thorup Madsen, managing director of CTR, Denmark, May 2004.

There are several ways of calculating transmission tariffs or network charges.[19] The simplest is to charge a set access fee regardless of distance, though this is not likely to be very cost-effective as it provides incentives to build heat plants far from demand regardless of the losses. Another option is to charge a tariff based on the kilometres travelled between heat supplier and customer. While this is the most accurate pricing method, it adds a level of complexity that is probably not justified. Two other intermediate models are nodal and zonal charges. With nodal charges, the charge is based on the number of "nodes" that the heat passes from the supplier to the consumer. Zonal charges, instead, increase each time the heat has to travel into a new zone of the network, much as fares are set for many commuter rail lines. There is little experience in the district heating sector to indicate which approach might be the most effective in balancing administrative costs with economic benefits. In the power industry, nodal charges have proven particularly effective in reaching this balance, but power systems are significantly more dispersed than district heating systems, so it is possible that zonal charges would work as well as nodal charges in district heating. Zonal charges are easier to administer.[20] The most important features of any system of transmission charges are that they are transparent and non-discriminatory and secondarily that they are fair in distributing the transmission costs according to location.

Few transition countries have formalised rules for transmission tariffs. Cities with generation unbundled from the networks, like Warsaw, have transparent cost structures, which helps to make transmission tariffs fair.

Recommendation

Policy makers can help ensure fair access to the wholesale market for heat supply by incorporating three elements into the market rules. First, the rules must require least-cost supply and merit order dispatch (even though the costs will likely be defined in long or medium-term contracts). Second, production must be unbundled from transmission and distribution. Third, transmission tariffs must be transparent and non-discriminatory.

● Wholesale Competition: Examples from the Field

Copenhagen has all three elements of formal access rights described here (least-cost dispatch requirements, unbundling and non-discriminatory network charges). Lithuania, Poland, Hungary, the Czech Republic, Slovakia

19. *The different approaches borrow from power sector regulatory developments.*
20. *IEA (2001a).*

and Romania all have legislation or regulation specifically requiring least-cost heat purchases, at least in some circumstances, although they do not strictly require unbundling of generation and transmission as in Copenhagen. Lithuania's Heat Law of 2003 lists guaranteeing reliable, least-cost heat supply and establishing reasonable competition as its first two objectives. The law states that: "Heat production shall be based on competition between heat producers." Two Lithuanian cities have begun to experiment with wholesale competition: Klaipeda and Mažeikiai, where a geothermal heat plant and a cogeneration unit at the oil terminal provide heat to the respective district heating systems.

The situation in Poland is a little more complex. The 1997 Energy Law allows third-party access to district heating networks, much as for electricity and gas, although the deadline for launching district heating competition has not yet passed; the idea exists on paper only for now. The law aims at retail competition, which will likely be difficult to implement in the district heating sector and so this provision has generated much controversy. Heat prices in both Lithuania and Poland are still regulated and both countries require municipalities to develop energy plans. Lithuania also allows district heating zoning, like Denmark.

Slovakia and Hungary both have laws that require district heating companies to buy cogenerated and waste heat when it is least-cost, but they do not have unbundling so their district heating companies have an incentive to use their own heat first. A relatively large share of Hungarian district heating comes from industrial waste heat.

Romania allows cogenerators access to district heating networks under its Heat Network Code of 2000, although the code is not applied consistently. The sector is partly unbundled. Cogenerators have to prepare a connection request that the transmission/distribution operator then reviews and approves. Termoelectrica had to divest of many of its cogeneration plants in recent years as part of electricity restructuring, so its share in the district heating market has dropped from 63 to 38%. Table 5.2 shows the structure of the wholesale heat market in Romania in 2003.[21]

Overall, the rules and regulation for wholesale heat competition in Romania are based on those for the power sector. Both electricity and heat are often included in the same competition-oriented regulations, but the heat provisions are not always implemented for a variety of reasons. An example is in the town of Sibiu. The main district heating system is supplied by Energia

21. *Institute for Studies and Power Engineering (2003 and 2004).*

Table 5.2

The Romanian Heat Market: Sources of Residential District Heating Supply

Source of Heat Supply	Market Share
Termoelectrica SA (national power company)	38%
Independent producers and autoproducers (mainly industry)	34%
Local district heating plants	28%

Source: Institute for Studies and Power Engineering (2004).

Termica SA, while a portion of the city gets its supply from boilers operated by Nuonsib, a joint venture between the Dutch firm Nuon and the local council. Nuon reports that many of Energia Termica's customers had asked to be supplied with heat from Nuonsib-operated boilers. Nuonsib needed to acquire or build new boilers to do this, but the local council denied this request. Recently, Energia Termica has decided to shut down some of its boilers, which means that some of its customers are being disconnected against their will.[22] On the other hand, the supplier for the Bucharest district heating company buys heat from several sources, including a cogeneration plant owned by Termoelectrica and heat from two or three independent industrial power producers. The Bucharest district heating company also owns some small heat generation plants.[23]

The Ukrainian government was considering establishing a competitive district heating market in the mid-1990s because of the large number of plants providing heat to local areas, but problems with non-payment in the wholesale electricity market discouraged the idea.[24] Ukraine's draft heat law provides some references to competition, but few specifics. It is possible that if the law is passed, regulations issued under the law would clarify access rights.

Recommendation

Policy makers could enhance competition policy to better promote wholesale competition in two ways. First, rules should reflect the specificities of district heating so that they are realistic. Second, governments should follow through on the rules they enact and issue.

22. *Communication with Nicolas Halberg, Nuon, Netherlands, May 2004.*
23. *Communication with Violeta Kogalniceanu, UNDP, Bucharest, June 2004.*
24. *IEA (1996).*

Prospects for Wholesale Competition

What are the prospects for wholesale competition? Wholesale competition can work in a regulated system, which may be best in countries that do not have the necessary conditions for heat source competition with unregulated tariffs.

Alone, wholesale competition will not solve the problems of the district heating sector, but it could play an important role in some of the major systems. For wholesale competition to be effective, the system needs to be large enough to offer a variety of potential generation options. In other words, the best opportunities for wholesale competition will be in cities with industry or other sources of waste heat, or with potential for new cogeneration. Given the small heat markets that district heating systems serve, it is unlikely that competition would encourage the construction of many new heat-only boilers, and the economic advantages of such an approach would likely be very small as the greatest economic gains are from better using existing waste heat (from cogeneration or other sources). As a result, any policy to promote wholesale competition should be very careful to target specific localities, probably in conjunction with local policy makers. A blanket approach could instead add unnecessary and expensive complexity to managing the sector in cities where wholesale competition is unlikely to bring major gains.

As countries gain more experience in wholesale electricity and gas competition, policy makers will probably be more willing to adapt the concept to new sectors, including district heating. That is happening already in Lithuania and it is planned in Poland. Lithuania has combined aspects of wholesale competition with heat source competition, which addresses both wholesale and retail at least on paper. Small-scale efforts to add least-cost heat supply to existing networks, like in Debrecen, will likely grow as well. As long as tariffs are not cost-based, but rather incentive-based, district heating companies will have some motivation to buy least-cost heat. Some transition economies are considering moving away from strictly cost-based tariffs or have already done so. Success in one country can stimulate others so it is possible that some form of wholesale competition will slowly gain momentum in the transition economies.

Recommendation

Policy makers should focus on developing wholesale competition in the largest cities, in close collaboration with local decision makers.

The Extent of Competition

Table 5.3 highlights the extent of competition in district heating and heat in various countries. The data are based on IEA estimates. There are no comprehensive, international surveys on the degree of competition in each city with district heating. Competition is local and data on district heating's market share do not necessarily indicate whether district heating operators are actively competing with other heat sources. Likewise, country statistics on independent heat production do not indicate whether there is more than one producer in a single geographic area.

Table 5.3

Extent of Heat and District Heating Competition in Selected Countries

Country	Extensive Heat Source Competition		Wholesale Competition	
	With Tariff Regulation	No Regulation	Formal Rules	Extent of Independent Production
Czech Republic	x		2	1
Denmark	No		3	3
Finland		x	0	2
Germany		x	n.a.	1
Hungary	x		1	2
Lithuania	x		2	2
Poland	x		3	2
Romania	x		3	1
Russia	No		1	1
Sweden		x	0	2
U.K.		x	0	2
Ukraine	No		1	1
U.S. (most systems)		x	0	2

Note: The first and second columns are mutually exclusive. No means that competition is absent; x means there is competition; blank means competition exists, but is accounted for in the other column. The third and fourth columns assess the extent of competition from 0-3, with 0 being none and 3 being well-developed rules or competition; n.a. means the information is not available.

Conclusions

Countries should be open to the idea of competition because of its significant benefits in terms of improved efficiency and service quality. Competition has successfully lowered costs in some countries and in many sectors beyond the heat market. That said, district heating is a unique, local commodity where competition needs to be carefully planned and monitored for fairness. Depending on how open, balanced and transparent a market is, policy makers can introduce more or less competition, starting with least-cost requirements relating to network access, through to retail competition in the form of heat source competition. Nonetheless, in countries or cities with high poverty rates or poor governance, better regulation may be the best approach for the present.

Monitoring is important whether the competition involves other heat sources or several district heating suppliers as it can help ensure fairness and consumer protection. With heat source competition, it is easy to overlook the need for careful review because most of this competition developed without a concrete decision to allow it. Heat source competition can work well in both large and small systems. Dramatic changes in market share are often a result of policy failures (like unfair subsidies) rather than true market forces. Negative impacts will hit small systems faster because it takes fewer disconnections to make these systems unviable. With regulated wholesale competition, monitoring is built into the system in one or two ways. First, the district heating system and pricing are still regulated; second, access to the district heating network might be regulated to enhance fairness and transparency. Regulated wholesale competition is generally only worthwhile in large systems with potential competitors for heat supply.

Retail competition between heat suppliers would not be feasible in district heating given the small size of the market in each system: while it might seem appealing in theory, it adds complication and cost that are not balanced by the benefits that it brings. Heat source competition is a better way of providing consumer choice in heat markets.

INVESTMENT, FINANCING AND THE INTERNATIONAL COMMUNITY

District heating companies in many transition economies have faced difficulties in attracting sufficient financing for new technology. Underinvestment leads systems to deteriorate, which undermines their competitiveness. Access to financing is therefore a major condition for the sustainability of district heating. This chapter highlights investment needs in district heating and describes financing mechanisms that can help address these needs. It emphasises that the role of the private sector and commercial financing should grow and discusses policy approaches to facilitate this process. The chapter then examines national and international support programmes, and the policy lessons they provide. The last section looks at the role of the international community from a wider perspective, as its role is not limited to providing financial support. Chapter 7 complements this chapter by looking more closely at ways of involving the private sector.

Investment Needs

In the past, investments were centrally planned with financing from the state or regional budget; this was true in all sectors, including district heating. In the transition to market economies, district heating utilities in many countries faced severe financing shortfalls. Today companies in many transition economies do not have strong enough balance sheets to finance major modernisation projects because of the below-cost tariff structure, non-payment and other related problems. Investment requirements for district heating differ between countries. They are generally higher in the former Soviet Union and South East Europe than in Central Europe and the Baltics. In much of South East Europe, the Caucasus and Central Asia, underinvestment has led to the collapse of district heating systems, with significant social and environmental implications. In Bulgaria, it would cost approximately €240 million to modernise heat production and an additional €100 million to refurbish networks.[1] Russian experts estimate total investment requirements in their heating infrastructure at $70 billion for the period until 2020.[2] Chapter 2 provides additional, regional details on the technical condition and investment requirements of district heating systems.

1. *Constantinescu (2003).*
2. *This is equivalent to €58 billion at the June 2004 rate; Source: Melnikova (2004).*

All parts of the supply chain need investment to operate stably and more efficiently:

- *Supply:* Refurbishment and modernisation of boilers and cogeneration plants; fuel switching; controls.
- *Networks:* Installation or renovation of substations; repair, better piping insulation or new pipes.
- *Consumer installations:* Demand-side energy efficiency improvements such as insulation or double-glazed windows; heat meters in buildings; individual control valves and heat cost allocators.

Balancing supply and demand should be a priority in investment decisions and having a policy framework that clearly addresses this balance is critical. Regardless of the source of financing, investments in district heating assets should take future demand and market potential into account so as to avoid excessive costs for unneeded capacity (see Chapters 2 and 3).

Financing Options

There are several options for financing district heating improvements, not all of which are optimal from a policy perspective:

- Equity investments.
- Commercial bank loans.
- Loans or guarantees from development banks, or local, regional or international funds.
- Third-party financing.
- Municipal or corporate bonds.
- Targeted budget financing.
- Grants or subsidies.

In the early years of transition, national, regional and local budgets financed most investments in district heating, along with additional support from special government funds and programmes, international financial institutions and bilateral donors. Since then, many countries, particularly in Central Europe and the Baltics, have made significant progress in attracting private capital and commercial financing. Today numerous district heating projects in these countries receive financing without government or international assistance. In the Caucasus, Central Asia and much of South East Europe,

however, banking sector liquidity is still low, and the district heating sector is not attractive to private investors for various reasons, including non-payment.

In countries where commercial financing is not yet available on a large scale, grants and other support schemes can be the only option for meeting urgent investment needs in the short term. That said, the main objectives of public financing, whether domestic or international, should be to create favourable conditions for commercial financing and private investments in the medium and long term. Public financing or guarantee schemes can mobilise commercial co-financing by helping to allocate the investment risk between different investors.

In countries with more mature market economies and a developed banking sector, it does not make sense to finance improvements in district heating wholly from public or multilateral funds. Generally, if commercial financing is available, grants, subsidies and other forms of direct financial support should not exist as they interfere with commercial investment decisions by distorting market signals. They may, however, be justified as a temporary tool for governments to promote an investment that is beneficial to public welfare, for example in environmentally friendly technologies. They should be carefully structured to promote specific policy goals without distorting the market in the long term.

Overall, commercial financing is the most important form of financing in the district heating sector. It is also the source for which there is the least published data: private entities often consider such information confidential and when the information does exist, it is dispersed because there are many commercial financiers. Commercial financing comes from equity investments (when district heating companies or their owners and managers invest in the company and its infrastructure), from commercial bank loans and occasionally from bonds. In fact, in countries where such financing is not available, for the most part little modernisation occurs.

● Commercial Financing

This section briefly describes the types of commercial financing that exist and how best to use them. It also summarises information on regional differences in commercial financing and on overcoming the financing barriers. Chapter 7 goes into more detail on this theme, describing the types of ownership and management structures, so this section highlights only major issues relating to overall financing structure and policy.

Equity Financing

District heating companies make many capital investments or improvements using internal financing. This is actually the simplest and most common form of commercial equity financing. In most cases, a district heating company makes such investments using sales revenue, which is why it is so important for tariffs to cover full costs. When additional financing is needed, the company can tap its own savings (also known as assets in financial terms); large international operators are in a better position to make such investments than smaller, municipal companies. The advantages of internal financing are simplicity, control and the lack of finance charges.

That said, investments in district heating modernisation are too large for most single-system companies to finance directly off the balance sheet or from savings. External financing can lower the risk for any single investor and allows for larger investments than might be possible otherwise. Such an approach does add to the time, complexity and cost of a project, so it is important to tailor the amount and structure of financing to the needs. District heating companies and their owners should seek to finance smaller projects internally. For example, investing progressively in energy efficiency measures can reduce operating costs, making larger deals less expensive and more feasible to finance. Larger projects and comprehensive modernisation will almost always require some external financing.

The most common way to finance such large projects is to attract new investors with an equity stake or management rights in the district heating company. Money from the sale of the equity or management rights can be used to modernise the company. Alternatively, the sale can be combined with direct investment in the company, allowing the company to increase its value and future cash flow. When municipalities privatise district heating companies, they may want to retain some or all of the privatisation revenue. In such cases, municipalities should be careful to cover investment requirements in the overall privatisation package; for example, a municipality might agree to raise tariffs to pay for capital investments.

Careful advance planning can ensure that the investment is well structured. It can also reduce the total financing costs and raise the value of the assets sold.

Debt Financing

Commercial debt financing comes in essentially two forms: loans and bonds.[3] Loans are comparatively easy to arrange, but they still need to be well

3. *A loan is borrowed money that is usually repaid with interest. A bond is a certificate of debt (usually interest-bearing or discounted) that is issued by a government or company in order to raise money; the issuer is required to pay a fixed interest payment annually until the bond matures and then a fixed sum to repay the principal.*

structured to keep interest rates down. For example, guarantees from major customers or suppliers can lower the risk, which should lower interest rates. Banks are the most common source of commercial loans; other potential sources can include equipment suppliers and owners. An example of commercial lending for district heating is the €49 million Energobaltic project in Poland, which was implemented in 2002. This project involved building a new cogeneration plant to burn waste gases from the petroleum industry, thus allowing several coal-fired boilers to close. Financing came from several sources, including a commercial bank loan, a loan from the implementing companies' shareholders and Polish environmental funds.[4] Slovak, Czech, Latvian and other commercial banks also frequently provide loans for municipal infrastructure projects like district heating. Loans have several advantages over external equity financing. They allow the owner to maintain more control than is possible when financing comes from equity sales. They can also be fairly flexible and simple, though this also depends on the size. Interest payments can make some types of loans expensive.

Municipal or corporate bonds can also finance district heating projects, but they are relatively rare because the cost of arranging them can be excessive for all but the largest projects.

It is often best to structure a financing package using several forms of financing to balance risk and cost. While this is more complex to arrange than financing from a single source, it is usually essential for large projects.

Structuring Commercial Financing: Issues to Consider

For municipal companies, collateral is a major problem since they cannot legally pledge many assets, and even if they could, the assets may have little commercial value (a school is a good example of such an asset). Private companies, particularly larger ones, have many options for collateral. Depending on the health of their balance sheet, they may not even need collateral.

Given the easier access to credit that private companies usually enjoy, many public district heating companies seek to attract the private sector to help finance investments. One mechanism for doing so is involving an energy service company (ESCO), as described below.

Mitigating the foreign exchange rate risk is another important financing issue. For example, if a loan is priced in euros, a local company is paid in rubles and the exchange rate changes radically, the local company may find repaying the

4. *Energobaltic, www.energobaltic.com.pl/ANG/firma.html.*

loan difficult, even financially catastrophic, unless it has hedged its foreign exchange risk. Larger companies, particularly foreign ones, may be less sensitive to exchange rate fluctuations. They can deal with changes in currency value more easily because less of their cash flow is tied to a single loan.

Access to financing largely depends on the company's ownership and size. Private companies generally have more experience in financing projects: they have established relationships with banks and others actors and know what documentation is required to apply for a loan. They usually have more internal capital, which is critical to structuring financing since few lenders will make a loan for a project's full value, particularly if the project is large. Private companies (particularly foreign ones) therefore can obtain a better interest rate, which makes investments more cost-effective. Also, private companies are typically more knowledgeable about financing options and techniques, for example, supplier credit or export financing. Public companies, on the other hand, may have easier access to domestic financial programmes, many of which provide more favourable conditions for public institutions.

Access to Commercial Financing: Regional Differences

Access to commercial capital differs significantly among transition economies, depending on the state of their financial systems and markets. Banks in the former Socialist countries used to be state-owned and faced many problems, including government interference, directed lending and poor management. Some transition economies have advanced in restructuring their banking systems, while others still have a long way to go toward a modern and competitive banking sector. In Central Europe and the Baltics, competing commercial banks today offer short and long-term loans for district heating and cogeneration investments at reasonable interest rates (6 to 10% in local currency). By contrast, in much of South East Europe, including Romania, the market for corporate lending is underdeveloped and banks are highly risk-averse, so the cost of borrowed capital is extremely high.[5]

Commercial lenders may consider investments in district heating to be very high-risk in the following circumstances. These problems are common in much of the former Soviet Union and South East Europe:

- Heat tariffs below cost and subject to political interference.
- Continuing cross-subsidies between consumers or direct subsidies to heat providers (these can raise doubts about future revenue once the subsidies are removed).

5. *ESMAP (2003).*

- Growing disconnection rate and unclear future heat demand.
- Low consumer payment discipline, which leads to unstable revenue.

Another barrier is the low creditworthiness of district heating companies. Poor financial performance, large arrears to fuel suppliers, unclear or non-transparent ownership and operating structure, inadequate managerial skills and weak business plans all lead to low creditworthiness. Moreover, in many countries in the former Soviet Union and South East Europe, potential lenders cannot assess a company's credit risk as they do not always have access to reliable corporate financial information.

In many transition economies, banks and companies have little experience in lending for investment in district heating. As for district heating companies, their lack of experience creates two problems: first, they do not always know how to obtain a loan (for example they may have limited knowledge of application procedures and documentation requirements). Second and more importantly, they often do not know how to run their business so that they can be eligible for loans (for example by developing a solid business plan, making payments on time, improving cash flow, reducing debt and building good relationships with banks through small loans or credit lines).

Building the Conditions for Commercial Financing: the Role of Policy

Policy has an impact on the availability of commercial financing for energy efficiency, modernisation and other improvements. The regional differences in access to financing are one of the best examples of this. Macro-economic and finance sector policy obviously play a large role in this, but so do policies specifically relating to district heating. Tariffs that do not cover costs and lack of legal mechanisms to enforce payment are two examples of policies that can deter investment. Tariff regulation that allows companies to retain profits from efficiency improvements (such as price capping) tends to attract investment, on the other hand. The same is true for policies to involve the private sector in district heating through privatisation and various forms of management, as discussed in Chapter 7.

Recommendation

To facilitate commercial financing of district heating projects, governments should focus on the following measures:

- Developing tariffs that cover costs and provide a return on investment.
- Instituting stable and predictable legal and regulatory frameworks.

- Encouraging district heating companies to focus on customers and reduce overcapacity.
- Enforcing payment discipline and setting up targeted subsidies for poor households.
- Pursuing overall reforms in the financial sector.
- Establishing clear accounting standards and financial reporting requirements for companies.
- Involving the private sector.

National and International Public Financing Schemes

Some of the major multilateral and bilateral organisations that provide financing or technical assistance for district heating projects include:[6]

- The World Bank.
- The Global Environment Facility (GEF).
- The United Nations Development Programme (UNDP).
- The European Bank for Reconstruction and Development (EBRD).
- The European Investment Bank (EIB).
- The European Union TACIS, PHARE and Obnova programmes.
- The Nordic Environmental Finance Corporation (NEFCO).
- The Nordic Investment Bank (NIB).
- The U.S. Agency for International Development (USAID).

Additionally, most transition countries have put in place national and/or regional schemes to facilitate district heating financing and sector restructuring. A number of successful projects began with a limited amount of government or international support. This has encouraged commercial banks to provide loans for district heating projects in much of Central and Eastern Europe and the Baltics. Examples of such schemes are mentioned below for illustration; they are organised according to design features that promote specific policy goals. These goals include leveraging commercial financing, protecting the environment, replicating project results more broadly and building institutional capacity. Many projects pursue several goals at the same time. Achieving these goals requires carefully structuring financing programmes and the projects they fund.

6. *These organisations are not ranked by their financial contribution per se, but rather are grouped according to whether they are multilateral, regional or bilateral.*

Leveraging Financing

Leverage is important to public financing because it allows public institutions to provide a small amount of seed financing, lowering risks enough so that commercial or other financing can fill the gaps. In practice, leverage means that a publicly sponsored financing programme will only pay for a portion of the project costs or will provide guarantees for commercial loans.

One success story is the Municipal Infrastructure Finance Program (MUFIS), which USAID and the Czech government implemented between 1996 and 2000. MUFIS provided guarantees to Czech commercial banks for municipal housing-related infrastructure loans. The programme's main objectives were to end municipalities' reliance on central government grants and subsidies and to speed up the development of a viable banking sector. This programme encouraged restructuring and competition in the banking sector and helped in stabilising macro-finance in the country.[7]

The Public Investment Programme in Latvia provides co-funding for energy projects in the form of municipal investment grants. This allows the programme to leverage financing to make better use of limited funds.[8]

Multilateral financial institutions have co-financed many district heating projects in the region. For example, the World Bank financed projects to improve the technical and institutional efficiency of district heating systems in several countries including Armenia, Bosnia, Estonia, the Kyrgyz Republic, Latvia, Poland, Slovenia and Ukraine. Sector restructuring is typically an important goal of World Bank projects. The UNDP and GEF financed a number of heating and hot water projects in countries such as Armenia, Georgia, Kazakhstan, Latvia, Russia, Kyrgyzstan, Turkmenistan and Uzbekistan. The UNDP and GEF put great emphasis on capacity building in most of their projects. Projects co-financed by the EBRD include the Belgrade District Heating Rehabilitation Programme (Serbia), the Andijan District Heating Improvement and Reform (Uzbekistan), the Sofia District Heating Rehabilitation (Bulgaria) and other projects in transition countries, including Poland, Romania and Russia.

Multilateral investment banks such as the World Bank, the EBRD, the NIB and the EIB generally finance projects through loans or acquisitions of equity stakes. As a rule, they require co-financing from public or private sources and have special requirements and procedures for lending. For instance, the World Bank requires a sovereign guarantee for the loan; the EBRD's

7. USAID, www.usaid.org and the Urban Institute, www.urban.org.

8. Brendow (2003).

guarantee requirements depend on who will receive the loan, so guarantees can range from sovereign to municipal or corporate.

One problem with financing from international financial institutions is that the project development process may take several years from concept to construction. This sometimes results in investments that are no longer needed or might have been financed commercially. Given the high transaction costs, financing from international financial institutions usually works only with relatively large projects. Several small-scale district heating companies with similar investment needs can get together and apply for loans under "project umbrellas", but this also generally requires long and complicated project preparation.

Using Public Funds for Targeted Environmental Goals

Many international or governmental institutions finance projects that contribute to environmental goals. For instance, the GEF, a joint programme of the World Bank, the UNDP and the United Nations Environment Programme, provides grant funding to certain energy efficiency projects with global environmental benefits.

Another example is the Ecofund, which was founded in Poland in 1992. It manages a debt-for-environment swap fund, one of the largest environmental funds in the region.[9] The Ecofund finances environmental projects, including energy efficiency improvements in district heating systems. It provides grants or preferential loans for 10 to 30% of total project costs (municipalities can obtain grants for up to 50% of a project's value in certain cases). The remaining costs have to be financed from the investor's own funds, commercial bank loans or loans from national or regional environmental funds.[10]

In the Czech Republic, the State Environmental Fund uses state revenue from environmental fines and taxes to finance small and medium-scale cogeneration and district heating projects through a combination of direct grants and soft loans.[11] Public entities have easier access to the grants and can obtain loans at a low interest rate (30% of the market interest rate),[12] while private investors may obtain a preferential rate equal to 90% of the market rate. Similar environmental funds operate in Poland at the national, regional and local levels. These funds typically only cover a small portion of a project's

9. *It received these funds after the Paris Club countries agreed to convert 10% of the Polish foreign debt into a fund for environmental projects. The Polish government pays into the fund instead of repaying its old foreign debts.*
10. *PROCHP (2002b).*
11. *PROCHP (2002a).*
12. *The benchmark market interest rate is the Prague inter-bank offered rate (PRIBOR), which is published daily by the Central Bank.*

costs, but they allow project developers to make investments in environmentally friendly technologies that would not be possible without these resources.

Many countries have energy efficiency funds that finance district heating projects. National governments, international financial institutions and donors have made the initial capital investments in these funds. The funds are often managed by local commercial banks, and one of their main objectives is to build the capacity of domestic financial intermediaries to finance energy efficiency investments. For example, Hungary established the Energy Efficiency Co-financing Program with a $5 million grant from the GEF. Many Russian regions have energy efficiency funds that are financed through energy taxes. The Belarusian government has a similar fund that allocates up to $300 million per year for energy efficiency projects, including district heating.

Replicating Results

Countries in the former Soviet Union and South East Europe, where investment needs for district heating are the greatest, can learn from other countries that have already travelled this path when designing their domestic financing schemes. Moldova, for example, is planning to set up a revolving loan fund for financing new heating systems and upgrading existing systems. The fund will provide loans under near commercial conditions, but will accept higher risks than commercial banks. An advantage of revolving loan funds is that they can finance many small projects that might otherwise fall below the lending threshold of large development banks. Revolving loan funds can also provide excellent leverage, as the initial capital is reused many times to finance new loans.

Although most projects of international financial institutions are designed to be replicable, replicating specific projects can be difficult in practice. Even if a project proves successful, it often cannot be replicated without additional international financial support. For instance, World Bank projects are usually very large (the total cost can be up to several hundred millions of dollars) and project risk is covered by a sovereign guarantee. Not many commercial lenders would invest in such large projects, particularly without a new sovereign guarantee (sovereign guarantees require approval from both parliament and the government). The chances of replicating successful projects increase when it is possible to find another risk mitigation mechanism.

Capacity Building

Many national and international programmes help finance investments in district heating by building institutional and technical capacity. The MUFIS

programme discussed earlier is one example of this. Through guarantees and technical assistance to Czech municipal finance staff, MUFIS helped commercial banks to lend to municipalities and municipalities to borrow from banks.

The EU Phare Programme also aims to strengthen institutional capacity and promote structural reforms that can benefit district heating.[13] Likewise, the Tacis Programme, launched by the European Commission in 1991, provides grant-financed technical assistance to 12 countries of Eastern Europe and Central Asia.[14] Tacis has implemented technical assistance projects for district heating in Armenia, Russia, Uzbekistan and other countries. The main objective of both the Phare and Tacis Programmes is to enhance the transition process in these countries, building on experience within the EU. The new EU states are also eligible for EU structural funds, which promote economic and social cohesion in the EU and help EU states learn from the experience of others. Municipalities are the main target of such funds and since many of them own district heating companies or assets, the funds can in some cases help to modernise their heating systems.[15]

USAID and other American technical assistance programmes have also emphasised building capacity for financing. This includes business plan training, manuals on financing and assistance in building capacity in specific fields, like financial analysis or auditing. In addition, USAID provided start-up funding for energy efficiency centers in 5 transition economies; these centers are now highly skilled at preparing business plans and other documentation for district heating projects.

Recommendation

National and international financial support schemes ideally should be designed to help create the conditions for commercial financing and private investments. Loan guarantees and training programmes are typically better suited for this than direct grants. Guarantees leverage commercial financing, which automatically increases their impact. When commercial financing is available, public financing should be very limited and targeted.

13. *Originally created in 1989 to assist Poland and Hungary, the Phare Programme currently covers 10 countries: the 8 new member states (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) as well as Bulgaria and Romania. Until 2000, Albania, Bosnia-Herzegovina and the Former Yugoslav Republic of Macedonia were also beneficiaries of Phare.*

14. *Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. (Tacis also covered Mongolia from 1991 to 2003).*

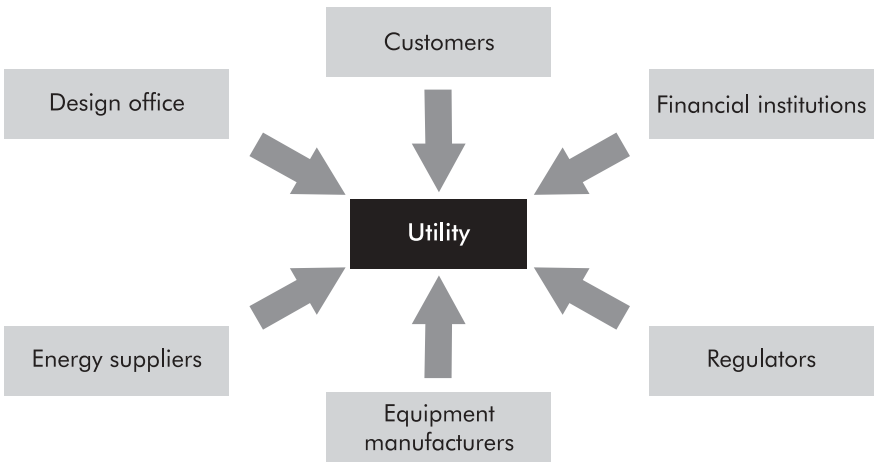
15. *Before the Cogeneration Directive was enacted in early 2004, there was no legal basis for using structural adjustment funds to support district heating. Thus, the Phare Programme was the only source of EU funding for district heating in Central Europe and the Baltics. For more information see EU Structural Funds Operational Programmes, www.eugrants.org.*

● Energy Service Companies (ESCOs)

Energy service companies (ESCOs) can play an important role in district heating finance. ESCO contracts can be an effective way of financing energy efficiency improvements. ESCOs first appeared in North America and are now increasingly used in other parts of the world, including transition economies, to implement energy efficiency projects in industry, public and commercial buildings and the housing sector. In brief, an ESCO can be defined as "a company that provides integrated solutions for achieving energy cost reductions, and whose payments are linked to the performance of the implemented solutions."[16] Under the ESCO model, the client deals with a single entity for all the project components throughout all stages of the project cycle, rather than with several institutions, as illustrated in Figures 6.1 and 6.2.

Figure 6.1

Traditional Approach to Utility Business Relations



Source: Based on CTI (2003).

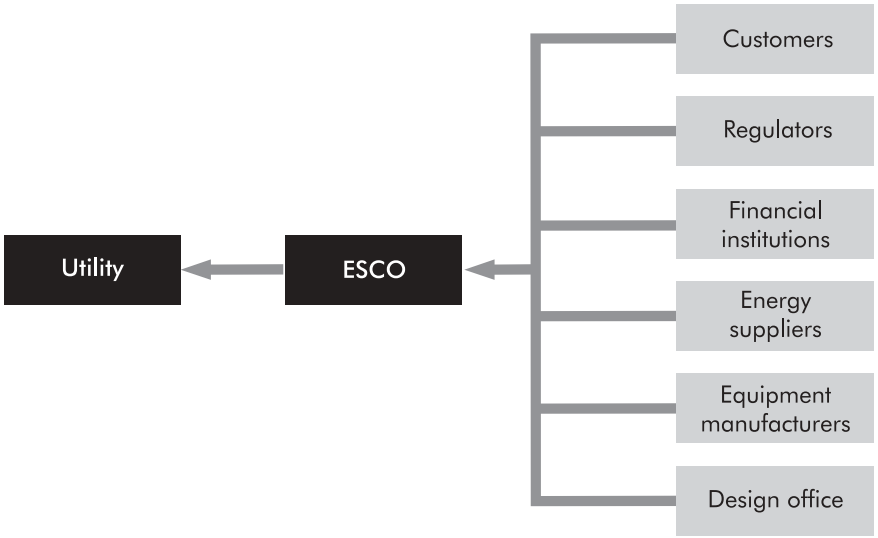
The concept of ESCO is often associated with the principle of third-party financing (TPF). Under TPF, an external party[17] implements a project to improve energy efficiency in a user's facility. This external party arranges or provides the bulk of the financing needed to implement a project, either by borrowing from a financial institution or investing its own money. The

16. CTI (2003).

17. This external party is usually but not necessarily an ESCO.

Figure 6.2

ESCO Approach to Utility Business Relations



Source: Based on CTI (2003).

guarantee expected by the financial institution is either based on the project value, on the balance sheet of the company that implements the project (for example an ESCO) or on the client's balance sheet. For example, the municipal district heating company in the Hungarian city of Nyiregyhaza has refurbished its secondary distribution system, partly with third-party financing, and reduced its energy use by 25%.[18]

It should be noted, though, that an ESCO's responsibilities do not always include financing per se: sometimes the client finances the project entirely. On the other hand, the ESCO's responsibilities are broader than financing. They can include a wide range of other services such as:

- Energy analysis and auditing.
- Project design and development.
- Engineering and installation.
- Facilitation or provision of financing.
- Management and operation.

18. *Energy Charter Secretariat (2003).*

- Monitoring of energy savings.
- Performance guarantees.

The historical North American definition of the ESCO concept has evolved over recent decades, and the term ESCO is used today to denominate rather different activities. In this book, the terms energy performance contracting (EPC) and contract energy management (CEM) are used to describe different approaches to the ESCO business. Both approaches can coexist in one country; however, these terms are sometimes used interchangeably. In the Czech Republic, for instance, energy performance contracting coexists with contract energy management.

Energy Performance Contracting

EPC is when an energy service company develops and implements energy efficiency projects by offering turnkey solutions, from auditing to installation and monitoring. The ESCO accepts some degree of risk for achieving energy efficiency improvements, and its revenue is linked to actual energy savings. In other words, the ESCO guarantees to its client a certain level of energy cost reduction. Revenue generated by the cost savings can either be used to repay the ESCO for its services, or shared between the ESCO and the client on a pre-agreed basis.

Contract Energy Management

CEM[19] is when the ESCO not only develops and implements projects, but also assumes responsibility for providing the agreed level of energy service (such as district heating), and manages system operations and energy sales. Improving operations and management is usually the primary goal of this approach. Return on investment and net profit are based on revenue from energy sales, not just energy savings. Under this model, the ESCO guarantees a certain level of energy service, usually at a predetermined price (which can be adjusted to external factors such as fuel price fluctuations). The ESCO is interested in reducing costs to maximise its profit. Some foreign companies, such as the French company Dalkia, operate a number of district heating systems in Central Europe and the Baltics under this approach (see Chapter 7). In many countries, however, such an approach would simply be called efficient utility operations, not CEM. In such cases, CEM means a contract for energy supply to a single client and end user. The advantage of supplying a single client is that the ESCO can try to integrate both demand and supply-side measure more comprehensively than would be possible for multiple clients.

19. *This approach is often called the "French model" because French companies widely use it.*

Sometimes, the term ESCO refers to energy services in a broad sense. Such ESCOs provide only a limited range of services such as project development, engineering or implementation, but do not offer turnkey solutions nor provide financing.[20]

Energy service companies can be owned privately (for example, Siemens owns the Landis & Staefa ESCOs in the Czech Republic) or publicly (for example, the State Committee on Energy Conservation owns UkrEsco in Ukraine). They are often the subsidiary of a large utility or manufacturer of energy efficient technologies. In Hungary, for example, several large utilities have created their own ESCOs (for example, E-Partner of DÉMÁSZ/EDF or Synergy of ÉMÁSZ/RWE). The energy services these ESCOs offer help the parent utilities retain customers or attract new ones. Energy service companies have been very successful in some countries, particularly in the Czech Republic, Hungary, Poland and Ukraine.[21]

In some cases, however, involving ESCOs in the district heating business can harm the long-term relationship between the system owner and its customers. When an ESCO takes over system operation, it becomes an intermediary between the owner and its customers. If the ESCO is a poor business manager, the owner cannot easily improve the situation because it lacks the necessary knowledge of the customers and transactions with them. This highlights that an adequate framework is necessary. Otherwise, it is difficult for ESCOs to be an effective solution to the financial and managerial problems of district heating. In most countries, however, ESCOs still face numerous barriers, impeding their effective operation. In addition to the general barriers to financing mentioned earlier, the ESCO business faces specific obstacles. For example, policy makers and district heating managers may misunderstand or not be aware of the ESCO concept. An inadequate legal and regulatory framework can also hinder energy performance contracting and contract energy management.

The legal and regulatory basis for energy service performance can affect the perceived risk and therefore the number and cost of projects developed. In many countries, including Russia and Ukraine, the legal and accounting systems do not explicitly allow payments based on future performance (although they do not prohibit them either), which makes ESCO contracts difficult to enforce in court and creates a potential risk for project developers.[22] If heat tariffs are regulated, incentive regulation creates a more favourable

20. *EGI Contracting/Engineering (2002).*

21. *Although not necessarily in district heating. In Ukraine, for example, ESCOs have been effective in improving energy efficiency in industrial facilities.*

22. *Evans (2000).*

business climate for ESCOs than cost-plus regulation (see Chapter 4). Some specific policies and regulations can also promote the development of ESCOs, for example a reduced value-added tax (VAT). In Hungary, VAT is typically 25% for most products and services. Energy services such as the supply of electricity, gas or heat have 12% VAT. When ESCO services are categorised as development services, the 25% VAT applies. When the ESCO operates renovated energy equipment, its whole service may be considered an "energy service" and thus enjoys low VAT. It would make sense to harmonise this regulation and apply low VAT to all ESCO activities.

Some countries have set up financial support schemes to stimulate the initial creation of an ESCO market. In Hungary, for instance, there is a 1.7 billion Hungarian forint scheme called the Energy Saving Credit Programme. It was established in 1995 to provide preferential loans for energy efficiency projects in public buildings and for projects to modernise district heating networks. To be eligible for a fund loan, at least half the project's financial benefit must be from energy savings. Some district heating companies believe, however, that this programme is not very effective because of its small scale and long approval procedures.

Given the need to replace or renovate much of the existing heating infrastructure to improve efficiency, the potential for ESCOs in most transition economies seems large. For ESCOs to be an effective solution, however, they need a suitable legal and regulatory framework. Specific policy support measures and financing schemes can help develop this potential.

Recommendation

Governments can take specific steps to create favourable conditions for an ESCO market. In particular, they can improve the legal and regulatory basis for performance contracting. Replacing cost-plus tariffs by incentive regulation will stimulate the development of ESCOs. In addition, fiscal and other incentives such as investment tax credits, accelerated depreciation, adaptation of public procurement can promote investment in energy efficiency. Improving the overall investment climate and access to commercial financing is also very important.

● The Kyoto Flexible Mechanisms

The Kyoto Protocol will be an important source of investment finance for district heating modernisation if it enters into force.[23] Its flexible mechanisms

23. *The Protocol can only enter into force if the fraction of emissions from Annex I countries that have ratified it rises above 55%, which will happen if Russia ratifies.*

(see Box 6.1) can be used to finance such investments because improving the efficiency of existing district heating systems or fuel switching can lead to significant reductions of greenhouse gas emissions.

Although the Kyoto Protocol has not yet entered into force, several countries have already implemented projects within the framework of the flexible mechanisms' pilot phase. The World Bank has also established a Prototype Carbon Fund (PCF) to develop pilot emission reduction projects within the framework of JI and CDM. The PCF has invested in projects designed to produce emission reductions consistent with the Protocol and its flexible mechanisms.

International Emission Trading

International emission trading can be a source of financing for countries like Russia and Ukraine, which have emission caps that are likely to be above their real emission levels.[24] These countries can be major players in the emission trading market under the Kyoto Protocol. If they can improve their energy efficiency, the benefits that they will reap from emission trading will be even higher.

District heating companies in the new European member countries can also take advantage of the EU Emission Trading Scheme (ETS) to access financing for emission reductions. ETS is compatible with the Kyoto system for emission trading but is not linked to the Protocol's entry into force (see Chapter 8, Box 8.1).

Box 6.1

The Kyoto Protocol: Key Concepts

The Kyoto Protocol

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) contains a set of legally binding emission targets for industrialised countries. Annex I Parties (see below) that ratify the Protocol are obliged to cut their total annual emissions by an average of at least 5% from 1990 levels by 2008-2012. Each Annex I Party has its own individual emission target, which may be more or less than 5%. The three flexible mechanisms of the Kyoto Protocol – joint implementation (JI), the clean development mechanism (CDM) and international emission trading (IET) – are designed to help the Parties meet their commitments.

24. *It should be noted, however, that the large drop in their emissions in the 1990s was mainly due to a sharp decline in economic activity.*

Annex I and Annex II Parties

Annex I of the UNFCCC currently includes 41 industrialised countries: 24 countries also listed in Annex II of the Convention (see below) plus Belarus*, Bulgaria*, Croatia*, the Czech Republic*, Estonia*, Hungary*, Latvia*, Liechtenstein, Lithuania*, Monaco, Poland*, Romania*, the Russian Federation*, Slovakia*, Slovenia*, Turkey, and Ukraine*.

Annex II includes Australia, Austria, Belgium, Canada, Denmark, the European Community, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America. All other countries are known as non-Annex I Parties.

Notes: Kazakhstan has announced its intention to be bound by the commitments of Annex I Parties, but is not formally classified as an Annex I Party under the Convention. It will, however, be considered like an Annex I Party for the Kyoto Protocol once it enters into force. * Indicates countries with economies in transition.

Joint Implementation (JI)

Joint implementation allows Annex I Parties to invest in an emission reduction or sequestration project in another Annex I country to earn *emission reduction units* (ERU) that the investor can credit toward its emission limit. Generally, this instrument encourages industrialised countries to invest in emission reduction or sequestration projects in transition countries, where there is greater scope to cut emissions at lower cost.

International Emission Trading (IET)

International emissions trading allows one Annex I country to sell some of its allowable emissions (called *assigned amount units* or AAUs) to another Annex I country. The seller of AAUs can "recycle" revenues from emission trading by investing them in projects generating further emission reductions.

Clean Development Mechanism (CDM)

The CDM allows Annex I Parties to implement projects that reduce emissions in the territories of non-Annex I Parties. The *certified emission reductions* (CERs) generated by such projects can be used by Annex I Parties to help meet their emission targets, while the projects also help non-Annex I Parties to achieve sustainable development and contribute to the emission objective of the Convention.

Source: UNFCCC (2002).

One option for managing international emission trading would be through a Green Investment Scheme (GIS).[25] This mechanism (sometimes called "greening") is designed to channel funds received from international emission trading into environmentally-related projects. The scheme will ensure that the revenues from emission trading are earmarked for environmental (or social) purposes and that these revenues are transparent and subject to control. Potential buyers have different views on the nature and scope of projects that could be implemented under the GIS. Energy efficiency improvements, including modernisation of district heating systems, are likely to be a priority. On the other hand, opponents believe that the GIS would raise transaction costs, and therefore limit emission trading opportunities.

Joint Implementation and the Clean Development Mechanism

JI and CDM provide opportunities to set up technology partnerships between the West and transition economies,[26] and to finance investments in district heating. For example, the Finnish CDM/JI Pilot Programme, co-ordinated by the Ministry for Foreign Affairs, has developed several JI and CDM projects, among them a district heating project in the Estonian town of Paide. In this project, a Finnish company replaced an oil-fired district heating plant in Paide with a new woodchip-fired plant. The contracting parties (the Finnish Ministry of Environment and the Estonian company Ou Pogi that owns the plant) agreed that between 2003 and 2012, Finland will buy 100,000 tonnes of carbon dioxide emission reduction units at €5.34 /tonne from Ou Pogi.[27] Latvia has implemented joint projects with Sweden, Germany and the Netherlands, including five projects to improve the efficiency of district heating networks.[28]

JI and CDM financing tends to be small compared to total project financing. First, these mechanisms can finance only investments that comply with the "additionality" criteria .[29] Second, countries must comply with a number of conditions set by UNFCCC in order to be eligible for hosting a JI or CDM project.[30] The administrative burden of JI and CDM approval will tend to limit investments.

---

25. *For detailed information of GIS, see Tangen et al. (2002).*
26. *JI can work in most transition economies except those in Central Asia and the Caucasus; CDM works in countries where JI is not allowed.*
27. *Euroheat and Power (2004b).*
28. *Ekodoma (2003).*
29. *Additionality means that a JI or CDM project should result in a greenhouse gas emission reduction that is additional to any that would otherwise occur.*
30. *See UNFCCC Secretariat, http://unfccc.int.*

Although the Protocol can be expected to increase investment opportunities for district heating, signatories are likely to choose the least-cost options to comply with their targets. JI and CDM projects in transition economies will therefore compete for funds with JI and CDM projects in other countries. They will also compete with emission trading; emission trading projects tend to have lower transaction costs and provide greater flexibility. Potential investors will take into account all the barriers and risks associated with projects in different countries.

Recommendation

In order to attract investment though the Kyoto mechanisms, governments should improve their overall investment climate, as well as the regulatory and institutional framework related to climate change.

The International Community: the Wider Role

The international community cannot stand aside from transition economies' efforts to transform their district heating sectors because the environmental and energy security implications of these efforts are global. If transition economies manage to preserve their district heating systems and improve their efficiency, this would result in significant fuel savings and in greenhouse gas emission reductions. By raising cogeneration levels to those of Western Europe and improving the fuel mix in modernised plants, transition economies could save the equivalent of 80 bcm per year. This would reduce carbon dioxide emissions by about 350 Mtons annually.

The international community's role, however, is not limited to providing finance for investment in district heating infrastructure. As noted earlier, international financing can help develop successful demonstration projects that can be replicated. The international community can influence district heating's development in other ways too. The UNDP/GEF has carried out a study of lessons learned from non-UNDP/GEF heating projects in transition economies. This highlights that most heating projects implemented by different multilateral or bilateral actors have had some impact on all or several of the following areas:

- Influencing national strategic policy and mainstreaming global environmental objectives.
- Supporting institutional, legal and regulatory reforms.

- Capacity building.
- Leveraging financing for investment.[31]

International co-operation can help former Socialist countries build viable district heating policies and integrate them effectively in overall national policy agendas. That said, the existence of international assistance cannot replace effective national policy making. Well-structured international assistance can provide national governments with information on the advantages and disadvantages of policies, as well as suggestions for designing implementation strategies.

Over the last ten to fifteen years, the actions of international financial institutions, multilateral governmental organisations, non-governmental organisations (NGOs) and individual countries have directly and indirectly affected the development of district heating policy in transition economies, as the following examples demonstrate.

In the late 1990s, Kazakhstan had an active debate over its heating policy. Some argued in favour of replacing district heating with decentralised or individual heating systems. Kazakhstan's decision to preserve its existing district heating systems was largely based on the country's obligations under international agreements. The Energy Charter Treaty, signed in Lisbon in December 1994, together with the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (see Box 6.2), and the Ministerial Declaration adopted in June 1998 at the Fourth Ministerial Conference "Environment for Europe" in the Danish city of Aarhus (Århus), had a particular impact on Kazakhstan's heating policy.[32]

District heating policy in the Baltic states has many similarities with that of Denmark, probably because Denmark has been very active in promoting district heating in transition economies, particularly in the Baltic region. For instance, the Danish Board of District Heating actively disseminates information on district heating abroad. It publishes a quarterly magazine in English, Russian and Chinese, which is distributed in around 50 countries. The Danish Energy Authority (DEA, also known as the Danish Energy Agency) has implemented heat planning projects in several cities in Poland, Latvia and Estonia.[33] Although these projects were implemented in different ways, they all helped to raise awareness of energy planning issues and demonstrated that, in the right conditions, district heating has economic, social and environmental benefits. The projects contributed to developing regional and

31. *UNDP (2004).*
32. *Correspondence with S. Katyshev, KEGOC, Kazakhstan.*
33. *Danish Energy Authority, www.ens.dk and Danish Board of District Heating, www.dbdh.dk.*

Box 6.2

Abstracts from the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA)

Article 3 Basic Principles

Contracting Parties shall be guided by the following principles:

(1) Contracting Parties shall co-operate and, as appropriate, assist each other in developing and implementing energy efficiency policies, laws and regulations.

(2) Contracting Parties shall establish energy efficiency policies and appropriate legal and regulatory frameworks which promote, inter alia:

-efficient functioning of market mechanisms including market-oriented price formation and a fuller reflection of environmental costs and benefits;

Article 8 Domestic Programmes

(1) In order to achieve the policy aims formulated according to Article 5, each Contracting Party shall develop, implement and regularly update energy efficiency programmes best suited to its circumstances.

(2) These programmes may include activities such as the:

-support and promotion of cogeneration and of measures to increase the efficiency of district heat production and distribution systems to buildings and industry.

municipal heat strategies, and the energy planning methodology and criteria for prioritising investment projects. Lessons learned from these projects had an impact on national strategic policy decisions. The Polish Energy Law and the Lithuanian Heat Law, for instance, contain requirements for local energy planning.

In some other countries, international experts and consultants have contributed to the development of strategic policy decisions. For instance, Moldova's heat strategy and its draft heat law have been developed with the support of USAID.

International discussion of district heating policies and measures can help countries design effective policies by sharing information on lessons learned and best practices. This is why the IEA launched its district heating initiative in 2002. This initiative serves two goals: to raise awareness of district heating problems and opportunities at a high policy level, and to analyse the best

policy approaches to address the sector's challenges. The high-level participants at the conference on district heating policy that the IEA held in Prague in February 2004 acknowledged the importance of exchanging experiences between countries to build national policies.[34] This publication aims to stimulate further discussion. This discussion and exchange of experiences benefit not only to transition economies but also to many other OECD countries. Very few OECD countries have an explicit district heating policy today, yet the potential environmental, energy security and social benefits of district heating are well worth closer attention by policy makers.

OECD member countries can be important sources of encouragement and advice to transition economies. The U.K. government, for example, has funded a study on district heating policy in Russia and the U.K. Minister of Energy visited Russia to discuss district heating with the government and to participate in a U.K.-sponsored conference on energy efficiency. OECD member countries should include district heating in their bilateral energy discussions with transition countries.

Recommendation

District heating policy warrants broader discussion both internationally and bilaterally. The international community should highlight the social, economic and environmental importance of district heating more actively and work with governments in transition economies to integrate heat policy into wider energy policy.

Conclusions

Given the technical deterioration of many district heating systems in transition economies, large investments are necessary to improve their efficiency and service quality. Investments in district heating should take account of the need to balance supply and demand.

Commercial financing and private investment are playing an increasingly important role in some countries, notably in Central Europe and the Baltics. Some other countries still have a long way to go to make district heating attractive for private investors. Therefore, national and international support schemes still have an important role to play in the region. Policy makers should carefully design these schemes so as not to distort the market: the

34. *F. Vyrlan, Deputy Minister of Energy of Moldova, and other participants.*

schemes should stimulate and facilitate commercial financing, but not interfere with it.

National policies to make district heating more attractive for commercial financing include in particular: tariff policy aimed at cost recovery, a stable and predictable regulatory framework for district heating companies, legal mechanisms to enforce payment and an adequate framework for private-sector involvement.

The role of the international community is not limited to providing finance for investment in district heating infrastructure. International co-operation can help former Socialist countries build viable district heating policies and integrate them effectively in overall national policy agendas. Nonetheless, international assistance cannot replace effective national policy making.

OWNERSHIP AND MANAGEMENT

The two main challenges for district heating in transition economies are financing and competitiveness. These issues are closely linked to the ownership structure of a district heating company and its management. If a company is poorly managed and it fails to focus adequately on customers, the company's competitiveness and finances can be jeopardised. This chapter takes a closer look at the relationship between ownership, management and performance. This begins with a comparison of different forms of ownership (both private and public). The chapter then highlights issues to consider for enhancing private-sector participation in the industry.

Ownership and Management Structures[1]

● Transforming Ownership in District Heating

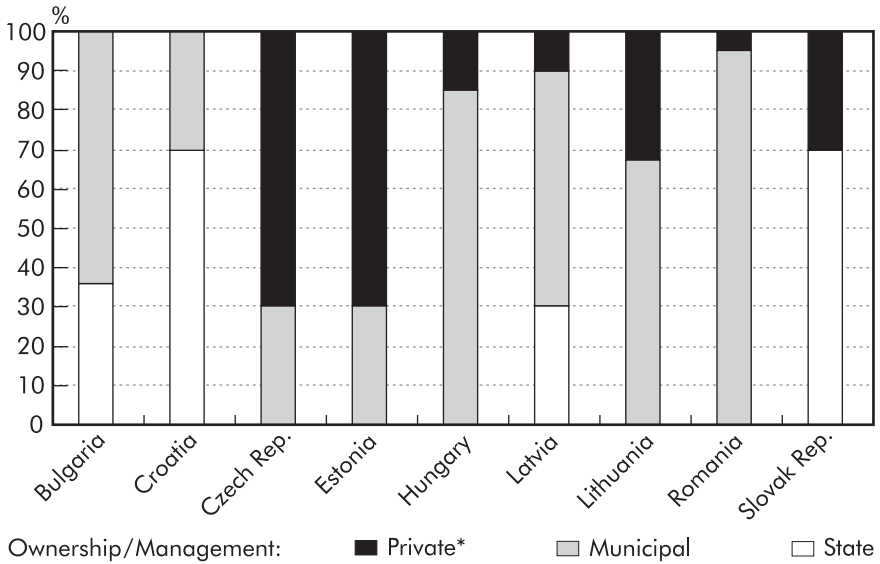
In centrally planned command-and-control economies, the state generally owned district heating, as well as other sectors of the economy. In most cases district heating was part of national state-owned electricity utilities; in some cases district heating networks were owned and operated directly by municipalities. Public ownership historically meant that the state or municipality had strong political control over the planning, investment and business decisions of the company. Significant changes in ownership and management of district heating systems have taken place over the last 15 years. Many utilities have been transferred to municipalities, and more recently the private sector has made significant inroads into the industry. Figure 7.1 shows the rough division of ownership structures in the district heating sector in selected transition economies.

It is interesting to note that this publication and other sources often use the term "private" to refer to companies that are not necessarily 100% private. Many active players on the district heating market in the region are owned partly or fully by a foreign state or a municipality. For example, MVV Energie AG, which operates district heating systems in several transition economies, is predominantly owned by the German city of Mannheim. Vattenfall AB, which has a presence on electricity and district heating markets in Sweden, Finland, Germany and Poland, is wholly owned by the Swedish government. Another operator, Steirische Fernwärme GmbH, is 75% owned by an Austrian region

1. *This section is largely based on Zeman and Werner (2004).*

Figure 7.1

Approximate Share of Private vs. Public Ownership and Management, Early 2000s



*Note: * Indicates district heating systems privatised or transferred to private management under leases or concession agreements. Source: Euroheat and Power (2003).*

(Steiermark). Such companies are often called private because they act as profit-making business entities. In this publication, involving the private sector therefore means transferring the operation, management or ownership of a district heating system from a municipal or state-owned company to another company (which is generally but not necessarily private).

Transforming district heating ownership and operating structures is still a work in progress in transition economies. (This is also true in Western Europe, where such restructuring is often linked to privatisation and liberalisation in the electricity and gas industries.) Some municipalities plan to sell district heating utilities to private investors, while others intend to preserve or even increase their control over these utilities. Most of the Commonwealth of Independent States (CIS) countries have been slower than the Baltics and Central Europe in attracting the private sector, so they have the highest potential for privatisation and other forms of private-sector involvement. Analysing the experience of other countries can provide important insights into the best decisions for restructuring district heating companies. Table 7.1 summarises the different forms of ownership and operation of district heating companies worldwide.

Table 7.1

Ownership and Operation of District Heating Companies

Public	Mixed Public-Private	Private
• State • Regional • Municipal • Other (consumer co-operatives, housing associations, etc.)	• Service contract • Management contract • Lease • Concession • Private minority shareholder • Private majority shareholder	• Generation of heat only • Both generation and transmission/distribution

Public Ownership

In several former Socialist countries, the state, regions or municipalities still own many district heating systems. Municipal ownership also remains common in some Western economies such as Denmark, Sweden or Germany, although private-sector participation is growing in these countries. In Russia, Ukraine and Belarus, municipalities own most district heating systems. In Slovakia, the state owns a large number of systems.[2] In Bulgaria, Sofia's district heating system is owned by the municipality and most other systems are state-owned.[3] In Denmark, municipalities own most district heating companies; in some cases, consumer co-operatives are part-owners as well. In Sweden, 60% of district heating systems are owned by the local municipalities, including the systems in Göteborg, Västerås, Linköping, Eskilstuna and Växjö; the rest, including Stockholm, are private or mixed.

Municipal district heating companies can be of two kinds: a municipal department or a separate commercial enterprise owned by the municipality (often called an incorporated company). In the first case, the risk of a conflict between the municipality's commercial and political interests is higher. In the second case, the district heating company acts more as an independent business, although the municipality as the owner may still exert some control over the company's business decisions (Chapter 4 considers the conflict of interest issue in more detail).

2. In 2001, Slovak district heating companies were restructured into joint-stock companies and open to partial privatisation.

3. Bulgaria has announced plans to privatise several district heating companies, including Toplofikatsia in Sofia.

- **Private Ownership**

  Some municipalities sell all their district heating assets to a private company, which becomes the full owner and has complete control over business decisions. One example is Lounské Tepelné Hospodářství which owns the heat utility in the Czech city of Louny. In Kazakhstan, 45% of cogeneration and connected district heating systems are private and another 35% are joint-stock companies with mixed ownership.[4]

  In many cases, only the generation assets are transferred to a private company, while the heat transmission and distribution networks remain in public hands. For example, Vattenfall has bought the cogeneration company in Poland's capital, Warsaw, while the municipality owns the distribution company, SPEC.

  In the case of full private ownership of district heating systems, public institutions usually cannot influence the private companies' management and investment decisions, but they still have a certain degree of control over them through tariff regulation, energy planning, environmental and service quality standards and other regulatory requirements. To preserve a higher degree of control, many municipalities prefer to keep a share in the local district heating company or to use other forms of public-private partnership.

- **Multi-utilities**

  A district heating utility can be part of a multi-utility that provides a range of municipal services. Multi-utilities can be both public and private. A typical example of a public multi-utility is a German or Austrian municipal *Stadtwerke* which provides electricity, natural gas, district heating and water, in addition to other services such as transportation, waste management and street lighting. In Russia and Ukraine, housing and communal services companies are also multi-utilities. The Russian private operator RKS (see Box 7.2) can be considered a multi-utility as it provides electricity, gas, heat and water supply. The U.S. and the U.K., which have competitive markets, also have private diversified power-heat, gas-power, or water-power utilities. An advantage of multi-utilities is the potential synergy of integrated investments. One disadvantage may be the lack of incentive to improve efficiency in the absence of competitive pressure.[5] In addition, multi-utilities

4. *Doroshin (2004).*
5. *Meyer and Mostert (2000).*

can reduce the extent of heat source competition by limiting the services and companies that consumers can pick from: a multi-utility rarely wants to compete against itself to provide district heating versus gas to a household.

● Public-Private Partnership

Service Contract

Heat utilities worldwide make considerable use of service contracts (or outsourcing) to delegate specific tasks such as studies, construction, billing, collection, repairs or operation and maintenance of networks, to a private company. Parties sign contracts for a specified period of time, usually from one to five years, depending on the nature of the service.

Management Contract

In a management contract, a private company manages and operates the entire district heating system and is paid for the services performed. Similar to the service contract, there is neither ownership change nor capital investment from the private company, although depending on the contract details, the private operator may have to cover small-scale repair and rehabilitation costs. Management contracts are generally medium term. In Sweden, for instance, the municipal company Borås Energy owns the district heating system in Borås, while another company Fortum Service operates and maintains the system according to a contract.

Leasing

Under a lease, the public entity continues to own the district heating system and a private company acquires the exclusive right to operate specific assets such as cogeneration plants, boilers, pipes, heat exchangers and meters, for a specific, generally long period (10-30 years). The lessee is responsible for operation, maintenance and repairs; it sells the heat, manages the cash flow and assumes the company's commercial risks, but the responsibility for new investments and capital expenditure during the period of the lease remains with the owner/lessor. Under a typical leasing agreement, the lessee pays a set amount of rent to the public owner and gets the revenue from heat sales until the lease expires. The leasing agreement does not generally include provisions on setting heat tariffs or service quality standards. Separate contractual documents need to be signed for this.

Private operators have leased numerous district heating utilities in the Baltic States, the Czech Republic, Poland, Hungary and other countries. For instance, the French operator Thion leases heat generation and distribution assets in the Polish city of Kalisz and lease payments are used for investment

in the system's modernisation. The Ukrainian utility Gas-Heat, created in April 2003 as a subsidiary of the national gas company Naftogas, obtained a lease for the heat supply system in the town of Armyansk (Crimea) and signed management contracts with numerous district heating plants in other cities.

Concession Agreements

Concession agreements involve more risk for the private operator than leasing. Similar to leasing, a concession agreement allows a private company to buy the exclusive right to operate a district heating system for a fixed, usually long, period. The major difference is that the contractor has the responsibility for all new investments during the concession period, including system upgrades, rehabilitation, and replacement of assets, as specified in the contractual agreement. At the end of the concession agreement, all old and new assets are returned to the owner. Concession agreements usually contain detailed agreements on the end-user tariff structure, the operator's obligations regarding technical improvements to the system and the level of service quality, as well as other provisions. Concession agreements are widely used in communal services in Western Europe, especially in France. There are examples of concession agreements in Central and Eastern Europe and the Baltics. For instance, the French company Dalkia International operates district heating networks in ten Lithuanian cities (including Vilnius) under concession agreements.

The terms leasing and concession are sometimes used interchangeably. This is because all concession agreements include a lease arrangement for use of the assets as well as other contractual agreements. A concession agreement should also not be confused with a licence to provide services in a specific geographic area.

Build-operate-transfer (BOT) and Build-own-operate (BOO) Contracts

Build-operate-transfer (BOT) or build-own-operate (BOO) contracts are similar to concession agreements but they are signed when new generation assets or networks need to be built. These contracts shift the responsibility for financing, building and operating facilities from the public authorities to the private sector. In a contract of the BOT type, the contractor operates the assets that it builds during the contract period and transfers them to the public entity when the contract is over. In the BOO type of agreement, the company retains the ownership of assets it has financed and operated under the contract.

Private Equity Participation

Private equity participation (also called privatisation or capital opening) means that a public company divides its total value into equity shares, each share representing a unit of ownership, and sells a majority or minority stake in these shares to investors.[6] Even though a company opens its capital, it may not necessarily become 100% privately owned. Many district heating companies in Central Europe and the Baltics have sold part of their equity. In the Czech Republic, for instance, private investors control the majority of shares in the Prague, Brno and Ostrava district heating companies, and minority shares in the Plzeň utility. In Slovakia, six major state-owned district heating utilities in Bratislava, Trnava, Zvolen, Martin, Žilina and Košice are scheduled to be privatised in 2004, and private investors will be offered a majority interest in generation and distribution assets.[7] Legislation in some countries such as Hungary requires that a majority stake in each utility remain in public hands.

Privatisation can occur in two ways: selling shares through the stock market (like in the Wroclaw district heating system in Poland) or to a strategic investor. In the first model, one or more private partners select the public district heating company; in the second model, the roles are reversed and the public company selects its private partner(s). The second case may be preferable if the public authority wants not only to acquire capital through the sale of equity, but also to tap a strategic investor's management and operation skills. District heating systems in transition economies are usually privatised to strategic investors. In Western countries, privatisation also takes place through equity sales on the stock market. For instance, in March 1999, the German municipality of Mannheim launched an initial public offering of its utility MVV Energie and sold 25% of its shares to stock market investors.[8] Today MVV Energie operates district heating systems in many countries.

Recommendation

When restructuring the district heating sector, public authorities should keep in mind that there is a variety of ways to involve the private sector: from short-term service contracts to complete privatisation of district heating assets. Even if they choose to preserve the public ownership of district heating assets, they should consider transferring certain management/operation tasks to private companies to improve system efficiency and service quality.

6. *As mentioned earlier, companies that acquire equity shares are not necessarily private.*
7. *Zeman and Werner (2004).*
8. *An initial public offering is when a company's owners place shares in the company on the stock market for the first time. The Mannheim municipality later reduced its ownership share further to 72.8%.*

Criteria for Making an Effective Choice

The DHCAN ownership guide concludes that there is no single recommendation on the best ownership/management structure: "In the CEE (Central and Eastern Europe) countries, there are common examples where the privatised district heating utility is well managed and provides better service quality for a competitive price than the original publicly owned utility. There have also been some cases where the private investor had only short-term interests and the quality of service and utility performance were lower than in other publicly-owned utilities."[9]

Box 7.1 illustrates the point that a utility's performance depends not so much on ownership structure as on the company's management approach and business culture. The box describes two examples of successfully operated district heating utilities. One remained under municipal ownership, and the other is operated by a foreign company under a concession agreement.

Although private or predominantly private companies have some common aspects that distinguish them from public or primarily public ones, much depends on factors other than ownership. In identifying the best approach to restructuring district heating companies (with or without private-sector participation), public authorities should take into account several relevant factors considered below.

- **Cost-effectiveness and Service Quality**

The experience of different economic sectors around the world suggests that private companies generally provide better product or service quality at a lower cost than public companies. This is probably the reason why private-sector participation in electricity, gas, heat and water utilities is growing worldwide. The private sector in general is under greater internal and external pressure to increase its return on investment. It therefore has a greater incentive and better skills for improving system efficiency and competitiveness. The public sector is generally under less pressure to improve competitiveness and gain market share, but this is not always the case: the state-owned Vattenfall is facing increased pressure from the Swedish government to improve its return on investment.

According to the ownership guide prepared under the District Heating in Candidate Countries Promotional Programme (DHCAN), public-sector ownership in transition economies often brings higher prices and lower

9. *Zeman and Werner (2004).*

Box 7.1

Two Success Stories: Public and Private

Debrecen Case Study. The municipally owned district heating company in Debrecen, Hungary started its restructuring in the early 1990s and underwent another reconstruction in 1999. The company's managers worked closely with the municipality and the city council in its significant efforts to reduce costs and improve the quality of district heating. Measures taken include implementing a cost monitoring system, installing meters, raising customer awareness, introducing customer care, developing a marketing campaign, decreasing the number of employees and optimising staff work. These and other measures resulted in improved energy efficiency and lower costs, greater customer satisfaction, reduced non-payment rates (under 4%) and a 16.5% growth in market share over three years. The company's tariffs grew only by 2.8% per year from 2000 to 2003 (below the average inflation level).

Vilnius Case Study. The municipal government of the Lithuanian capital Vilnius signed a concession agreement with the French operator Dalkia International in 2002. In compliance with this agreement, Dalkia has made extensive investments in the network and reduced the heat tariff for households by 5%. The company has successfully introduced a management strategy focused on customer satisfaction (although about 75% of its staff are former employees of the old municipal district heating company). Better management, direct contact with clients and modernisation of networks has improved service quality, and the non-payment rate has stabilised at only 1-2%. The disconnections have stopped; moreover, the company now attracts new connections of 2% per year.

Sources: DHCAN (2003); Interview with Jean Sacreste, Director for Lithuania, Dalkia.

service quality. In particular, interrupting heat supply for several weeks each summer is still more common with publicly owned utilities than private ones in Central and Eastern Europe. The Alliance to Save Energy, which has investigated ownership changes in the district heating sector in Poland and other transition economies, concludes that "Polish heating companies with PSP (private sector participation) have been more successful than non-PSP suppliers in reducing prices to consumers while still covering operation costs".[10] Experience in some other Central European and Baltic countries confirms this trend. For instance, the French operator Dalkia improved service quality and decreased final consumer prices in some Lithuanian cities

10. *Morin (2003).*

(e.g. by 5% in Vilnius) as a result of significant cost improvements. However, in Sweden, heat tariffs in private district heating utilities were until recently slightly higher than in public utilities.[11]

- **Access to Financing**

  Given the significant investment needs of many district heating systems, a company's balance sheet and credit rating, as well as its knowledge of financing techniques and options, are more important than its form of ownership. Private companies usually have easier access to commercial financing, but many national and international support programmes are designed to provide loans or grants to public companies on favourable terms (see Chapter 6).

- **Decision Making and Public Benefits**

  Decision making in private companies is market-driven, so private companies are generally more flexible and can adapt more easily to a changing market environment. However, the interests of the utility as a business entity do not always correspond with public interests such as social welfare, employment and environmental protection. Public authorities tend to interfere in business decisions of utilities they own in order to "protect" these public interests. Such political interference may, at best, make implementing a rational public policy easier (e.g. promoting clean energy sources or investment in demand-side management). That is the case in Debrecen, Hungary, where the municipal district heating company made a strategic decision to operate in an environmentally friendly way. This decision led to a number of new measures, including use of waste heat and biogas, and an active, demand-side energy saving campaign.[12]

  Protecting public interests, however, may lead municipal or state companies to uneconomic decisions, for example overstaffing to help reduce local unemployment. If policy makers such as city councillors take key business decisions when they are not very familiar with the economic, technical and commercial aspects of running a district heating utility, this can undermine a company's finances and competitiveness. A decision making process which involves local or regional authorities can be very bureaucratic and time-consuming, which is a drawback in a market environment that requires rapid reaction.

---

11. *Higher prices at private utilities can be partly explained by the fact that many private companies own not only district heating distribution networks, but also cogeneration plants, and taxation of cogeneration plants was not favourable to district heating until January 2004. Also, many cogeneration plants use fossil fuels that are heavily taxed.*
12. *DHCAN (2003).*

Some municipal or state-owned companies are environmentally aware and undertake environmental initiatives, but this does not always happen without strong regulation. Ten to fifteen years ago, publicly owned district heating systems were extremely polluting by Western standards, and many still are. Private-sector participation generally leads to more modern and environmentally friendly technologies. The Alliance to Save Energy concludes that in Poland, "private sector involvement enhanced and in many cases introduced energy management and enabled the transfer of high-efficiency, pollution control technology and shifts to cleaner fuels."[13] Poland today is 40% more energy-efficient on average than in the early 1990s, when the private sector had just started participating in district heating. That said, strong environmental regulation encourages both public and private companies to improve their environmental performance.

- **Size**

The size of a district heating company is also very important for performance. Larger companies make better use of economies of scale. For example, a big company operating in several cities can purchase large volumes of fuel and negotiate advantageous prices. If it is financially sound, it has more internal capital than a small company so it can finance larger projects, either directly or with loans. Its asset base enables it to provide better collateral, so it can take out loans on better terms. If a project fails, the company may remain financially stable because of its revenue from other activities. A project failure may bankrupt a small company. On the other hand, if a company is too big, its management may become too bureaucratic, which can reduce its effectiveness.

- **Local or Foreign Ownership**

When a district heating operator is foreign, its form of ownership – public or private – is less important as it is not directly involved in the political decisions of the host country, region or municipality. Foreign companies that operate in transition economies may have advantages over domestic ones. They can bring experience with state-of-the-art technologies, and better commercial and management skills because of greater experience operating in a market environment. Foreign companies can often gain access to international loans with lower interest rates. On the other hand, foreign operators can have a disadvantage because of their lack of knowledge of local conditions and laws.

---

13. Morin (2003).

Market Structure

Market structure is another important factor for a company's performance. If there is competition from other heat sources, a district heating company (either public or private) is under pressure to reduce costs and improve service quality. Conversely, if a company has a monopolistic position, these pressures do not exist and it may not have incentives to improve. In this respect, a private monopoly can perform as poorly as a public monopoly. Strong anti-monopoly legislation and enforcement can further strengthen the performance incentives, even in a competitive heat market. In Sweden, for example, the Ministry of Industry, Employment and Communication, the Swedish Competition Authority, and the Swedish Energy Agency monitor the application of the Competition Act. This act gives the authorities power to intervene on markets that are not functioning effectively, for example if there is an abuse of dominant position.

Public/Private Approaches: Lessons Learned

Private ownership or operation of the district heating industry often brings greater efficiency and provides better service quality in transition economies because it separates management decisions from political considerations. This separation can and should also occur in public utilities. Where there is separation of management from politics, there is no reason why a publicly owned utility should not act like a market-oriented, commercial company. The most important factor in a company's effectiveness is not its ownership, but its business culture and access to financing, which depend to a certain extent on the company's size and nationality. The conditions under which the utility operates (market structure and the legal and regulatory framework) are even more important for its efficiency and service quality.

Both private and public ownership of district heating systems can be successful. In many cases, the most effective solution is a well-organised partnership between the public and private sectors because it combines the advantages of both approaches. Public-private partnership can be particularly attractive where laws prohibit privatisation or do not adequately support it (though of course, changing the laws is also an option). Many private operators share the view that full privatisation is not always desirable, and that a long-term partnership with public authorities may be a better solution.[14] Contracts for delegated services, leases or concession agreements may be advantageous for all parties: the local authority, the private operator

14. *Greim (2004); Matthies and Thielemans (2003); (representing views from Dalkia and MVV, respectively).*

and consumers. In an effectively implemented private-public agreement, the public authority, as the owner of assets, determines the utility's long-term strategy and ensures that the operator's contractual obligations respect public interests. The private operator brings its technical, managerial and commercial skills and manages the system for maximum profitability, while meeting predetermined obligations. Heat supply becomes consumer-oriented and service quality improves. Examples of successful private-public partnerships are plentiful. About 12 Slovak cities have created joint ventures with the Austrian company Steirische Fernwärme GmbH: the municipalities provide the district heating assets, and Fernwärme contributes capital and expertise. Both citizens and municipalities are reportedly pleased with these joint ventures, which have led to system-wide modernisation and better service quality with very modest tariff increases.[15]

Recommendation

In restructuring public district heating utilities, relevant authorities should consider different ownership and management options, taking into account factors such as business culture, financial health, size and nationality of the actual and potential future owners and operators. If they decide to preserve public ownership, it is essential to separate business decisions at the utility from political considerations. Regardless of the approach (with or without private-sector participation), national and local governments should create conditions for improving the efficiency and service quality of district heating, and for protecting public interests.

After the Choice: Making New Ownership and Management Structures Successful

- **Ownership and Management Approaches: Experience to Date**

  The private sector only began to enter the district heating market in the former Socialist countries some 10-15 years ago, so it is too early to make a clear assessment of its impact on district heating systems and their long-term sustainability. There have been several studies in this area, including the ownership guide prepared under the DHCAN project and an ongoing study of private-sector participation by the Alliance to Save Energy, but they tend to focus on anecdotal evidence rather than broader economic and price impacts.

15. *PADCO (2002).*

Obtaining an unbiased analysis of private-sector participation is a challenge: as a rule, only successful cases are described in industry publications, the press and at conferences and workshops. Since private companies operate in a competitive environment and their positive image is important for winning potential markets, they are understandably unwilling to disclose unsuccessful cases, should they occur. If involving the private sector ends in failure, both the municipality and the company involved are usually reluctant to discuss it publicly. They may agree to discuss the case only if the names of the company and city are not mentioned.[16] The same is true of unsuccessful public ownership. Our references in this publication to unsuccessful cases are therefore usually anonymous.

Successful private-sector involvement means that private equity participation or other forms of public-private partnership has had a positive effect in terms of improved system management and better customer service. Successful public ownership means that a public company has achieved the same positive results without private-sector participation. Failure of private-sector participation can be of two kinds. Public authorities may half-heartedly try to attract private companies. In Moldova, for example, authorities have offered minority and even majority shares in many district heating companies to private investors, but these offers were not taken up because of the low value of the companies and high investment risk.[17] A variant on this kind of failure is the withdrawal of a private investor from a privatised company or concession deal. This happened, for example, in Kazakhstan, where a number of foreign investors left the country because of the corruption, political interference in companies' business and lack of willingness to raise tariffs as agreed.[18] In the second type of failure, service contracting, concession agreement or private equity participation takes place, but it performs very poorly because of corruption, asset stripping, poorer service quality and other problems.

To avoid failure of the first type, governments need to establish a favourable investment climate and attractive business conditions for district heating. The second type of failure can be avoided through increased transparency in the award of initial private-sector contracts and clear policy, legal and regulatory frameworks for involving the private sector in public services. This section looks at conditions for success in more detail.

Experience in involving the private sector varies significantly among countries. In Central Europe and the Baltics, private-sector participation is

16. *Interviews with stakeholders; EGI Contracting/Engineering (2002).*

17. *Kalkum and Rajkiewicz (2002).*

18. *In particular, the Belgian company Tractebel SA sold Almaty Power Consolidated and other facilities back to the government and left the Kazakhstan power market in May 2000.*

more often successful, while in South East Europe and some CIS countries both kinds of failure occur. It should be noted that there are also numerous examples of unsuccessful public ownership across the region. Corruption and abuse occur in some public companies where municipal officials sign inflated contracts for services to siphon off value. There have also been cases where a public heating company is on the edge of bankruptcy, but its managers earn huge salaries and drive luxury cars.[19] Many other managers of public companies are not necessarily corrupt, but simply lack managerial and commercial experience, so the system functions poorly.

● National and Local Policy: Long-term Perspective

Decisions about allowing the private sector into district heating systems are generally made at the local level and depend on the political preferences at this level. However, they are also influenced by the national policy framework and development of the wider energy market. If national policy leans toward competition (for example between heat sources), competitive pressure will force public companies to improve their effectiveness or to seek out partnerships with the private sector. Under these conditions, private-sector participation will likely grow, so measures should be taken to ensure transparency in the process. If a country chooses a less competitive approach that does not promote private sector involvement, even as an interim policy, it should create incentives for public companies to improve their performance, reduce costs and focus on customers.

The Alliance to Save Energy (ASE) concludes that a clear policy framework should be established before introducing the private sector into district heating.[20] Many privatisation projects took place in the early years of transition, when policy, regulatory and legal frameworks were weak and unstable. It is not surprising that some of these projects were relatively unsuccessful. A clear national policy, regulatory and legal framework for private-sector participation in energy services can significantly reduce the risk of failure.

A well-defined, transparent ownership and operation policy for district heating is therefore needed. It should be based on a clearly defined local energy policy that is co-ordinated with regional and national policy in order to avoid potential future conflicts.[21] A long view must be taken because the

19. *Discussions with participants of the IEA Conference on* District Heating Policy in Transition Economies, *February 2004, Prague.*

20. *Countries under study: Poland, the Czech Republic, Hungary, Lithuania, Moldova, Macedonia and Albania. Source: Morin (2004).*

21. *EGI Contracting/Engineering (2002).*

timeframe of concession agreements or operating contracts is generally much longer than the mandate of the municipal council or the mayor approving the agreement, and privatisation is normally permanent.

Given this, privatisation should not be carried out as an act of desperation. ASE reports that some municipal councils and mayors in Central Europe have sold district heating assets because they wanted to get rid of the burden of managing and operating heat networks or because they urgently needed capital and decided to raise it by selling communal assets. In some cases, privatisation led to asset stripping, decreases in service quality and price increases. This led municipalities to try to buy back their stakes but in some cases the assets could not be returned.[22] From a long-term perspective, it might have been more reasonable to keep an ownership stake, or to preserve full public ownership and delegate operation to a private operator under a management, leasing or concession contract. This does not mean that full-scale privatisation can never be successful: it can be a complete success if it is implemented thoughtfully, openly and transparently, which can only happen with a clear supporting policy, regulatory and institutional framework.

● Legal and Regulatory Framework

To make district heating attractive for the private sector and simultaneously to enhance the efficiency of public utilities, several conditions are necessary:

- Clear and stable regulatory policy defining fair market rules for district heating and other heat sources: if regulation changes every year, there is no security for investors, yet investments in district heating and cogeneration are capital-intensive and long-term.
- An efficient policy, legal and regulatory base for private-sector involvement: if legislation restricts privatisation, then policy makers should facilitate concessions, leasing and management contracting, or seek to change the laws.
- Well-designed tariff regulation: if tariffs are regulated, the regulation should allow cost recovery and a certain level of profit. To attract investment, communal services operations must be able to generate a positive cash flow. Introducing tariff formulas can avoid the need for frequent tariff change approvals.
- Regulation allowing district heating companies to use enforcement measures in case of non-payment.
- Clear rules and rapid procedures for approving licences.

22. *Morin (2004).*

Clear legal documentation is critical. A specific problem that hinders private-sector involvement in some countries is the lack of legal documentation proving that municipalities own the assets and can therefore carry out transactions based on this ownership (such as leases or concession agreements). In Russia, for example, although municipalities own district heating and other communal assets, they do not always have a legal proof of this because the legal registration of ownership is a time-consuming and costly process. Box 7.2 gives an example of the problems such legal confusion can create. It has been one of the main barriers in Russia to investment in district heating and other communal services.

- **Transparency and Stakeholders' Interests**

Transparency is critical in helping to avoid potential problems with corruption and asset stripping leading to a deterioration of service quality. In particular, the processes of privatisation and delegation of operational control must be managed transparently. The private owner/operator should be chosen in an open tender procedure, and selection should be based on predetermined and pre-announced criteria. These criteria should include factors such as the financial and technical credibility of the bidders and their experience in running similar systems.

Effective dialogue and co-operation between all the relevant stakeholders is important whatever the route taken. Given that district heating is an integral part of communal infrastructure and has high social importance, there should be co-operation between industry, local authorities and consumers, even where district heating has been fully privatised. Involving consumers is particularly important. Negotiating with consumer representatives and carrying out opinion surveys can help district heating companies to identify better ways of dealing with market problems. Performance can only improve as a result. Public authorities should also be involved in this dialogue.

The issue of staff lay-offs during restructuring can raise problems. In some cases, private-sector participation runs into difficulty because the potential private investor and the public administrator do not agree on the issue of downsizing utility personnel. Driven by the pressure to decrease costs, private owners and operators may seek to reduce staff at the utility. This may create social tensions, particularly when the lay-offs are significant. Public authorities therefore often force the companies to maintain jobs, even if it is not economic. For example, a Polish district heating company in the town of Elk agreed with the municipality to postpone staff dismissals for several years. Another Polish company, Kalisz Heat Enterprise, retained the utility's

Box 7.2

Russian Communal Systems (RKS)

Russian Communal Systems (RKS) was founded in May 2003 by the electricity company RAO UES and Gazprombank (the bank of the state gas monopoly Gazprom) with 25% of the shares each, and five other shareholders with 10% shares each.[23] Today, RKS operates electricity, gas, heat and water supply systems in about 30 cities through its 23 regional subsidiaries, and it is negotiating contracts with many other cities. The main business objectives of RKS are to reduce costs and improve payment discipline. In particular, RKS plans to reduce heat production costs by 10%, by optimising the operation of heat-only boilers. It plans to achieve a 95% collection rate (up from 54% prior to its arrival). In the first quarter of 2004, RKS consumers paid 88.6% of their heat bills, according to the company.

In the first year, RKS signed initial rent contracts with municipalities for 11 months, and planned to sign long-term contracts (up to 49 years) for the second stage. However, the municipalities failed to register their legal ownership rights on communal services infrastructure before the end of the initial contract. This was an obstacle to further long-term contracts and investment.

In May 2004, RKS announced its new business model (the-so-called "municipal request"), which is very similar to a concession scheme. In brief, this model means that the local authorities determine the quality standards of communal services and the investment requirements over a certain period; RKS makes the necessary investments in system modernisation and rehabilitation, operates the systems and collects payments. RKS has reportedly had meetings with representatives of several foreign companies to study their experience and the possibility of co-operation.

Attitudes toward RKS in Russia vary. Some believe that a private operator is just what is needed to attract investment and pull the country's communal services out of crisis. Opponents believe that allowing such an operator into communal services will lead to an abuse of monopoly power, tariff increases, and a collapse of the infrastructure over the long term. Importantly, municipalities sign contracts with RKS without going out to competitive bid, which means it is impossible to know if the transactions are really the best options. Such an approach also limits transparency.[24]

23. Gasprombank sold its shares in April 2004, according to the press announcements.

24. Russian Communal Systems (RKS), www.roscomsys.ru and Regnum Information Agency, www.regnum.ru.

employees and phased them into new jobs in an energy service company that it created. Retaining unnecessary staff drives up costs and hence prices so it should be avoided, if possible, both in public and private companies. Reducing staff can have a positive effect on the company's performance. The municipal district heating company in the city of Debrecen in Hungary, for instance, reduced its personnel from 348 to 101 in the process of restructuring, which significantly improved its cost-effectiveness.[25] An adequate social policy should be in place to deal with problems related to lay-offs.

- **Careful Contract Negotiation**

In involving the private sector, policy makers and district heating companies should pay careful attention to contracts. Asset sales or concession agreements should clearly define the responsibilities and commitments of each party in accordance with the policy objectives. Contracts should contain provisions on:

- Financing, maintenance, repair and modernisation of existing assets.
- Financing and ownership of new assets (including reconstruction, new development, extension of the grid and connection of new customers).
- Tariffs and payment collection.
- Performance specifications for operation and maintenance.
- Service quality and customer satisfaction.
- Connection, disconnection and upgrade.
- Areas of co-operation with the municipality.
- Environmental protection.
- Sustainability and planning strategies.
- Asset warranties.
- Exit strategy – especially in the case of poor operator performance, with details on who would take over, by when and under what conditions the operational and ownership rights would be transferred.[26]

25. *DHCAN (2003).*
26. *Zeman and Werner (2004).*

Recommendation

Local governments should establish a transparent policy regarding utility ownership and management in conformity with national policy and legislation. It is important and beneficial to involve consumers and other stakeholders in the discussion of policy approaches. National policy makers need to set up a clear legal and regulatory framework for attracting the private sector in public utilities. Owners of district heating assets should carefully negotiate contracts for assets sales, leases or concession agreements with private parties, taking into consideration long-term public interests.

Conclusions

Both private and public owners of district heating systems can be very successful if they act as commercial, market-oriented business entities not tied up by political considerations. The most important factor that predetermines a company's effectiveness is therefore not its ownership, but its business culture and access to financing, which depend to a certain extent on the company's size and local versus foreign status. The conditions under which the utility operates (market structure and the legal and regulatory framework) are even more important for stimulating its efficiency and service quality.

That said, the evidence so far demonstrates that the private sector can resolve key district heating problems in transition economies by attracting financing and improving the systems' performance and competitiveness. To make district heating attractive for the private sector, several conditions are necessary, including clear and stable regulatory policy, tariffs covering costs and improved payment discipline.

Transforming utility ownership should happen within a clearly defined national and local policy framework. Any changes in ownership or managerial structure should take the long-term perspective into account, given that district heating utilities involve large, long-term investments. If restructuring involves a private company, this should be through an open tender procedure with clearly stated objectives, criteria and responsibilities. The choice of the private investor should take into account the managerial experience of the investor, its financial strength and credibility as well as the concrete terms of privatisation or contracting arrangements.[27]

27. Zeman and Werner (2004).

COGENERATION AND ENERGY EFFICIENCY

Technology is important to the future of district heating. District heating is appealing because of the environmental and economic benefits of efficient heat generation and cogeneration (also called combined heat and power, or CHP). This chapter focuses on tapping these benefits through policies to promote cogeneration and energy efficiency. This is not to suggest that they are the only two technology strategies for tapping the benefits of district heating. Expanded use of industrial waste heat and heat from renewable energy can also play a role in reducing emissions and enhancing energy security. The decision to focus on cogeneration and energy efficiency is because they are the most prevalent technologies, with the largest range of applications in most countries. That said, in some areas, like the Baltics, renewable energy can play a prominent role; the same is true for industrial waste heat in industrial cities of the former Soviet Union.

Both better regulation and competition can promote energy efficiency and more extensive use of cogeneration, but regulation and markets are not perfect. District heating companies need to recover investments in existing generation assets, which often have long lifetimes, so new technologies will tend to enter the market slowly. Specific policies to promote cogeneration and energy efficiency can help speed up the process. Climate change and international climate agreements play an important role in shaping domestic energy policy, including policies for cogeneration and energy efficiency (see Box 8.1 as well as Box 6.1 in Chapter 6).

Cogeneration

- **Current and Future Role**

Cogeneration is an essential reason why policy makers are attracted to district heating. District heating provides the demand for the heat produced in cogeneration plants. In many Western countries, one of the challenges of expanding cogeneration is finding a market for the heat. Figure 8.1 shows that cogeneration's share in district heating is generally higher in Western Europe than in most transition economies, while the share of electricity production from cogeneration varies among countries. In other words, heat production and demand are the main difference in cogeneration between countries, not electricity production. Growth in district heating will have a large impact on

Box 8.1

Climate Change as a Policy Driver

Cogeneration and energy efficiency can both have a positive impact on the environment and climate by reducing emissions. At the international level, three agreements have the most influence on climate policy in transition economies. The first is the UN Framework Convention on Climate Change (UNFCCC), which almost all transition economies have ratified. The UNFCCC was agreed to in 1992. It provides a framework for limiting emissions by establishing a base year (usually 1990) and requiring annual emission inventories, among other things. The second agreement is the Kyoto Protocol under the UNFCCC. Most transition economies have signed the Protocol, but not all have ratified it and the Protocol will not enter into force unless it is ratified by Russia or the U.S. The Protocol sets specific limits for greenhouse gas emissions in each country compared to the base year. Because of emission reductions since then, most transition economies have excess emission allowances that they can sell to other countries. These potential sales would give them an incentive to reduce emissions domestically. The third agreement is the EU Directive on Emission Trading, which sets up an Emission Trading Scheme (ETS) within the EU. The ETS is compatible with the Kyoto allocation system for emission trading. Allocations under the directive are typically more restrictive for transition economies than those under Kyoto. Thus, the directive puts additional pressure on the new EU members to reduce greenhouse gas emissions.

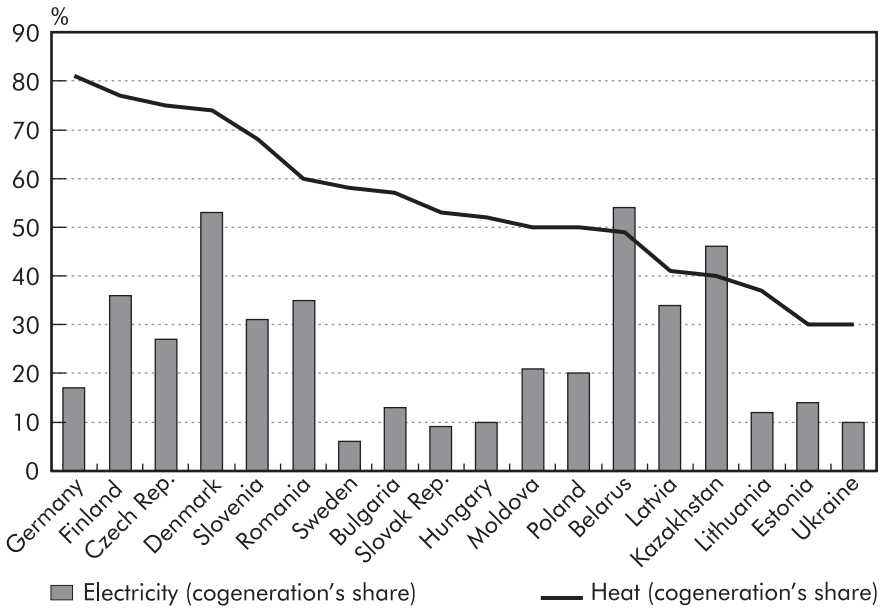
the potential for cogeneration in Western Europe. In transition economies, on the other hand, these district heating networks and a market for the heat already exist. Yet only about half of district heating comes from cogeneration on average in transition economies. Cogeneration rates tend to be even lower in the former Soviet Union than in Central Europe because many district heating systems in the former Soviet Union rely on heat-only boilers for their heat supply. Such arrangements are not economically optimal, particularly when there are condensing power plants that have unused waste heat nearby. This creates a significant opportunity for cogeneration.

The IEA's World Energy Outlook projects under its reference scenario that cogeneration will grow faster in new EU member states and accession countries than in the former Soviet Union.[1] Growth will be particularly important for cogeneration based on biomass and natural gas, the former because of new renewable energy requirements in EU member states. The

1. *IEA (2004, forthcoming).*

Figure 8.1

Cogeneration of Heat and Power in Selected Countries, 2001



Sources: IEA Statistics and other sources.[2]

Notes: These data refer to electricity and heat sold to third parties; they do not include electricity and heat produced by industry, commercial and public services, households and others for their own use. In other words, the heat data show heat production for district heating.

alternative scenario shows a higher share of cogeneration than the reference scenario because it assumes more aggressive policy measures to promote cogeneration.

● Environmental Benefits

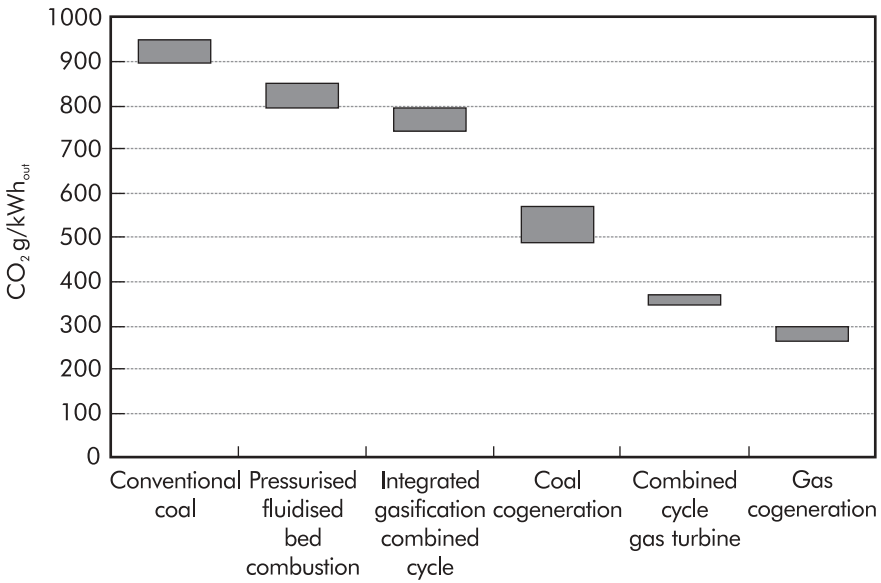
The environmental benefits of cogeneration are significant because cogeneration is much more efficient than separate production of power and heat. In traditional condensing power plants, the steam produced to generate electricity is condensed (in short, wasted) after it spins the steam turbines. With cogeneration, the remaining steam is extracted after it emerges from the turbines and used for district heating or industrial processes. In addition,

2. *The data in Figure 8.1 rely on a number of sources to ensure as much accuracy as possible because data tend to vary significantly depending on the source and methodology. Many governments do not collect statistics in a way that allows them to record cogeneration easily and consistently; they should be encouraged to improve their cogeneration statistics to provide a sound basis for policy making.*

cogeneration plants tend to be located near energy consumers to limit heat losses, while condensing power plants can be located much further from customers. This proximity reduces power transmission losses, further increasing the efficiency of the whole process. When the process is more efficient, emissions are lower. Another factor that helps make cogeneration more environmentally friendly than heat-only plants is that cogeneration plants tend to have better environmental controls than most heat-only boilers. On the other hand, because cogeneration has to be near energy users, the emissions are closer to large populations, but this is partly offset by the greater efficiency and the fact that the emissions for heat production are local anyway. Figure 8.2 shows average carbon dioxide emissions for various power technologies.

Figure 8.2

Carbon Dioxide Emissions from Fossil-based Power Production



Source: Based on IEA (2004, forthcoming).

● Conditions for Expanding Cogeneration

Cogeneration can only expand if conditions are right. Demand for heat and power should be growing or, alternatively, there should be opportunities for investments to replace existing facilities. For example, existing heat-only boilers and condensing power plants may need replacement or existing

plants may be more expensive to operate than cogeneration. When there is excess power capacity, as in much of Europe, cogeneration will face stiff competition. In European countries that have liberalised their power markets, this means that cogeneration often has difficulty competing because of low electricity prices (and relatively high gas prices). This is true in Germany, for example, where cogeneration growth is flat. On the other hand, the Czech Republic has excess power supply and yet has been successful at increasing the share of cogeneration over the past decade, in part because of the existing demand for heat. Demand for heat can be a challenge for cogeneration if district heating networks are already operating with overcapacity. That said, the district heating networks with the most excess capacity also tend to be those with the oldest equipment.

Sharing the economic benefits of cogeneration equitably between power and heat is essential to expanding cogeneration. Chapter 4 provides a more detailed review of cost allocation issues. If too much of the cost is allocated to power, cogenerated power is not competitive.[3] On the other hand, if too much of the cost is allocated to heat, district heating companies will resist buying cogenerated heat. Until recently, all the economic benefit of cogeneration in Russia and other former Soviet countries was allocated to electricity, which meant that cogenerated heat could be more expensive than heat from heat-only boilers. Even today, the split tends to favour electricity, which continues to dampen district heating companies' enthusiasm for buying cogenerated heat. Balanced cost allocation is fundamental for cogeneration to be cost-effective and grow.

Ultimately, if cogeneration and its products are cost-effective, they do not need subsidies. Getting the cost allocation and the policy framework right is important to ensuring that cogeneration has a fair chance. Many countries, however, feel that cogeneration is worth promoting more explicitly because of its environmental benefits and because the existing electricity infrastructure reflects past subsidies for coal and nuclear energy.

Recommendation

Ensuring fair market conditions in which cogeneration can compete is very important to cogeneration's long-term success.

3. *Some would argue that when power prices are set by the market, any residual cost must be charged to heat. However, if heat prices are regulated, the power company has an incentive to allocate most, possibly even all, of the cost to heat. This is particularly true in areas that are zoned for district heating as there is no competition for heat. Thus, regulators have an obligation to make sure that the cost allocation between heat and power is balanced fairly to protect consumers and ensure equilibrium in district heating supply and demand.*

Policies to Promote Cogeneration

Countries have taken different approaches to promoting cogeneration. One of the reasons for electricity liberalisation in some countries is to capture more of the benefits of independent power production, such as industrial cogeneration, by giving it a fair chance to compete. Liberalisation is not, though, an explicit policy to promote cogeneration and it may even discriminate against cogeneration if market rules do not take cogeneration's lower transmission costs into consideration.[4] Market rules should be carefully designed to ensure that cogeneration and independent power have a fair chance to compete. Some of the most common policies specifically designed to promote cogeneration include:

- *Least-cost purchase requirements:* Slovakia and Poland, for example, require district heating companies to purchase least-cost heat from cogeneration plants.[5] Other countries that still regulate their power sectors require power companies to purchase cogenerated power when it is least-cost (and countries with liberalised power markets all require non-discriminatory access for least-cost power). This is one of the most common measures used to promote cogeneration in transition economies, though simply requiring utilities to purchase least-cost power and heat does not guarantee it access, as Chapter 5 explains.

- *Bonus payments and feed-in tariffs:* The German Cogeneration Act of 2002 gives qualified cogeneration facilities a bonus payment varying between €0.0138 and €0.0511 per kWh, depending on plant type. To qualify, the power must be fed into the public grid. A surcharge on all electricity sales funds this payment, which is scheduled to be phased out by 2010. Feed-in tariffs are most common as a policy to promote renewable energy, but some countries like Denmark and Spain also allow small, efficient cogeneration facilities to benefit even when they do not use renewable sources of energy. The idea is to guarantee a minimum, regulated price, usually for a certain number of years, to stimulate new investment. In the Czech Republic, cogeneration facilities can gain priority access to the power grid and feed-in tariffs. Policy makers endorsed this provision because such facilities must produce heat for district heating or industrial processes. Latvia also guarantees priority access for cogeneration and provides feed-in tariffs for small or renewable-based cogeneration facilities that use most of their heat for district heating.[6]

---

4. *PROCHP (2003).*
5. *Gochenour (2003); EGU Bratislava (2003); PROCHP (2002b).*
6. *Speeches at IEA Conference on* District Heating Policy in Transition Economies, *Prague, 2004; PROCHP (2004); Oniszk-Poplawska (2003).*

- *Grants for new cogeneration:* Several regional energy efficiency funds in Russia have invested in cogeneration using revenue from energy taxes. The Slovak Energy Agency also provides grants to support small cogeneration facilities and the Czech government has a similar programme.[7]

- *Tax incentives for cogeneration:* The U.S. provides several tax incentives to promote cogeneration, including investment tax credits and shortened depreciation periods. Likewise, the Slovak Republic provides a corporate income tax deduction for the first five years of revenue from small, new cogeneration facilities. Italy also provides an incentive through reduced taxes on natural gas used for cogeneration, and Sweden has recently lowered fuel taxes for cogeneration. Cogeneration also lowers the level of environmental taxes due in many countries because it is less polluting than separate power and heat production. For the most part, transition economies provide few tax incentives specifically for cogeneration, though several provide a reduced VAT for district heating sold to households.[8]

- *Green energy portfolio requirements:* Some jurisdictions, including some U.S. states and Belgian regions, require power companies to have a certain percentage of green energy in their generation portfolio. This is often renewable energy, but sometimes cogeneration also qualifies. In some systems, companies can buy green energy certificates when they do not meet portfolio requirements with their own production. Transition economies do not seem to use this mechanism yet.[9]

The World Bank, Cogen Europe and Euroheat and Power provide more detailed, country-specific information on cogeneration policies in Europe.[10] The European Commission has also recently issued a new cogeneration directive that will guide policy in many transition economies. The directive was approved in early 2004 and is a starting point for harmonising EU member legislation and incentives for cogeneration. It provides several definitions. For example, cogeneration facilities need an overall fuel conversion efficiency of at least 75% for their power to qualify as cogeneration. It also instructs member states to collect data on cogeneration and high-efficiency cogeneration in order to guarantee the origin of such

7. *PROCHP (2003); Slovak Energy Agency, www.sea.gov.sk; Gochenour (2003); Czech Energy Agency, www.cea.cz.*
8. *American Council for an Energy Efficient Economy, www.aceee.org; EGU Bratislava (2003).*
9. *Gochenour (2003).*
10. *Cogen Europe is a Europe-wide organisation that promotes cogeneration; Euroheat and Power represents the interests of national district heating associations and companies at the European level. Sources: Gochenour (2003); COGEN Europe (2001); Euroheat and Power (2003).*

power. Thus, it establishes the framework for a Europe-wide scheme to promote cogeneration. The directive also requires member states to ensure objective, non-discriminatory procedures for grid access, tariff setting and administration.[11]

Recommendation

OECD countries, including several transition economies, have used a wide range of policies to promote cogeneration. These policies can provide a useful reference for transition economies more broadly. In particular, several of the policies promote cogeneration without government subsidies, which is particularly important where resources are tight.

Energy Efficiency

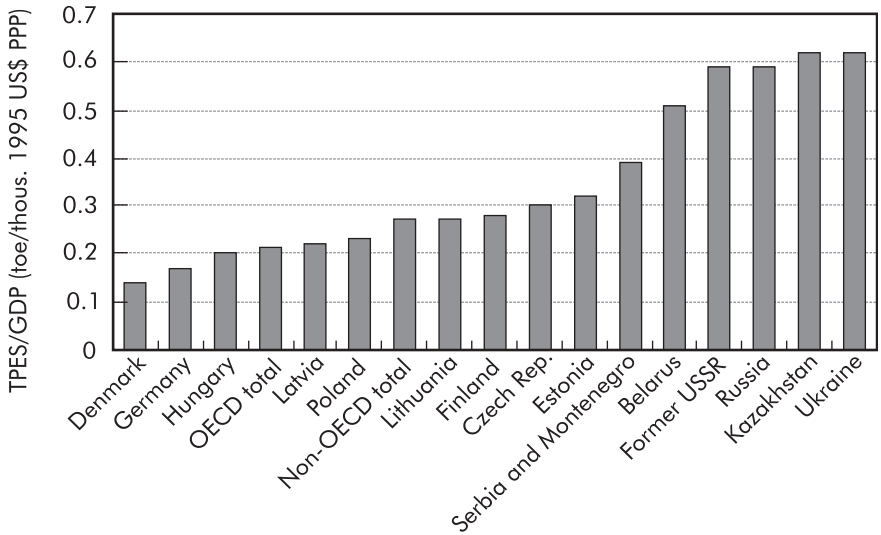
District heating holds the promise of high energy efficiency, which can bring significant environmental and economic benefits to a country. Most district heating systems in OECD countries are very efficient. Energy efficiency is a challenge for district heating in former Socialist countries, yet it is also important to recognise that district heating in almost all transition economies is more efficient than it was ten or fifteen years ago. Thus, this represents work in progress. This section provides a brief overview of policies that can promote efficiency, both within district heating systems and at the point of consumption. In both cases, this overview synthesises the major policy trends into a few categories. Relatively few major policies address efficiency in district heating systems or end-users exclusively; this chapter identifies those most relevant to district heating.

Figures 8.3 and 8.4 provide some background by showing relative levels of energy intensity in various countries. Energy intensity describes how much energy is used on average to produce a unit of economic output (GDP). Intensities vary significantly because of levels of heavy industry, regional climate conditions and differing policies toward energy efficiency. The data are given both on the basis of purchasing power parities and exchanges rates. Generally purchasing power parity is a more accurate way of comparing such data across countries, but as purchasing power parity conversion factors are estimated, exchange rates can also be helpful in showing differences between countries.

11. *European Parliament and Council (2004); OPET (2003).*

Figure 8.3

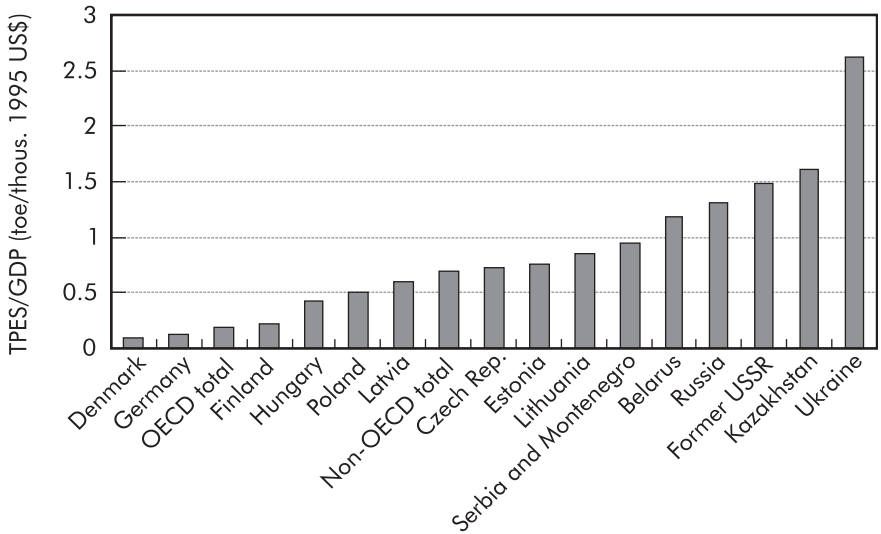
Energy Intensity on a Purchasing Power Parity Basis in Selected Countries and Regions, 2002



Source: IEA Statistics.

Figure 8.4

Energy Intensity on an Exchange Rate Basis in Selected Countries and Regions, 2002



Source: IEA Statistics.

Policies to Promote Efficiency in District Heating Systems

Each country tackles efficiency in district heating in a different way. The policy groupings below are thus not organised by the relative impact or importance, which varies from country to country, but rather by where the policy falls on the spectrum of mandatory to voluntary. This is not to imply that one end of the spectrum is better than the other, but this organisation can simplify the description, particularly as some national policies may straddle different categories.

- *Standards and Certification:* Several countries as well as the EU have minimum efficiency standards for household boilers, though countries do not tend to regulate efficiency in industrial boilers. Some countries have requirements to certify industrial boilers either before they begin operating or on a periodical basis to ensure quality maintenance and performance. Periodic certification through industrial energy audits is becoming increasingly common in the former Soviet Union; national and regional energy inspectorates carry out the task and can fine companies they find in violation. The drawbacks to this inspection-based approach are that it creates a large administrative burden and it carries the risk of corruption, but many such programmes have been successful in improving energy efficiency in district heating and other industrial sectors.

- *Benchmarking:* Some countries have built benchmarking for efficiency into their tariff system. In others, like Sweden, district heating companies benchmark for efficiency on a voluntary basis because prices are not regulated. Best practice programmes, described in more detail below, are based on benchmarking. Benchmarking could benefit district heating systems in transition economies by allowing them to proactively and continuously improve efficiency compared to domestic or international efficiency leaders.

- *Tax incentives:* Tax reductions can create incentives for improved energy efficiency; for example, a company might receive tax credits for investments in efficiency. This mechanism is quite common in OECD countries but much less common in transition economies.

- *R&D:* Many OECD countries invest in research to improve the efficiency of district heating or its components. The IEA Implementing Agreement on District Heating, Cooling and CHP is an international research programme funded collectively by governments, institutes and companies in ten countries. Most of the research projects address efficiency in some way, for example, by looking at strategies to manage heat losses or optimise

systems. Several Nordic countries have particularly large district heating R&D programmes, reflecting the size of district heating in their energy mix. The Danish Energy Authority provides approximately €7 million annually for research into district heating; it co-ordinates this work with the Danish district heating association and system operators, who fund additional research. The U.S. has also invested significantly in heat plant and distribution efficiency through its Steam Challenge programme. Many transition economies also conduct research on more efficient district heating technologies, but because of funding, these efforts tend to be small.

- *Best practice programmes:* Many countries have energy efficiency best practice programmes to provide technical expertise and energy audits. Usually, the goal of these programmes is to help companies benchmark their energy systems against the best in the industry by giving them information and advice. Several Central European countries have developed active programmes along these lines, for example, through the Czech Energy Agency, the Slovak Energy Agency or KAPE in Poland. The U.K. also has a well-known Energy Efficiency Best Practice Programme; of note for district heating, this programme includes a focus on heat exchangers. Typically such programmes are voluntary but they are not usually aimed exclusively or specifically at district heating. Some programmes of this type also bring together groups of industry experts to develop common strategies for technology leaps, blending research, information campaigns and competitive benchmarking. The IEA Implementing Agreement described above also works in this way, though it is not a best practice programme per se. The U.S. Department of Energy has developed a programme called Industries of the Future that specifically brings together experts in a particular heavy industry, like aluminium production, to develop new approaches and technology. Another U.S. programme provides free energy audits to small and medium-sized manufacturers through Industrial Assessment Centers, while training graduate students in industrial energy efficiency.

- *Financing:* Several governments provide assistance with financing for energy efficiency improvements in district heating. The type of assistance can range from help in preparing investment documentation to equipment grants and guarantee funds. Typically, guarantee funds and assistance with documentation have the largest impact for the money spent because they overcome specific market barriers in order to leverage additional funds (see Chapter 6). Grants are simpler to implement, and prudently used, they can provide important encouragement to projects. Many former Socialist countries used to provide extensive subsidies for district heating but this

hurt efficiency because it encouraged poor cost discipline. This underlines the need to design financing programmes carefully to target barriers without providing subsidies to encourage poor efficiency or lack of fiscal discipline.

● Policies for Efficient End Use of District Heating

District heating is used in a wide range of sectors (including residential, commercial and industrial), so it is difficult to summarise all the relevant energy efficiency programmes that governments have developed. For the most part, the same industrial energy efficiency programmes described above apply both to district heating and the industries that consume heat.[12] This section focuses on programmes to promote heat efficiency in buildings.

Metering and Controls

Policies to promote meters and controls at the building or apartment level can significantly enhance other end-use energy efficiency measures. Consumers whose heat bills are based on metered consumption have incentives to reduce heat losses in their facilities, for example, with better insulation, double-glazed windows and other types of weatherisation. Many countries have introduced obligatory metering (see Chapter 3).

Building Energy Codes

Building energy codes are the single most common policy to improve heating efficiency in buildings. Most northern countries, including OECD and transition countries, have building energy codes. They work by mandating either a performance approach, with maximum total levels of heat loss for various types of buildings, or a prescriptive approach, which specifies the types and quantities of materials to be used in construction. In the former, the building designer has flexibility to choose between a variety of measures (for example, additional insulation could offset the heat loss from larger windows). The flexibility is appealing, but this approach requires computer programming, so when it is used, building designers and contractors are typically offered the option of using the prescriptive approach if they prefer. In the prescriptive approach, building energy codes specify the technical characteristics of some components, like the type of windows or insulation to be used. This is the most common approach in transition economies. For the most part, building energy codes are stricter in OECD countries than in the

12. *Voluntary agreements with industry on energy efficiency and greenhouse gas emissions could be counted as another programme. They are increasingly important in the EU-15, but transition economies have not used them yet, so we will not discuss them in detail here. In Finland, voluntary agreements with industry commit the industrial signatories to reduce heat consumption by an average 15%.*

former Soviet Union, but this is changing. Russia, for example, has a very well-developed programme to improve building energy codes at the regional level. The Russian Energy Efficiency Center, CENEf, has carried out substantial work to encourage regions to adopt more stringent standards and to develop model codes. Building energy codes affect new buildings and, in many cases, older buildings when they undergo major renovation. They do not have a major impact on most of the existing building stock. Thus, building energy codes have a gradual impact over long periods.

Other Energy Efficiency Policies for Buildings

Few countries have systematic policies to improve energy efficiency in existing buildings, which remain a challenge and a potential area for improving energy intensity nationally and internationally. The costs of retrofitting a building are much higher than building it efficiently in the first place, but at the same time, many building owners and users could cost-effectively reduce their heat use. Buildings in transition economies, particularly in the former Soviet Union, have a huge potential to improve their energy use. Making these improvements can facilitate district heating reforms by reducing the painful impact of price increases (as residents consume less) and improving integration with the district heating system (for example, by reducing water or steam losses to boost return water, which saves on energy and water treatment).

In most transition economies, there are four general types of policies to promote energy efficiency in existing buildings: financing support, information campaigns, energy audits or certification of existing buildings, and efforts to improve efficiency in state-owned buildings. Financing support can range from partial support for energy efficiency investments and help attracting financing from large development finance institutions like the World Bank, to guarantees necessary for such financing. Information campaigns are popular because they are relatively inexpensive and can be quite effective. Many countries, including Poland, the Czech Republic and Ukraine, have sponsored television advertisements to promote energy efficiency; others prepare brochures for the public or set up special information centres that the public can access.

The second two policy measures are not as universal. Most countries do not require energy audits or certification in existing buildings. Russia has an ongoing, voluntary programme to certify building energy performance through "building energy passports". The passports record key information about maintenance and performance in a simple, easy-to-track format. Bulgaria's new Energy Efficiency Law does require energy audits in buildings

with more than 1,000 m² of floor space (in line with the EU Buildings Directive), and new EU members will have to do the same. Russia, Ukraine and several other countries have programmes to improve energy efficiency in public buildings, modelled in part on the U.S. Federal Energy Management Program. The Ukrainian government allocates about €5 million annually for this programme and disburses awards for the money based on competitive proposals from state entities throughout the country.

Several EU legislative provisions will or could also affect new member states, in particular, the Buildings Directive and the proposed Energy Services Directive. The Buildings Directive requires member states to adopt minimum energy standards for new buildings and for existing buildings with over 1,000 m² of floor space.[13] Since most apartment buildings in transition economies are large, multi-story buildings, this directive, when fully implemented, could have a significant impact on existing building stock. The proposed Energy Services Directive would commit member states to improving their energy intensity by 1% annually. (Most new EU members improved their intensity by more than this annually on average over the past ten years, though as they get more efficient, it will become more expensive to make further improvements.) In addition, this directive would require energy service providers, including district heating companies, to provide demand-side energy services to at least 5% of their customers.[14]

Demand-side Management (DSM)

Several countries have policies that require energy supply companies to invest in demand-side energy efficiency when such investments cost less than building new supply. A DSM programme might include information on energy efficiency for consumers, rebates for efficient lamps and home energy audits; the funding would be built into the energy tariff, much as new power plants are funded. DSM programmes are used to ensure least-cost supply in a regulated context. With electricity and gas market liberalisation, DSM programmes have tended to shrink or be replaced with system benefit charges for demand-side energy efficiency.[15] DSM is not as common in district heating as it was in electricity. One of the reasons may be that in many OECD countries, district heating was not (and is not) regulated. DSM does exist in Denmark, where it is required for electricity, gas and district heating under the Energy Savings Act. The law requires that energy utilities and municipalities form regional energy saving councils. These councils develop

13. *European Parliament and Council (2003).*

14. *European Commission (2004).*

15. *System benefit charges are charges on energy sales used to fund certain public benefits, like low-emission power production.*

energy savings programmes, with participation from consumer groups and other stakeholders. The 2000 Heat Act reinforces DSM obligations in the Danish district heating sector.[16]

Other Policies

A few additional policies in other OECD countries are worth noting. For example, tax incentives for energy efficiency investments are common in OECD countries, though most transition economies do not use tax policy to promote efficiency investments. Several countries also provide support for energy efficiency improvements in low-income housing, as this simultaneously improves the environment and provides social support to the needy (long term, this approach is much more cost-effective than ongoing support for energy as a household expense). Sweden has an interesting policy that requires landlords to maintain buildings to certain standards in order to be able to rent them; the standards include energy use. This makes it very easy to improve efficiency in much of the building stock as technology improves.

Recommendation

Targeted policies and programmes to improve energy efficiency can play an important role in national and local energy policy. Building codes usually have the largest impact. Voluntary measures tend to be easier to implement and are less subject to corruption from powerful inspectors than mandatory audits. Policies to assist with financing are often most effective when they leverage resources, for example, through loan guarantees instead of grants.

Conclusions

Cogeneration and energy efficiency are at the core of why policy makers do and should care about district heating. They are an essential part of why district heating, when it is well managed, is very environmentally friendly and cost-effective. Many transition economies have significant potential for improving their energy efficiency and for shifting separate production of heat and power to cogeneration. In fact, transition economies are in the enviable position of starting out with large heat loads, a prerequisite for cogeneration.

16. *Hein Nybroe (2001)*

There are many policy options for expanding cogeneration and improving energy efficiency. Transition economies have already taken many important steps in this direction, but they also have a variety of additional policy options to consider, based on the experience of OECD countries. EU directives and proposals on cogeneration, buildings and energy services will help harmonise EU policy in this area and in some cases raise the requirements for transition economies.

PART III:
THE BIGGER PICTURE

DISTRICT HEATING IN THE NATIONAL POLICY AGENDA

District heating is a national issue in almost all countries in transition because of its economic impact and social importance. Seventy percent of Russian or Latvian residents cannot find a new way to heat their homes overnight. Russian experts estimate that the total Russian heat market is on the order of $30 billion per year, and residential heat sales equalled $14.3 billion in 2002.[1] Even in countries where district heating is a smaller share of GDP, like Romania, it can have a major impact on the national economy when poor policy undermines the sustainability of district heating and leads to its collapse. In Romania, district heating debts have become so significant that the International Monetary Fund has included district heating improvements as a condition of future stability lending.[2] In fact, stated government priorities in many transition economies include district heating fairly high up on the list.

Yet there have been fewer steps toward reform in district heating than in other parts of the energy sector. This may be partly because the problems seem too socially explosive to touch, and as district heating is rarely a priority in the West, transition economies are not often encouraged to reform this sector in high-level dialogues. Some people have an impression of district heating as a Communist relic with no value in a market economy. This impression condemns it by the mere fact that it is a centralised form of energy, implying that it is necessarily inefficient and inflexible (such an argument might also condemn centralised electricity and gas networks). As the experience of many Western countries demonstrates, district heating can be efficient, environmentally beneficial and well designed for the needs of a modern market economy. Still, as applied in many transition economies, it has some way to go. This is not an argument for scrapping or neglecting the district heating systems of these countries. At the technical and economic level, each system should be evaluated for optimal performance, and managers need to ensure that customers receive quality service. At the policy level, governments need to develop regimes that support quality district heating and do not encourage inefficient district heating (or inefficient heating from any other source).

This chapter examines the case for integrating district heating more fully into the wider policy agenda and ways to achieve this integration.

1. *Bashmakov (2004); Institute of Urban Economics (2003).*
2. *APER (2003); IMF (2004).*

Co-ordinated Energy Policy

Heat accounts for a large part of the energy balance in most transition economies. Dealing with heat in isolation from other parts of the energy sector can lead to poorly focused and contradictory policies.

- **A Coherent Policy and Regulatory Framework**

National governments typically create the policy framework for regulating energy. This is true for most types of energy, with some important and unfortunate exceptions for district heating. When district heating regulation is not governed by national policy or standards, the regulation is often rather haphazard. This point is relevant even if the regulations per se are set at the local level. Varying approaches to tariffs and tariff-setting can make it more difficult for private companies to invest in the sector. Thus, district heating tends to be poorly integrated into national policy most often in countries with small district heating sectors or with district heating sectors in distress.

A policy framework that supports common regulatory principles is also important to ensure that there are no major differences in the way various energy forms are regulated. For example, if tariffs for fuel inputs are revised more frequently than district heating tariffs, district heating companies can run into financial difficulty when costs rise but receipts do not. Also, if tariff regulations for competing heat sources implicitly or explicitly allow a greater return on investment or profit on sales, this will encourage investment in these sectors whether such investments make the most economic sense or not. The same is true for related tariff issues like the speed with which new investments are amortised in the rate base and whether full investment and maintenance costs are considered at all. Once uneconomic investments are made based on distorted price signals from regulation, it is difficult to correct those mistakes. It is easier to make sure that the regulation is co-ordinated and compatible to avoid price distortions in the first place.

- **Separating Regulation and Ownership**

Good regulation should be devoid of conflicts of interest as far as possible (see also Chapter 4). The principle that regulators should not receive personal compensation from industry while acting as regulators is a prime example of this. An inherent conflict of interest also arises when regulators own the assets that they regulate. In the district heating sector, this most often happens when a municipality simultaneously owns district heating assets and

regulates heat tariffs. A municipality cannot maintain an arm's length relationship from a company it owns, even if that company is managed by a third party. An example is Budapest, where local regulators allow the local district heating company to charge a high portion of its costs as fixed charges, which ensures steady income for the company, but encourages inefficiency and may not be in the public interest.[3] Several towns in Ukraine and Russia are in the same situation: the municipal owners may not push for metering because it adds cost and can reveal losses in the network that the district heating company (and indirectly the city) must pay for. This does not imply that all cities which both own and regulate district heating systems are poor regulators. Nonetheless, it creates a risk that the quality and impartiality of regulation will suffer (or, alternatively, that the district heating company will suffer from the dual political pressure of regulation and ownership).

The best solution is to establish an independent regulator, which typically requires some involvement from the national government, even if regulations ultimately are set below the national level. In other words, setting up a system to ensure that there are no conflicts of interest is easier at a level not directly involved in these ownership conflicts.

- **Liberalisation, Fair Competition and Subsidies**

A poorly co-ordinated process for launching competition, dismantling subsidies and introducing tariffs based on full cost recovery across different energy sectors can lead to distorted investments, and jeopardise company finances. In former Socialist countries that regulate district heating but are liberalising their gas or electricity markets, district heating companies may not be able to change their heat prices to reflect market conditions. For example, gas is both a major fuel input to district heating and a competing heat source. If gas prices rise, district heating prices may not rise as quickly, which puts cost pressure on the district heating company. Simultaneously, the company may lose potential income because it cannot raise prices in response to the competition. On the other hand, if gas prices drop, the district heating company may be reluctant to charge less than the tariff. Since it needs to compensate for losses during periods of high prices, it may lose market share.

Moreover, most countries in Central and South East Europe have kept gas subsidies or cross-subsidies in place longer than district heating subsidies, putting district heating at a competitive disadvantage. In some countries like

3. *On the other hand, one could argue that Budapest is an example of a government deciding that, for policy reasons, it needs to protect a company temporarily against unfair competition. Nonetheless, 70% is a very high percentage of fixed costs and is unlikely to reflect the real cost structure.*

Romania, this has been a significant cause of the large-scale disconnections that have led to the collapse of numerous district heating systems. The social, economic and environmental consequences of such collapses are enormous.

Liberalisation of gas and electricity markets can directly impact district heating. Likewise, the existence of district heating can affect the results of gas and electricity liberalisation when policy makers neglect to consider energy comprehensively. Also, liberalisation can affect heat source competition because some of the competing heat sources are still regulated while others are not.[4]

This is not to say that liberalisation must wait for all energy sources to move forward at the exact same time, but co-ordination and some synchronisation are necessary. Countries need to be mindful of the impact that liberalisation in other sectors has on district heating and include the latter in the overall strategy. This task is easier when district heating is an integral part of national energy policy, the same policy that defines the schedule and approach to energy liberalisation.

Since most countries in transition have some degree of heat source competition, it is important for them to monitor this competition and consider it in energy planning and policy. This is often easier to do at the national level because that is the level at which natural gas and electricity are usually regulated or incorporated into policy. Thus, while monitoring can be local, acting on the results typically must be national. Likewise, because of the national regulation of gas and electricity prices (and national decisions on subsidies for these fuels), it makes sense to make similar decisions about district heating at the national level to avoid distorting price signals.

Another problem that faces district heating in liberalisation is that some countries include district heating in the liberalisation process, but do not think through the implications. Polish experts have criticised the fact that the 1997 Polish Energy Law allows third-party access to district heating, using the same terms for such access as in the electricity sector, but without adapting the clauses to the specific conditions of district heating. Romania has followed a similar path. In both Poland and Romania, the third-party access clauses for district heating are included in the laws and regulations, but they have not been implemented. This can create the false impression that policy makers have addressed district heating satisfactorily in energy policy.

---

4. Czech district heating companies have complained about this dichotomy.

Electricity and Cogeneration

Given how cogeneration links electricity and heat markets, balanced policy on electricity and cogeneration must consider and integrate district heating. Cogeneration links heat and electricity in several ways. First, the rules on allocating cogeneration costs between electricity and heat play a major role in the competitiveness of electricity, heat and also cogeneration. Second, liberalised electricity markets can affect the dispatch of cogeneration, which necessarily affects district heating based on cogeneration. District heating companies that are regulated but are affected by liberalisation may feel this pinch acutely because they cannot raise and lower prices in reaction to the power market. If cogenerators are forced to supply heat regardless of electricity market conditions, this creates disincentives for new cogeneration plants. It also creates incentives for cross-subsidising electricity from district heating sales by showing a maximum amount of costs on the heat side. Third, when policy and regulation of electricity and heat are split, cogeneration or district heating will suffer. Either regulations treat electricity and heat separately, which makes life difficult for cogenerators, or heat from cogeneration and heat-only boilers will be treated and regulated separately. This is the case in Latvia, for example. This adds to the regulatory burden for district heating companies, which must navigate multiple, uncoordinated levels of regulation. This can decrease efficiency and at times create conflicting price signals.[5]

Differences in Fuels

When governments assess net benefits of district heating and other energy sources given all the policy goals they juggle, it is important to consider the total energy picture. For example, it is difficult to determine the efficiency of systems based on individual gas boilers or district heating without considering distribution losses, which can be larger in some gas distribution networks than they are in district heating networks. Many of these details are local, but in the aggregate, they can and should affect national policy.

Other policies beyond the energy sector may affect fuel choices. Many countries have regional development policies that seek to lower unemployment, for example by promoting local energy sources, be they coal or biomass. Governments often promote biomass in district heating for this reason. Moreover, district heating itself can influence fuel use and hence local jobs.

5. *Karnitas (2003).*

Environmental Policy

District heating can help protect the environment by reducing emissions. At the same time, outdated, inefficient district heating systems can impede efforts to improve environmental quality. Policy can make the difference in whether district heating systems are modernised or not, and in the design of the next generation of such systems. Moreover, environmental regulations can play a role in how district heating systems are operated and how cost-effective they are compared to other heat sources.

Three areas of environmental policy are particularly relevant to district heating: climate change, acid rain and local air quality. Climate change is by nature a global problem. The United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the European Commission Directive on Emissions Trading play a major role in shaping national climate and energy policy in Europe. While acid rain is not a global problem in that emissions do not have global reach, it is a regional problem, stretching beyond borders. It is caused by sulphur dioxide and nitrogen dioxide, both of which are emitted from fossil fuel combustion (and in particular coal combustion). Most laws dealing with these emissions are national but there are also several international treaties addressing transboundary pollution from these chemicals. Climate and acid rain policies typically encourage or require district heating plants to improve efficiency and to switch to less polluting fuels (gas instead of coal, or biomass instead of gas).

Local air quality is also typically governed by national laws, but local authorities have much more influence over policy and regulation of air quality in their jurisdiction. Local air quality regulations can affect district heating in several ways. First, district heating plants may only be allowed on the outskirts of a city. While this can play an important role in relieving local pollution, policy makers may also want to consider the impact such regulations have on the competitiveness of district heating. (In the extreme, if district heating loses market share to local fuel combustion because of higher transportation costs, the local environment may be the loser.) Second, district heating is usually more amenable to scrubbers, which clean exhaust air, than small local boilers; district heating companies are usually required to install such equipment.

Sweden provides an interesting example of how national environmental policy interacts with district heating. The Swedish government is concerned that district heating operators can make unjustified profits because of environmental taxes. Carbon taxes are based on the net carbon emissions of

fuel combustion, and district heating in Sweden relies to a large extent on clean fuels like biomass. District heating companies have a monopoly on district heating within their service area, though they must compete with other heat sources, such as fuel oil, that have higher emissions and higher taxes. Because of this, the Swedish government is looking into whether district heating companies will be able to make excessive profits. (On the other hand, one could argue that if district heating has a cost advantage, operators should be able to profit more or keep prices more competitive, as they see fit. The first would stimulate more investment in district heating and the second would stimulate more connections to district heating. Either of these would help reduce emissions, the desired effect of the law).

Integrating concerns of this kind requires a broad debate. Given the level at which most environmental policy is made, it makes sense for at least part of this debate to take place at the national level.

Housing Policy

Housing ownership and development policies both have an impact on district heating. The interaction between ownership and district heating policies can have a profound influence on energy efficiency. The structure of the housing market affects how much influence district heating consumers have with the monopoly suppliers. In addition, development policies can shape housing density and the cost-effectiveness of district heating.

Tenants have less incentive to improve their energy efficiency than owners because they typically cannot own any improvements they make. This means that owners need to be responsible for efficiency. In Sweden, most housing is owned by large quasi-public or private landlords. District heating is metered, but the cost is included in the rent. Thus, these large owners have a considerable incentive to improve energy efficiency: their profits depend on it. The landlords also have market power because of the size of their utility expenses, so they are in a stronger position to push district heating companies to lower their prices than large numbers of small buyers.

In several transition economies, there is a growth in housing or condominium associations that bring together small consumers for greater market influence. The Hungarian Heat Law provides many rights for such associations in negotiating with district heating companies. Such associations can have a positive influence in several ways. First, they can put pressure on district heating companies to lower prices and improve quality. Second, they can ensure that all

apartment owners pay their heat bills. Third, they can bring apartment owners together to make large energy efficiency improvements in a building.

There are also strong incentives for energy efficiency when the resident both owns the dwelling and pays directly for its heat use. There are problems in promoting efficiency, however, when the owners are not the ones to pay the bills. When residents live in public housing and pay the bills directly, they may not have the right to make major changes to the building, and their incentive to make major non-recoverable investments may be low. Moreover, they cannot use the value of the housing as collateral for home improvement loans, which means higher interest rates. When housing is privately owned but residents are charged for energy use based on apartment size, they have almost no incentive to save energy. So the issues of whether private ownership is allowed, and whether there are policies to promote mortgages and home ownership generally are very important to this interaction with district heating. In many countries in transition, mortgage and home improvement loans are very expensive or difficult to obtain, thus making it impossible for many people to buy a home. Such problems also make it difficult to finance home energy efficiency improvements.

It is also important to note that when housing costs are a high share of average income, the impact of large utility bills on families and poverty is even greater.

Policies on developing new housing are also important for district heating. Policies that encourage large, spread out suburbs make district heating in these areas next to impossible. Examples of policies that have an impact in this respect include property taxes, mortgage policy and public financing of the infrastructure for suburban versus urban developments.

While local residents and policy makers can and should have considerable say over how their community develops, many decisions on ownership structures and rights as well as infrastructure funding are also made at a national level. District heating should be one of the factors considered when such decisions are made at both the national and local levels.

Social Policy

District heating is an essential commodity in countries with cold climates. This makes district heating policy more challenging, but it also makes the stakes for finding the right policy balance even greater. Countries with direct subsidies for district heating tend to have high heating costs and poor quality service. Neither of these is desirable when district heating is essential.

That said, some families need support in order to make ends meet, including paying for heating. For example, the main breadwinner may be unemployed, or a retired couple may have seen the value of their pensions shrink with inflation. All countries in transition provide some support to low-income families, though the extent to which social welfare networks are developed varies. Much of welfare support in fact goes for heat, either as heat subsidies or as general welfare support that includes money for heat. Thus, district heating policy can have a profound impact on social welfare policies: when district heating is poorly run and inefficient, these welfare payments can become a major burden on national and local budgets. This is the case in Russia, for example, where heat subsidies have stubbornly remained about the same despite rising heat tariffs. One of the problems is that lack of investment has made district heating increasingly expensive, so over time, the problem becomes more difficult to solve. The Russian government realises this and is now considering a new heat law that would encourage greater investment in district heating through more rational planning and involvement of the private sector.

In most countries in transition, like in Russia, social welfare policy is closely linked with district heating policy, so the two issues must be addressed in a co-ordinated way. The size of the payments also makes solving these social issues almost impossible at the local level as some towns tend to be more affected by unemployment than others and taxes in most countries are levied primarily at the national level.

Privatisation Policy

Privatisation policy can also affect district heating. Many countries restrict privatisation of district heating assets. In some countries, like Lithuania, these restrictions are designed to try to ensure stability in the district heating sector. (In Lithuania, up to 70% of the generation assets in any given district heating system can be privatised, but the network itself cannot be privatised as a means of promoting more transparent competition and ensuring stable network operation.) In other countries, privatisation restrictions may simply lump district heating with other types of energy assets. In Ukraine, for example, the law on privatisation does not allow privatisation of district heating assets and moreover, pipelines cannot be privatised. The draft Ukrainian law on heat, on the other hand, encourages private-sector participation in the district heating sector while trying to stay within the boundaries of the privatisation law.

Co-ordinating privatisation policy with district heating policy obviously will improve management of the district heating sector, regardless of whether a government decides to privatise assets or not. Likewise, a national government can help to ensure that when district heating assets are privatised, the privatisation conditions meet certain standards. The draft Russian heat law, for example, leaves privatisation decisions to local authorities, but requires them to follow national standards for documentation, transparency and fairness.

Economic Policy

District heating represents a significant part of GDP. In Russia, heat sales account for about 5.6% of GDP at current prices and this does not include most industrial heat purchases. In Lithuania, the district heating networks are one of the largest domestic assets based on market value, worth 3 billion Lithuanian litas or €868 million at current rates.[6]

District heating can help promote economic growth when it is well managed; on the other hand, because of its size, when the sector encounters problems, it can drag down the economy both on local and national scales. A well-designed district heating policy makes tremendous sense from an economic point of view. It is as much a part of economic policy as any other large sector.

The Need for a Heat Policy

Given how important district heating is to so many aspects of national policy, it is surprising that until recently, Hungary was the only country in transition with a law on heat. Heat is mentioned in energy or electricity laws in most countries, but these references tend to be brief and often treat heat like electricity, without recognising some of the fundamental differences between the two energy types (such as the highly local nature of district heating). Effective policy requires broad discussion and clear representation of ideas. Enacting a law is one way to create a broad discussion and reach consensus and clarity. Formally issuing a policy on heat after extensive discussion is another way. The key point is that in open societies, good policy requires

6. *Euroheat and Power (2004).*

broad debate and discussion, not the exact form that the document takes (government policy, parliamentary law or other official document).

Countries that want to use heat source competition to balance their heat markets may find that developing a policy document or including district heating in other energy laws is enough. When a country decides to regulate the price of district heating, a law will probably work better because it can codify the regulatory approach based on the goals the country seeks to achieve.

It is true that few Western countries have heat laws. District heating also accounts for a smaller share of the energy balance in most of these countries. While in some cases, this may be for reasons of climate or housing density, it is also possible that the lack of a supporting legal framework has hindered the development of district heating. In former Socialist countries, the planning process originally took the place of laws, as the state made all the investment decisions. Now that there are many actors, a government's main role is through policy, not financing.

● Heat Laws in Specific Countries

The lack of a clear policy toward district heating in most transition economies in the first 10 to 15 years of democracy has led to many of the problems of the sector. A clearer policy framework might have solved the problems earlier. This situation is changing as countries recognise the importance of district heating and the need for effective policy making. In the last few years, several countries have debated heat laws or have issued new secondary legislation on how heat is regulated and managed. Table 9.1 shows the countries that now have heat laws or have prepared draft laws for parliamentary consideration.

Table 9.1

Transition Economies with Heat Laws, as of July 2004

Countries with Heat Laws	Countries Preparing Heat Laws	
Estonia	Moldova	Russia
Hungary	Romania	Ukraine
Lithuania		

Note: Ukraine enacted a new Law on Housing and Communal Services in June 2004. It has draft laws on heat and cogeneration pending approval.

In addition, Poland's 1997 Energy Law contains substantial provisions on district heating, although in some ways it tends to treat district heating like electricity (particularly in the way the law theoretically structures competition). Poland's Energy Law is quite effective, on the other hand, in requiring municipal energy plans and establishing co-ordinated regulation for all forms of energy through the Energy Regulatory Authority.

Hungary

Hungary approved its Act on District Heat Supply in 1998, the first in the region. As the title indicates, it focuses primarily on supply and not balancing supply and demand. It determines licensing procedures and sets obligations for district heating producers and suppliers, including the obligation to carry out necessary investments. The act has worked well in stimulating investment in district heating and ensuring that the sector is financially stable. The focus of the law is on better regulation, but without excluding the possibility of heat source competition or wholesale competition (the law is silent on the former and provides for unbundling of generation and distribution, which can facilitate wholesale competition in a regulated context). Another issue in Hungary is that despite the legal policy framework, district heating receives very little attention at the national level and there are almost no policy officials who deal with district heating. The Hungarian Energy Office does have a division dealing with district heating, but in a regulatory, not a policy capacity.

Estonia and Lithuania

Estonia and Lithuania both approved heat laws in the spring of 2003. While the laws are similar in several ways, there are key differences. Both laws allow municipalities to establish district heating zones and both require that municipalities prepare energy plans. Both envisage continued regulation of heat tariffs. The Lithuanian law, however, makes competition an important tool for improving service quality and efficiency. The competition comes in two forms and it is up to municipalities to decide whether to incorporate them. The first is heat source competition (which obviously is excluded if a municipality decides to set up a district heating zone). The second is wholesale competition: the law requires that the least-cost heat sources obtain network access. Lithuania has also taken steps toward unbundling: heat transmission assets must be held in municipal or state hands, but heat production assets can be privatised. The Estonian law does not mention competition. In addition, Lithuania's law contains clear provisions for incorporating demand assessments into municipal energy plans, whereas the Estonian law does not.

Romania

Romania is also considering a law that would allow district heating zones, although the meaning of the zones is still under debate. Two options are 1) charging everyone in the zone for the fixed costs of district heating, regardless of whether they buy district heating services or not, or 2) not allowing disconnections in the designated zones (similar to the approach in the Estonian and Lithuanian laws). Charging large fixed costs for district heating tends to encourage inefficiency because consumer investments in energy efficiency do little to reduce bills (the same is true for the district heating company, since it is paid regardless of how efficient or inefficient it is). This law is currently stalled in parliament and it is possible that the government will pursue new regulations instead.

Russia and Ukraine

Russia and Ukraine also have draft heat laws under consideration. Both laws would require municipalities or regions to prepare heat supply plans. The Ukrainian version is clearly supply-side oriented with no explicit provisions for demand assessments or demand-side management, though it does mention that energy efficiency should be encouraged. The Russian draft law is longer and more explicit on many points, for example, on a requirement that energy plans include heat balances and energy efficiency measures. Still, it does not provide a specific requirement for preparing demand assessments or any reference to methodologies for such assessments. Both laws require that district heating companies install heat meters at the building level. The Ukrainian draft is very explicit about encouraging private-sector involvement through contracts and concession agreements. It also specifies that district heating is not to be subsidised. The Russian draft law mentions involving the private sector, and extends the possibility of privatisation (which is not possible under current legislation in Ukraine). Both the Russian and Ukrainian draft laws would allow for disconnection of customers who do not pay. The Russian law contains more enforcement provisions relating to the district heating company's obligations, though these often take the form of sticks rather than carrots. The Russian law also provides detailed information on the obligation to serve (customers who want district heating must be connected unless it is not technically feasible). Both laws gently encourage wholesale competition but neither provides much detail on how this is to occur. The Russian law also explicitly allows customers to disconnect, while the Ukrainian law is silent on this point (though it includes a list of customer rights). Another important difference is that the Russian law would set tariffs nationally, while the Ukrainian law would allow each municipality to set its own tariffs (though municipalities are typically the sole owners of the assets they would regulate).

Denmark and South Korea

Denmark and South Korea have relatively similar heat laws. Both are based on the idea of using regulation to promote least-cost district heating supply. They both allow district heating zones where buildings are required to be connected to the district heating system. Zones are defined through local energy plans. Tariffs are regulated. Both these laws provide considerably more detail on the methodology of energy planning and tariff regulation than the laws in transition economies. They are also more explicit in requiring that energy efficiency improvements be considered in planning and regulation.

Other Laws

Several countries have substantial sections on district heating in broader energy laws. The U.S. is in this category, although because of the federal system much of the decision making is done by legislatures and independent regulators at the state level. Also, several countries, including Germany, have laws on cogeneration (see Chapter 8).

● Key Elements of an Effective Heat Policy

What are the most important issues that district heating policies or laws should cover? The first thing is that countries should clearly state what mechanism they will use to balance supply and demand: regulation or the market. Thus the policy or law should address the idea of investment based on least-cost planning, whether that planning occurs in the government or in companies through competitive pressure. The policy or law should also encourage greater energy efficiency and a stronger customer focus, and outline how to pursue these goals.

If a country decides to regulate tariffs, it should recognise that the most important decision point for costs is not periodic tariff adjustment, but rather investment approval (for example in licensing new plants). Once an investment is made, the cost structure is more or less set. Thus regulators should take an active role in approving new investments and ensuring that these investments are necessary and least-cost. This begins with an objective assessment of future demand. Likewise, if a government decides to regulate energy prices, it should unify and standardise procedures for setting tariffs for all energy sources. Also, regulations should include clear rules on allocating costs between electricity and heat in cogeneration plants. If a government decides to liberalise one part of the energy sector, it should seriously consider liberalising district heating as well to avoid market imbalances.

If competition between heat sources will balance the market, the government should assess the market carefully before launching into it and ensure that all

the right conditions for fair competition are in place. Once competition begins, the government should not just step away. Instead, it should continue to play an active role by monitoring the market for fairness and balance. This allows for quick remediation if problems do arise. Heat policy should specify who is responsible for this monitoring, how often it will occur and what powers government bodies have to address potential problems. It should also provide a mechanism for customers to complain about abusive pricing, which can deter that problem from starting.

As far as possible, the system design should encourage the right behaviours. While enforcement is still important, relying too heavily on after-the-fact inspections and regulatory sticks can add to business costs, which ultimately increases district heating tariffs or prices. Moreover, heavy reliance on inspections can tempt corruption. Carrots, such as tax advantages, may achieve the same goals at a lower administrative and business cost. Policy makers should design policy to promote better customer service, including better quality heat, more control of heat use and clear billing.

Good policy needs to factor in the interdependence of district heating and other areas of national policy, particularly policies on the environment, social welfare, housing, privatisation and the economy.

Transparency is very important regardless of whether policy is based on competition or regulation. Information that can enhance transparency includes information on ownership, prices or tariffs, profitability, rules for connecting and accessing the network, fuel usage and emissions. Sweden, for example, is considering requiring that all district heating systems release information on their costs and profitability to ensure that they do not charge excessively high prices as they have little competition in the short term. Releasing such information to the public is equally important for transparent price regulation. On the policy side, draft regulations and laws should be open for public review and discussion before they are adopted. This can enhance the quality of these documents and ensure that they consider the needs of all stakeholders, not just producers. The same holds true for tariff and investment approvals as well as local energy plans. As the decisions affect more than just the suppliers, there should be some provision for external and public review, particularly for long-term decisions. The draft Russian heat law, for example, explicitly requires public comment and review of local district heating development plans.

Local government also has a role, for example, in preparing energy plans and encouraging investment. Local governments can have a very positive impact on the development of district heating. In fact, they are often key factors

behind district heating systems that are doing well. Expanding the impact of such positive leadership and expertise requires a national and international vision. Simply put, district heating is important enough to have a role in national policy as well. National involvement in district heating, when done well, can benefit district heating across a whole country through better co-ordination and clearer policy.

Conclusions

Countries that want to promote district heating need to have a clear policy toward it and they need to integrate district heating thoroughly into their energy acts and policies. They also need to be aware that district heating can have a profound impact on many other areas of national policy, including economic, environmental, social, housing and privatisation policy. In fact this relationship is often two-way: good economic policy can promote investment economy-wide.

Relatively few Western countries have heat laws, in part because their district heating sectors are comparatively small, and in part because they tend to rely on heat source competition to balance district heating supply and demand. In transition economies, district heating is regulated, but until recently, national laws and policies in most countries did not cover district heating in detail. This is changing as countries see the problems that poor co-ordination has created in the district heating sector, and the ripple effects this has in other areas.

Policy does make a difference. Clear, coherent policy can have a very positive impact on the development of district heating. Poor policy and lack of co-ordination can damage or even destroy the viability of district heating.

CONCLUSIONS AND KEY RECOMMENDATIONS

District heating can have a positive influence on a country's energy supply because of its potential advantages for energy security, environmental protection and economic development. Tapping this potential requires a more concerted political focus in addressing some of the challenges facing the sector, including the poor customer orientation of many district heating companies today, high energy intensity and the large investment needs of many district heating systems. These changes are feasible: around the world there are numerous examples of countries and cities with high-quality, well-managed district heating. This final chapter outlines the seven key issues that policy makers need to address, based on the findings of this book. First, however, it is important to add a word about policy sequencing.

Policy Sequencing

Properly sequencing reforms can be as important as selecting the right reforms. For example, moving too quickly to competition without first removing subsidies can be problematic. Liberalising heat markets when non-payment is still a large problem is also far from ideal. Table 10.1 highlights a logical sequence for district heating policy reform, starting with establishing an independent regulator and ending with steps for better regulation or introducing competition. The first part of this table describes prerequisites that are necessary before either approach can be successful. Once competition begins and the market is balanced, a tariff regulator is no longer necessary (an anti-monopoly regulator, though, would still be important). The other essential initial steps also serve as ongoing conditions.

Supply and Demand Policy

The implications of mismatching supply and demand are significant. When systems have excess capacity, they cannot operate efficiently, which raises costs. They have added pressure to sell more in order to justify and pay for these assets. Likewise, they have less incentive to promote energy conservation, either in their own facilities or at those of end-users. In addition, overcapacity makes it more expensive to respond to demand changes because fixed costs are a higher share of total costs. Profit margins in district heating

Table 10.1

Policy Sequencing

Essential Initial Steps	
1. Establish independent regulator.	
2. Set up social support programmes and eliminate direct heat production subsidies.	
3. Insist on good payment discipline through legislation and enforcement.	
4. Require meters at interface with all buildings and large consumers.	
5. Develop policies to promote demand-side energy efficiency.	
6. Establish conditions that allow for full cost recovery.	
7. Remove barriers to unregulated wholesale competition.	
8. Involve private sector through privatisation or public-private partnerships.	
Steps for Better Regulation	**Steps for Introducing Competition**
1. Prepare realistic demand assessments and least-cost plans for high service quality.	1. Remove barriers like subsidies for competing heat sources.
2. Establish least-cost supply requirements and use competitive licensing to get least-cost new supply options.	2. Establish more market-based tariffs.
3. Move toward more market-based tariff regulation (benchmarking, price caps with efficiency indexes or substitution tariffs).	3. Assess market conditions.
4. In larger cities, require more extensive wholesale competition for long and medium-term heat contracts by unbundling production from transmission/distribution and establishing non-discriminatory transit tariffs.	4. Establish a body that can review and act on complaints about abuse of market power.
	5. Ensure that consumers can disconnect and require district heating companies to process such requests quickly.
	6. Eliminate tariff regulation.
	7. Monitor market annually and establish a clear process for reviewing and acting on this information, when necessary.

companies are often predetermined percentages of cost, so the higher the costs, the more the profit. Thus, investments in energy efficiency such as repairing leaks, though highly profitable from a system perspective, are less enticing to a company that has excess capacity. At the same time, the supply and demand policy should provide incentives for companies to build additional capacity, when needed.

This is why it is important that countries get their policy for balancing supply and demand right, whether they use competition or regulation. They should clearly state what mechanism they will use: regulation or the market. Heat policy or law should address the idea of investment based on least-cost planning, whether that planning occurs in the government or in companies through competitive pressure.

If a country decides to regulate tariffs, it should recognise that the most important decision point for costs is not periodic tariff-setting, but rather investment approval. Tariffs should be structured to reward efficiency, not higher costs. And the potential benefits of competition in boosting efficiency should not be ignored.

Demand-driven Business Practices

Current business practices in many transition economies tend to emphasise production over quality and customer service. District heating will likely continue to lose market share in these countries if these practices are not improved, which ultimately could endanger the long-term sustainability of some district heating systems.

Lack of customer focus is probably the single largest weakness in district heating systems. Governments can proactively design policy that seeks to capture the benefits of district heating. This requires a cultural shift from a production model to a customer-focused model of management. Such a shift will ensure that customers receive a quality service, which will likely increase their willingness to use and pay for district heating services. In addition, it will allow district heating companies to better match supply and demand while limiting costs.

Governments should encourage demand-driven business practices. Heat policy or law should also encourage greater energy efficiency and customer focus, and outline how it will pursue these goals. District heating can be a very appealing product for consumers, but this requires a policy context that encourages and requires good customer service, efficiency and high product quality.

Essential Conditions for Reforming District Heating

There are several important prerequisites and necessary conditions for both approaches: improving regulation and introducing competition. Legal

mechanisms to enforce good payment discipline are important to revenue and hence the financial health of district heating suppliers. Simultaneously, governments should put in place an adequate social support network to ease the burden of district heating expenditures on low-income households. Installing meters and controls is vital for transparent billing practices that will improve energy efficiency and increase customer satisfaction. Other prerequisites include eliminating direct heat production subsidies, developing policies to promote demand-side energy efficiency and removing barriers to wholesale competition.

Better Regulation

If a country decides to regulate prices, an independent regulator, least-cost planning and full cost coverage are essential. An independent regulator ensures impartiality and separates tariff setting from short-term political goals. Least-cost planning is a way to give regulators enough information to ensure that costs are as low as possible and to avoid unnecessary investments, while at the same time helping them better project when new capacity is needed. Full cost coverage means that district heating companies will be able to survive in the long term. Policy makers and regulators should avoid cost-plus regulation. In most cases, other regulatory approaches, like price capping with efficiency indexes, benchmarking, or long-term competitive concession agreements may create better incentives for high efficiency and customer service. Substitution-based tariffs can also be effective when the heat market is balanced or there are clear national data on costs of alternatives. Also, regulations should include clear rules on allocating costs to heat in cogeneration plants, particularly when electricity markets are liberalised.

In general, using regulation to balance supply and demand is more suitable for countries that still have energy subsidies and high levels of non-payment.

Well-designed Heat Source Competition

International evidence indicates that heat source competition can reduce heat prices when the heat market is balanced. If a government decides to use competition to balance supply and demand, it should make sure the competition between various heat sources is fair. Fair competition means that

there should be no producer subsidies for any competing form of energy. It also means that companies should be able to take action against customers in arrears, since non-payment creates an implicit subsidy. If a government decides to liberalise one part of the energy sector, it should seriously consider liberalising district heating as well to avoid market imbalances. High levels of poverty can also create a barrier to a balanced market because of the difficulties the poor face in paying the capital costs of switching to a local boiler.

Governments should carefully examine the market situation before launching heat source competition. Once competition begins, regardless of whether tariffs are regulated or not, the government should periodically review the market for balance and transparency.

In general, competition is best for countries that are more advanced in economic reforms and that have lower poverty levels. Several countries in Central Europe are probably ready to use the market to set prices, as long as the government monitors it.

Wholesale Competition and Least-cost Bids

Governments should take advantage of competitive bids for new supply to lower costs in a regulated context. Specifically, regulators can use the licensing process to ensure that new supply is least-cost by requiring potential suppliers to competitively bid for licences based on estimated costs.

In larger cities, a more comprehensive approach to wholesale competition may help to lower costs further. Policy makers can help ensure fair access to the wholesale market for heat supply by incorporating three elements into market rules. First, the rules should require least-cost supply and merit-order dispatch (even though costs will likely be defined in long-term contracts). Second, production should be unbundled from network operations and sales. Third, transmission tariffs should be transparent and non-discriminatory. Overall, such regulated wholesale competition is most appropriate in those countries that still want to regulate their district heating sectors, including retail tariffs. It can be used as a mechanism to bring costs down and improve service quality. Likely candidates include countries in the former Soviet Union and the Balkans. Unregulated wholesale competition is already common in most countries that use extensive heat source competition instead of tariff regulation.

Regardless of whether governments take a small-scale approach through simple competitive bids for new supply or a more comprehensive approach to wholesale competition, they should make sure the rules are realistic for district heating and then follow through on implementing them.

Transparency

Transparency is very important regardless of whether the policy for balancing supply and demand is based on competition or regulation. Information that can enhance transparency in a competitive regime includes data on ownership, prices, profitability, connection and access rules, and emissions. Transparent information, including financial statements of local operations, can help indicate if companies are abusing their dominant position in sales of their respective heat sources. Such information can also help policy makers assess the overall situation and decide on policy directions. In a regulated system, this same information could be useful, along with information on the costs of production.

Regarding policy making and regulation, draft regulations and laws should be open for public review and discussion before they are adopted. This can enhance the quality of these documents and ensure that they consider the needs of all stakeholders, not just producers. The same holds true for tariff and investment approvals as well as local energy plans.

In addition, governments should ensure that regulators are at arm's length from the companies they regulate by setting clear and consistent rules on the regulatory process. Municipalities should not be asked to regulate heat tariffs if they own district heating assets so as to minimise conflicts of interest. Political independence can be enhanced through measures like irrevocable mandates (mandates that cannot be removed under any circumstances during a guaranteed period) and other measures such as separate budgets, autonomy in managing human resources and salaries, and non-renewable appointments. Also subsidy schemes should be transparent and targeted toward low-income families.

Also, because corruption hurts economic growth and market balance, governments should actively work to eliminate it in all sectors, including district heating. Transparency helps ease this task.

Proactive Policy Making

And finally, countries should be proactive in policy making.

National governments should incorporate district heating into national policy. They should be deliberate in deciding whether to use competition or regulation to balance supply and demand and then ensure that all aspects of energy policy are consistent with this as far as possible. A more consistent and focused policy can promote improved business practices in district heating.

Governments should not be afraid to touch district heating and to work hard to get the policy right.

ANNEX I

IEA STATISTICS: ECONOMIC, ENERGY AND HEAT DATA

IEA Statistics: General Information

The IEA collects, processes and publishes data and information on energy production, trade, stocks, transformation, consumption, prices and taxes as well as on greenhouse gas emissions and some general economic data. The geographical coverage of IEA's statistics includes the 30 OECD member countries and over 100 non-OECD countries worldwide.

The IEA Energy Statistics Division is composed of four sections dealing respectively with:

OECD Coal, Electricity, Heat and Renewables Statistics

Annual and Quarterly Coal Production and Trade
Monthly Electricity Supply
Annual and Quarterly Electricity Statistics
Annual Renewables Statistics

OECD Oil and Gas Statistics

Annual, Quarterly and Monthly Oil and Gas Statistics
Joint Oil Data Initiative (JODI) Statistics
Support to IEA Oil Committees
Support for the Oil Market Report

Prices, Emissions and OECD Energy Balances

Balances of OECD Countries
Forecasts for IEA Countries
Energy Indicators
Price and Tax Statistics
RD&D Statistics
Greenhouse Gas Emissions from Fuel Combustion
Methodology and Emission Factors

Non-OECD Countries Statistics

Annual and Short-term Data
Training of statisticians
Statistics support to organisations and countries

The data are originally collected by official bodies (often national statistical offices) in OECD member countries. These bodies collect the data from firms, government agencies and industry organisations and then report it to the IEA using special questionnaires to ensure international comparability. Data are also collected for non-OECD countries directly from government and industry contacts and from national publications.

Contact information

Phone: Coal, Electricity, Heat and Renewables Statistics (+33) 1 40 57 66 31
Oil and Gas Statistics (+33) 1 40 57 66 32
Energy Balances, Prices and Emissions (+33) 1 40 57 66 33
Non-OECD Country Statistics (+33) 1 40 57 66 34

Fax: (+33) 1 40 57 66 49

Email: stats@iea.org

Web: http://www.iea.org/dbtw-wpd/Textbase/stats/index.asp

Statistical Data

Table A.I.1

Basic Economic, Energy and Heat Data for Transition Economies, 2002

Country	Population (million)	GDP (billion 1995 $)	GDP (PPP) (billion 1995 $)	Total Primary Energy Supply (Mtoe)	Net Imports (Mtoe)	TPES/Pop. (toe/capita)	Heat Prod. (TJ)	Final Heat Consumption (TJ)	Final Heat Consumption/ Pop. (MJ/capita)	Share of Heat in TFC (%)
Albania	3.15	4.03	13.46	1.94	1.17	0.61	787	184	58	0.2
Armenia	3.07	2.33	8.76	1.93	1.19	0.62	1,553	1,221	397	2.5
Azerbaijan	8.17	5.22	21.81	11.72	-8.16	1.43	9,473	9,473	1,159	3.3
Belarus	9.93	20.80	48.21	24.77	21.28	2.49	276,228	240,139	24,195	32.4
Bosnia-Herzegovina	4.11	6.89	22.38	4.36	1.18	1.06	6,416	6,416	1,560	5.2
Bulgaria	7.97	13.70	51.06	19.01	9.02	2.38	49,751	36,009	4,520	9.0
Croatia	4.47	24.29	39.45	8.22	4.92	1.84	12,104	9,733	2,179	3.7
Czech Republic	10.21	58.11	138.62	41.72	11.07	4.08	142,294	110,601	10,837	10.6
Estonia	1.36	5.86	13.93	4.51	1.49	3.32	26,688	21,486	15,821	19.4
FYR Macedonia*	2.04	4.95	11.65	2.54	1.19	1.24	6,586	5,696	2,794	9.0
Georgia	5.18	3.95	10.86	2.55	1.19	0.49	7	6	1	0.0
Hungary	10.16	58.44	121.92	25.44	14.68	2.5	61,703	54,298	5,344	7.2
Kazakhstan**	14.88	28.71	74.54	46.45	-49.28	3.12	672,819	672,819	20	0.0

Country	Population (million)	GDP (billion 1995 $)	GDP (PPP) (billion 1995 $)	Total Primary Energy Supply (Mtoe)	Net Imports (Mtoe)	TPES/Pop. (toe/capita)	Heat Prod. (TJ)	Final Heat Consumption (TJ)	Final Heat Consumption/ Pop. (MJ/capita)	Share of Heat in TFC (%)
Kyrgyzstan	5.00	2.29	7.06	2.53	1.3	0.5	12,975	12,975	2,592	16.0
Latvia	2.34	7.08	18.89	4.26	2.44	1.82	33,048	26,316	11,255	16.5
Lithuania	3.47	10.22	31.26	8.58	3.59	2.47	43,965	32,599	9,397	16.4
Moldova	4.26	1.76	6.12	2.99	2.91	0.7	6,543	4,989	1,172	7.5
Poland	38.22	174.08	372.22	89.18	10.31	2.33	351,434	297,765	7,791	12.4
Romania	22.30	36.01	128.62	36.97	8.78	1.65	156,463	111,594	5,004	10.9
Russia	144.07	469.30	1,038.78	617.84	-410.42	4.28	6,297,064	5,471,352	37,976	31.6
Serbia and Montenegro	10.63	16.87	40.94	16.16	5.29	1.52	21,100	21,100	1,984	4.9
Slovak Republic	5.38	25.19	56.46	18.54	11.98	3.44	51,122	42,735	7,944	8.7
Slovenia	1.96	24.58	31.68	6.95	3.5	3.53	8,888	7,735	3,938	3.8
Tajikistan	6.27	1.48	5.44	3.24	1.91	0.51	3,385	3,385	540	2.8
Turkmenistan	4.79	4.19	20.14	16.6	-37.03	3.46	6,283	6,283	1,310	1.4
Ukraine	48.72	49.87	209.72	130.74	59.22	2.68	728,294	541,555	11,116	16.9
Uzbekistan	25.27	17.51	36.57	51.74	-4.02	2.04	108,607	108,607	4,297	6.7

** Former Yugoslav Republic of Macedonia.*
*** Based on revision submitted after release of IEA's* Energy Statistics of Non-OECD Countries, 2001 to 2002, *so data may differ.*

Table A.I.2

Heat Production and Breakdown by Fuel Type in Selected Countries, 2002

Country	Production (TJ)	Breakdown by Fuel Type (%)				
	All Fuel Types	Gas	Coal	Petroleum Products	Renewable Sources*	Other**
Belarus	276,228	81.6	2.0	13.4	3.1	0.0
Bulgaria	49,751	43.1	51.2	3.1	0.0	2.5
Denmark	125,671	34.6	29.6	5.2	30.5	0.0
Estonia	26,688	50.0	26.2	11.6	12.0	0.2
Finland	144,728	29.3	43.0	8.1	19.4	0.1
Hungary	61,703	70.6	19.6	7.6	1.2	1.0
Latvia	33,048	74.2	2.3	11.1	12.4	0.0
Lithuania	43,965	64.9	0.7	20.9	8.1	5.4
Poland	351,434	4.5	92.1	2.5	0.8	0.0
Romania	156,463	51.6	21.3	26.5	0.6	0.0
Russia	6,297,064	63.7	26.5	7.9	1.7	0.2
Slovak Republic	51,122	73.9	17.4	0.4	4.6	3.8
Slovenia	8,888	32.8	61.9	1.6	3.7	0.0

** Renewable sources: combustible renewables and waste (including solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste); geothermal energy; solar, wind and tide energy.*

*** Other: nuclear, electricity and waste heat.*

Table A.I.3

Heat Production and Breakdown by Fuel Type in Selected Countries, 2000

Country	Production (TJ)	Breakdown by Fuel Type (%)				
	All Fuel Types	Gas	Coal	Petroleum Products	Renewable Sources*	Other**
Belarus	278,481	81.9	3.1	12.7	2.2	0.0
Bulgaria	50,750	46.1	47.2	4.7	0.0	1.9
Denmark	117,850	34.9	32.6	3.3	29.2	0.1
Estonia	26,579	48.9	25.9	14.7	10.1	0.3
Finland	125,196	32.2	41.1	8.5	18.0	0.2
Hungary	68,864	63.6	27.2	7.0	1.3	0.9
Latvia	31,867	69.1	3.9	15.7	11.3	0.0
Lithuania	43,195	67.9	0.7	22.3	3.8	5.3
Poland	340,684	3.2	93.7	2.3	0.8	0.0
Romania	190,781	55.7	17.8	26.1	0.5	0.0
Russia	6,486,844	61.9	27.6	8.5	1.7	0.2
Slovak Republic	30,136	71.3	25.8	2.9	0.0	0.0
Slovenia	9,389	36.6	58.6	1.9	3.0	0.0

Table A.I.4

Heat Production and Breakdown by Fuel Type in Selected Countries, 1995

Country	Production (TJ)	Breakdown by Fuel Type (%)				
	All Fuel Types	Gas	Coal	Petroleum Products	Renewable Sources*	Other**
Belarus	269,443	62.2	3.6	34.2	0.0	0.0
Bulgaria	133,463	38.9	24.7	35.5	0.6	0.2
Denmark	117,971	24.6	46.4	5.4	23.5	0.0
Estonia	30,625	33.6	30.4	29.5	4.9	1.5
Finland	97,704	25.6	55.6	12.0	6.7	0.0
Hungary	60,992	48.9	27.1	22.7	1.4	0.0
Latvia	43,472	37.4	7.8	48.4	6.4	0.0
Lithuania	64,422	49.5	0.7	44.7	0.7	4.3
Poland	420,809	0.6	96.3	2.6	0.5	0.0
Romania	286,999	47.8	21.1	29.4	1.8	0.0
Russia	8,052,800	60.7	24.2	13.4	1.5	0.2
Slovak Republic	35,676	51.0	32.7	16.3	0.0	0.0
Slovenia	8,917	30.2	62.2	6.4	1.2	0.0

Table A.I.5

Heat Consumption and Breakdown by Sector in Selected Countries, 2002

Country	Final Consumption (TJ)	Breakdown by Sector (%)			
		Residential	Industry	Commercial and Public Services	Agriculture and Other
Belarus	240,139	41.8	35.8	4.6	17.8
Bulgaria	36,009	51.1	34.8	14.1	0.0
Denmark	100,514	62.6	7.0	28.6	1.9
Estonia	21,486	76.6	8.6	14.5	0.3
Finland	134,472	44.6	26.9	0.0	28.5
Hungary	54,298	46.8	34.8	18.4	0.0
Latvia	26,316	74.0	2.5	23.0	0.4
Lithuania	32,599	70.9	6.5	21.4	1.2
Poland	297,765	69.9	19.2	10.6	0.3
Romania	111,594	77.6	16.8	0.0	5.6
Russia	5,471,352	51.4	37.9	7.8	2.9
Slovak Republic	42,735	76.7	2.5	20.2	0.6
Slovenia	7,735	80.9	13.4	5.7	0.0

Table A.I.6

Heat Consumption and Breakdown by Sector in Selected Countries, 2000

Country	Final Consumption (TJ)	Breakdown by Sector (%)			
		Residential	Industry	Commercial and Public Services	Agriculture and Other
Belarus	243,023	40.6	36.5	3.9	19.0
Bulgaria	36,819	57.7	30.9	11.0	0.3
Denmark	94,124	62.9	7.3	27.8	2.0
Estonia	21,414	73.6	8.6	17.6	0.2
Finland	116,408	45.9	26.3	0.0	27.8
Hungary	60,294	46.4	35.4	18.2	0.0
Latvia	24,707	74.5	2.7	22.6	0.2
Lithuania	30,349	66.7	8.5	23.2	1.6
Poland	288,312	71.1	21.1	7.5	0.3
Romania	149,463	72.8	13.1	0.0	14.0
Russia	5,727,572	50.4	36.8	9.7	3.2
Slovak Republic	23,024	65.2***	3.2	29.7***	1.9***
Slovenia	8,181	80.9	13.4	5.7	0.0

*** *Estimated data*

Table A.I.7

Heat Consumption and Breakdown by Sector in Selected Countries, 1995

Country	Final Consumption (TJ)	Breakdown by Sector (%)			
		Residential	Industry	Commercial and Public Services	Agriculture and Other
Belarus	258,369	47.1	41.4	0.0	11.4
Bulgaria	117,164	21.1	69.9	1.0	8.0
Denmark	94,145	65.2	4.9	28.1	1.9
Estonia	24,830	87.7	6.8	5.5	0.0
Finland	89,028	55.7	10.4	0.0	34.0
Hungary	53,896	60.4	7.8	31.6	0.2
Latvia	36,740	68.8	12.0	18.9	0.2
Lithuania	47,723	71.5	10.4	17.3	0.9
Poland	369,156	72.3	21.1	6.2	0.4
Romania	195,896	54.8	26.8	0.0	18.3
Russia	7,198,200	44.4	42.6	8.3	4.6
Slovak Republic	27,381	54.3	4.5	37.7	3.5
Slovenia	8,021	59.1	15.0	25.9	0.0

Heat Statistics: IEA Methodology

IEA collects statistics for heat production by heat source and fuel type, and for heat consumption by sector. Heat data are usually expressed in terajoules (TJ), where one TJ is equal to 238.8 Gcal.

Heat Production

Heat production refers to all heat produced in heat plants, cogeneration or CHP plants, heat pumps, electric boilers, and other sources of heat sold to third parties. Thus, for all practical purposes, these statistics show heat production for district heating. The heat production data do not include heat produced by industry, commercial and public services, households and others for their own use. For example, heat produced by households for space heating or heat produced by industry to support manufacturing processes are not included. In these cases, the related fuel consumption is reported in final consumption of households or industry, and not in heat generation.

Gross heat production is the total heat produced by the installation and includes own use by heat-only and CHP plants.

Own use by heat-only and CHP plants is the heat used by the installations' auxiliary equipment, which use a hot fluid (space heating, liquid fuel heating, etc.) and losses in the installation and network heat exchanges.

Net heat production is the heat supplied to the distribution system as determined from measurements of the outgoing and return flows. It is equal to gross heat production minus own use by heat-only and CHP plants. For autoproducers,[1] heat used by the undertaking for its own processes is not included here; thus only heat sold to third parties is reported. As only heat sold to third parties is reported, gross heat production for autoproducers will be equal to net heat production.

Heat-only plants refer to plants (including heat pumps and electric boilers) designed to produce heat only and which sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. They could be both public[2] and autoproducer plants.

1. *Autoproducer plants refer to plants which generate heat for their own use in support of their primary activity. They may be privately or publicly owned. It should be noted that all heat production from public CHP and public heat plants is reported while heat production by autoproducer CHP and autoproducer heat comprises only the heat sold to third parties. Therefore, heat consumed by autoproducers is not included.*
2. *Public plants refer to plants which generate heat for sale to third parties as their primary activity. They may be privately or publicly owned. The sale need not take place through the public grid.*

Combined heat and power plants (CHP) refer to plants which are designed to produce both heat and electricity. Sometimes these are also referred as cogeneration plants. They could be both public and autoproducer plants. For autoproducer's CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs for heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer's establishment are not included, but are included with figures for the final consumption of fuels in the appropriate consuming sector.

Heat pumps, electric boilers and other sources of heat shows the heat output from these sources where the heat is sold to third parties. Other sources of heat comprise heat produced from non-specified fuels or waste heat recovered from industrial processes. Unfortunately, so far countries have not used the category heat output from non-specified fuels to report waste heat, so there are effectively no data on waste heat production.

- **Heat Consumption**

Final consumption of heat includes consumption in industry, agriculture, commercial and public sectors, households and other non specified end-use sectors. It excludes own use of heat by the heat and CHP plants, consumption by the energy industry and distribution losses.

Consumption in the energy sector includes energy consumption for coal mining, oil and gas extraction, petroleum refineries, patent fuel plants, coke ovens, gas works, blast furnaces, brown coal briquette (BKB) plants, liquefaction plants, gasification plants, charcoal production plants, nuclear plants and other non-specified transformation processes.

Heat distribution losses refer to losses that occur during transport and distribution, thus excluding losses during the process of transforming fuel into heat. It may include unaccounted use of heat in any of the final consumption sectors.

Data Quality Considerations

Reliable statistics are extremely important for making the right policy decisions. Policy decisions should rely on solid analysis of the past and present situation, and for such an analysis, consistent, high-quality data are vital. However, many transition countries still have a long way to go toward improving the quality of the heat statistics they collect. This should become a bigger government priority.

Considerable effort has been made to ensure that data presented comply with the IEA definitions contained in the general notes of the statistical publications. These definitions are used by most international organisations that collect energy statistics. Nevertheless, the national energy statistics that are reported to international organisations are often collected using criteria and definitions which differ, sometimes considerably, from those employed by international organisations. The data have been consequently adjusted to meet international definitions to the extent to which the IEA Secretariat has identified these differences.

In addition to any adjustments made to compensate for differences in definitions, estimations are sometimes required to complete major aggregates from which key statistics are missing. This entails providing the elements of supply as well as inputs of primary fuels. This has often required estimations prepared after consultation with national statistical offices, ministries of energy, energy industry and national energy experts.

Commodity balances for the republics of the former Soviet Union have been constructed since 1992. These balances have been constructed from official data and, where necessary, estimates have been calculated based on information obtained from industry sources and other international organisations. Energy statistics for some countries undergo continuous changes in their coverage or methodology. Consequently, "breaks in series" are considered to be unavoidable. The IEA Secretariat reviews its databases each year. In the light of new assessments, important revisions are made to the time series of individual countries.

National statistical accounts often lack adequate information on the consumption of fuels in different categories of end use. Many countries do not conduct annual surveys of fuel consumption in the main economic sectors and consequently published data are based on out-dated surveys. Sectoral disaggregation of consumption for individual countries should therefore be interpreted with caution.

Before the reforms of the 1990s, sectoral classification of fuel consumption in the transition economies differed greatly from that practised in market economies. Sectoral consumption was defined according to the economic branch to which the user of the fuel belonged rather than according to the purpose or use of the fuel. Where possible, the data have been adjusted to fit international classifications. Nonetheless, it has not been possible to reclassify all products.

ANNEX II: DISTRICT HEATING POLICY BY COUNTRY

Table A.II.1

District Heating Policies in Selected Transition Economies and OECD Countries, 2004

Policies / Countries	Tariffs Regulated?[1]	Residential Tariffs or Prices Cover Current/Investment Costs?[2]	Legal Basis for Zoning?[3]	Multi-utilities Exist?[4]	Heat Source Competition Allowed?[5]	Regulation of Wholesale Competition?[6]
Belarus	Yes	Yes*/no	No	No	No	No
Bulgaria	Yes	Yes/no	No	No	Yes	No
Canada	No	Yes/yes	No	No*	Yes	No
Czech Republic	Yes	Yes/yes*	No	No*	Yes	No
Denmark	Yes	Yes/yes	Yes	Yes	No*	Yes
Estonia	Yes	Yes/not always	Yes	No*	Yes, limited	No
Finland	No	Yes/yes	No	No*	Yes	No
Germany	No	Yes/yes	No	Yes	Yes, limited	No
Hungary	Yes	Yes/not always	No	No	Yes, some barriers	Yes
Kazakhstan	Yes	Not always/no	No	No*	Yes, limited	No
Korea	Yes	Yes/yes	Yes	No	No*	n.a.
Latvia	Yes	Yes/not always	Yes	No	Yes*	Yes
Lithuania	Yes	Yes/not always	Yes	No	Yes	Yes
Netherlands	Yes	Yes/yes*	No	Yes, some	Yes	n.a.
Norway	Yes	Yes/yes	Yes, some	No	Yes*	No
Poland	Yes	Yes*/not always	No	No	Yes	Yes
Romania	Yes	Not always/no	No	Yes	Yes	Yes
Russia	Yes	No*/no	No	Yes	No*	No

Policies / Countries	Tariffs Regulated?[1]	Residential Tariffs or Prices Cover Current/Investment Costs?[2]	Legal Basis for Zoning?[3]	Multi-utilities Exist?[4]	Heat Source Competition Allowed?[5]	Regulation of Wholesale Competition?[6]
Sweden	No	Yes/yes	No	Yes, some	Yes	Under consideration
Switzerland	Yes	Yes/no*	Yes, in municipal laws	Yes	Yes	No
Ukraine	Yes	Not always/no	No	Yes	Limited	No
U.K.	No	Yes/usually	No	Yes	Yes	No
U.S.	Varies[7]	Yes/yes	No	Yes	Yes	No

Notes: The table reflects the situation as of mid-2004 to the best of the authors' knowledge. It shows the general trends in national policies, but there may be exceptions in some localities.

**: In most cases.*

n.a.: information not available

1. ***Tariffs regulated.*** Yes*: a national, regional or local regulator approves tariffs.* No*: heat prices are set by the market.*

2. ***Current costs*** *means the costs of operation and minor repairs.* ***Investment costs*** *means the costs of major rehabilitation/upgrade investments. Occasional or targeted subsidies for envionmental upgrades or cogeneration not considered here. In some cases, experts within a country may not agree on the extent of cost coverage and in these cases, the table indicates that not all costs are covered.*

3. ***Legal basis for zoning*** *means that there are legal/regulatory provisions allowing (or requiring) municipalities to establish zones where only one heat source is allowed (for example district heating or gas).*

4. ***Multi-utilities*** *means large public or private utilities that provide multiple energy services such as electricity, gas and heat. This is an indication of whether heat source competition exists.*

5. ***Heat source competition allowed*** *means that there are no major impediments to customers selecting between various heat sources. In some cases, the choice will be offered by the same company, so the competition is in name only.*

6. ***Regulation of wholesale competition*** *means that there are special regulations regarding purchase of heat from different sources. In many cases,* Yes *simply indicates that there are requirements to purchase heat from third parties when this heat is least-cost (often such requirements focus on heat from environmentally friendly sources). In other cases,* Yes *represents more detailed rules on unbundling or non-discriminatory transmission tariffs.* No *means that there are no formal rules governing wholesale competition, not that there is no wholesale purchase of heat from third parties. In some cases, regulations exist even when there is very little if any wholesale competition (for example, in Romania).*

7. Some older district heating *systems in the U.S., such as the system serving New York City, are regulated by state public utility commissions. Tariffs are not regulated in newer district energy systems.*

Sources: IEA Secretariat based on correspondence with experts in different countries and sources listed in the bibliography.

LIST OF ABBREVIATIONS

ANRE	Electricity and Heat Regulatory Authority (Romania)
ASE	Alliance to Save Energy
BASREC	Baltic Sea Region Energy Co-operation
BOO	Build-own-operate
BOT	Build-operate-transfer
CDM	Clean development mechanism (under the Kyoto Protocol)
CEE	Central and Eastern Europe
CENEf	Center for Energy Efficiency (based in Moscow)
CHP	Combined heat and power
CIS	Commonwealth of Independent States
DBDH	Danish Board of District Heating
DSM	Demand-side management
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ERU	Energy Regulatory Authority (the Czech Republic)
ESCO	Energy service company
EU	European Union
EU-15	The first fifteen countries to join the EU: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom
EUROSTAT	Statistical office of the European Commission
FSU	Former Soviet Union
GDP	Gross domestic product
GEF	Global Environment Facility
GJ	Gigajoule
GWh	Gigawatt-hour
HCS	Housing and communal services companies
IA DHC	Implementing Agreement on District Heating and Cooling and Combined Heat and Power

IEA	International Energy Agency. Member Countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States
IET	International emission trading
IMF	International Monetary Fund
JI	Joint implementation (under the Kyoto Protocol)
KAPE	National Energy Conservation Agency (Poland)
KWh	Kilowatt-hour
MEH	Hungarian Energy Office
Mtoe	Million tonnes of oil equivalent
MUNEE	Municipal Network for Energy Efficiency (sponsored by USAID and the United Nations Economic Commission for Europe, and managed by the Alliance to Save Energy)
MW	Megawatt
NEFCO	Nordic Environment Finance Corporation
NIB	Nordic Investment Bank
OECD	Organisation for Economic Co-operation and Development
OPET	Organisations for the Promotion of Energy Technologies, a network sponsored by the European Commission
PEEREA	Protocol on Energy Efficiency and Related Environmental Aspects (under the Energy Charter Treaty)
PHARE	Poland, Hungary Assistance for the Reconstruction of the Economy (a European Commission technical assistance programme for new EU members and accession countries)
PJ	Petajoule
PPP	Purchasing power parity
RKS	Russian Communal Systems (a communal services company)
RPI-X	Retail price index minus efficiency index (a type of tariff regulation)
SEVEn	Středisko pro efektivní využívání energie (the Czech Energy Efficiency Center)

TACIS	Technical Assistance to the Commonwealth of Independent States, a programme of the European Commission
TFC	Total final consumption
TPES	Total primary energy supply
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VAT	Value-added tax

Currency note: The symbol € means euro, $ means U.S. dollar, £ means British pound. Other currencies are spelled out, for example, Czech crowns.

BIBLIOGRAPHY

Albon, R. (2000), "Incentive Regulation, Benchmarking and Utility Performance", discussion paper for the *Utility Regulators' Forum*, Australian Competition and Consumer Commission, Adelaide, www.accc.gov.au/content/index.phtml/itemId/3744.

Andreev, G. (2004), Information for IEA (International Energy Agency) Conference on *District Heating Policy in Transition Economies*, 23-24 February, IEA, Prague.

ANRE (Romanian Electricity and Heat Regulatory Authority) (2003), *Annual Report 2002*, ANRE, Bucharest.

APER (Romanian Energy Policy Association) (2003), *APER Info Romania,* December issue, APER, Bucharest.

Bashmakov, I. (2004), Presentation at IEA Conference on *District Heating Policy in Transition Economies*, 23-24 February, IEA, Prague.

Brendow, K. (2003), "Restructuring District Heating and Cogeneration in Economies in Transition: Toward Local Energy Systems", *Towards Local Energy Systems: Revitalizing District Heating and Co-generation in Central and Eastern Europe,* WEC (World Energy Council), London.

Cherubin, W. (2003), *DH Sector Development Need Report – Poland,* OPET (Organisation for the Promotion of Energy Technologies), European Commission, Brussels and Warsaw.

COGEN Europe (European Association for the Promotion of Cogeneration) (2001), *The Future of CHP in the European Market – The European Cogeneration Study,* COGEN Europe, Brussels.

Constantinescu, N. (2003), *The DCH Sector – Challenges and Opportunities in Central and Eastern Europe,* Euroheat and Power and OPET, Brussels.

CTI (Climate Technology Initiative) (2003), *Guide to Working with Energy Service Companies in Central Europe,* CTI/IEA, Paris.

CTR (Metropolitan Copenhagen Heating Transmission Company) (2003), *CTR 2002 Annual Report*, CTR, Copenhagen.

Danish Board of District Heating (DBDH) (2003), *Development* [of the Danish district heating system], DBDH, Copenhagen, www.dbdh.dk/dkmap/development.html.

Danish Energy Authority (2002), *Political Agreements: Heating*, Danish Energy Authority, www.ens.dk/sw 1080.asp.

DHCAN (District Heating in Candidate Countries) (2003), *Debrecen Case Study*, BRE and Euroheat and Power, Watford, U.K. and Brussels.

Doroshin, G. (2004), "Kazakhstan: District Heating and Energy Efficiency", presentation at the *UNDP/GEF Heating and Hot Water Workshop*, 25-26 February, UNDP/GEF (United Nations Development Programme/Global Environment Facility), Prague.

EGI Contracting/Engineering (2002), *Third Party Financing and Municipal Utility Restructuring*, MUNEE (Municipal Network for Energy Efficiency)/Alliance to Save Energy, Washington, DC.

EGU (Energy Institute) (2003), *Report on Electricity and Regulation in the Slovak Republic: Country Report*, Bratislava.

Ekodoma (2003), *Developments of the DH/CHP Sectors in CEEC. Phase 1 – Policy Level Latvia,* OPET, European Commission, Riga and Brussels.

Elleris, J. (2003), "Maximal Utilization of the Market Forces in the Heat Sector", *News from Danish Board of District Heating,* DBDH, Taastrup, Denmark.

Energy Charter Secretariat (2003), *Third Party Financing: Achieving its Potential,* Energy Charter Secretariat, Brussels.

ESMAP (Energy Sector Management Assistance Program) (2003), *Private Sector Participation in Market-Based Energy Efficiency Financing Schemes: Lessons Learned from Romania and International Experiences*, Report 274/03, World Bank, Washington, DC.

Euroheat and Power (2001), *District Heat in Europe: Country by Country, 2001 Survey*, Euroheat and Power, Brussels.

Euroheat and Power (2003), *District Heat in Europe: Country by Country, 2003 Survey*, Euroheat and Power, Brussels.

Euroheat and Power (2004a), "District Heating and CHP in Lithuania: Present Situation and Privatisation Process in the District Heat Sector", *Euroheat and Power*, Issue II/2004, Euroheat and Power, Brussels.

Euroheat and Power (2004b), "Successful Joint Implementation Project", *Euroheat and Power*, Issue 1/2004, Euroheat and Power, Brussels.

European Commission (2004), "Proposal for a Directive of the European Parliament and of the Council on Energy End-use Efficiency and Energy Services", European Commission, Brussels, http://europa.eu.int/comm/energy/en/fa_2_en.htm.

European Parliament and Council (2003), "Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on Energy", *Official Journal of the European Union*, L. 1, Vol. 65, 04/01/2003, European Parliament and Council, Brussels.

European Parliament and Council (2004), "Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the Promotion of Cogeneration Based on a Useful Heat Demand in the Internal Energy Market and Amending Directive 92/42/EEC", *Official Journal of the European Union*, L. 52, Vol. 47, 21/2/2004, European Parliament and Council, Brussels.

Evans, M. (2000), *Tapping the Potential for Energy Efficiency: the Role of ESCOs in the Czech Republic, Ukraine and Russia,* Pacific Northwest National Laboratory, Richland, WA, USA.

FER (Non-Commercial Foundation for Enterprise Restructuring and Danish Board of District Heating Financial Institutions Development) (2004), *World Bank Enterprise Housing Divestiture Project*, FER, Moscow, www.fer.ru/ehdp/english/.

Finnish District Heating Association (2003), *District Heating in Finland 2001*, Finnish District Heating Association, Helsinki.

FVB/SwedPower (2001), *Strategic Heating Options for Moldova*, Section 11 – Economic Analysis, Final Report, April, FVB/SwedPower, Västerås and Stockholm.

Gatautis, R. (2004), *Regulation and Competition in the Lithuanian District Heating Sector*, Lithuanian Energy Institute, Kaunas, Lithuania.

Gochenour, C. (2001), *District Energy Trends, Issues, and Opportunities. The Role of the World Bank,* Technical Paper No. 493, World Bank, Washington, DC.

Gochenour, C. (2003), *Regulation of Heat and Electricity Produced in Combined Heat and Power Plants*, World Bank, Washington, DC.

Greim, A. (2004), Presentation at IEA Conference on *District Heating Policy in Transition Economies*, 23-24 February, IEA, Prague.

Grohnheit, P. E. and B.O. Gram Mortensen (2003), "Competition in the Market for Space Heating. District Heating as the Infrastructure for Competition Among Fuels and Technologies", *Energy Policy,* Vol. 31, Issue 9, Elsevier, Oxford.

Gunnarsdottir, M. J., H. Juhler, H. Koivisto, B. Lauersenn and R. Staalebrant (2002), "More DHC/CHP Reduces Climate Problem", *Energy and Environment*, Multi-Science, Brentwood Essex, UK, Vol. 13, Nos. 4 & 5.

Heat Supply News (2003a), "[illegible]" (Heat Supply of the Russian Federation in Figures), *Heat Supply News,* February 2003, Heat Supply News, Moscow.

Heat Supply News (2003b), "[illegible]" ("Proceedings of the All-Russian Conference on the Problems of Heat Supply"), 22-23 May 2003, *Heat Supply News*, Heat Supply News, Moscow, www.ntsn.ru/doclad.html.

Hein Nybroe, M (2001), "DSM in Denmark after Liberalisation", Proceedings of ECEEE Summer Study, 11-16 June, ECEEE, Mandelieu, France, www.eceee.org/library_links/proceedings/2001/pdf2001/panel5/01p5_5_046pg.pdf.

IEA (International Energy Agency) (1996), *Energy Policies of Ukraine,* IEA/OECD, Paris.

IEA (1999), *Energy Policy Review: Finland,* IEA/OECD, Paris.

IEA (2001a), *Competition in Electricity Markets*, IEA/OECD, Paris.

IEA (2001b), *Regulatory Institutions in Liberalised Electricity Markets*, IEA/OECD, Paris.

IEA (2002), *World Energy Outlook*, IEA/OECD, Paris.

IEA (2004), *World Energy Outlook*, IEA/OECD, Paris (forthcoming October).

IMF (International Monetary Fund) (2004), *IMF Reviews Romania's Performance Under Past Fund-Supported Programs*, IMF, Washington, DC, www.imf.org/external/np/sec/pn/2004/pn0444.htm.

Institute of Urban Economics (2003), *Practice of Reform of Housing and Communal Services Sector*, Institute of Urban Economics, Moscow.

IPA Energy Consulting (2003), "Electricity Affordability and Energy Policy", *South East Europe Power Sector Affordability*, IPA Energy Consulting, Edinburgh, www.ipaenergy.co.uk/seeurope/.

ISPE (Institute for Studies and Power Engineering) (2003), *Development of the DH/CHP Sectors in Romania: District Heating Level,* OPET, European Commission, Bucharest and Brussels.

ISPE (2004), *Improving CHP/DHC Systems in CEEC – Report on CHP/DHC Policy and Recommended Measures (Romania),* OPET, European Commission, Bucharest and Brussels.

Kalkum, B. and A. Rajkiewicz (2002), *Moldova Heating Sector Development Project (Phase I)*, draft final report, USAID/Alliance to Save Energy, Chisinau and Washington, DC.

Karnitas, E. (2003), "Latvia's Energy Sector: General Regulatory Situation", Public Utilities Commission of Latvia, Riga, www.sprk.gov.lv/doc_upl/Latvia_-_General_situation.pps.

Kostama, J. (2003), *District Heating and Cooling: Business Function or Public Service?*, Finnish District Heating Association, Helsinki.

Lampietti, J.A. and A.S. Meyer (2002), *Coping with Cold: Heating Strategies for Eastern Europe and Central Asia's Urban Poor*, World Bank, Washington, DC.

Lillis, K. (1997), *Electricity Reform Abroad and US Investment,* Energy Information Administration, U.S. Department of Energy, Washington, DC.

Loesoenen, P. (2003), *Combined Heat and Power (CHP) Statistics in the EU, 2000,* EUROSTAT, Brussels.

Manczyk, H. and M. Leach (1998), *Combined Heat and Power Generation and District Heating in Denmark: History, Goals and Technology*, District Energy Library, University of Rochester, Rochester, New York, www.energy.rochester.edu/dk.

Maslichenko, S., P. Oppenheimer, R. Stoneman and S. Zlobin (2004), *Policies for Reforming the Heating and Hot Water Sub-Sector in Russia*, interim report, OTAC and ECORYS-NEI, Blackmoor, UK.

Matthies, J. and C. Thielemans (2003), "Restructuring and Privatising DH/CHP Industries in CEE: the Experience Gained by MVV Energie AG", *Towards Local Energy Systems: Revitalizing District Heating and Co-generation in Central and Eastern Europe*, WEC, London.

Melnikova, M. (2004), Presentation at the IEA Conference on *District Heating Policy in Transition Economies*, 23-24 February, IEA, Prague.

Meyer, A. and W. Mostert (2000), *Increasing the Efficiency of Heating Systems in Central and Eastern Europe and the Former Soviet Union*, ESMAP Report No. 234, World Bank, Washington, DC.

Minister for Economic and Business Affairs (2003), *Energy Policy Statement 2003*, Danish Energy Authority, Copenhagen.

Ministry of Fuel and Energy of Ukraine (2004), *[illegible] 2003 [illegible]* (Summary of Results of Work in the Fuel-Energy Complex in 2003), Ministry of Fuel and Energy of Ukraine, Kiev, http://mpe.energy.gov.ua/minenergo/control/uk/publish/article?art_id=10000106192&cat_id=900005100334.

Ministry of Trade and Industry of Finland (2003), *The Challenges Facing Finland's Energy Policy*, Ministry of Trade and Industry of Finland, Helsinki, www.ktm.fi/eng/3/esite/energypolicy.html.

Morin, A. (2003), "Signing Up or Selling Out? Polish Systems Partner with Private Sector", *District Energy Magazine*, Vol. 89, No. 1, International District Energy Association, Westborough, MA, USA.

Morin, A. (2004), "Private Sector Participation in District Heating and Communal Service Sectors of Central and Southeastern Europe: Lessons Learned in Energy Efficiency and Management", paper for *District Heating Days* Conference, Association for District Heating of the Czech Republic, Hradec Králové, Czech Republic.

MUNEE (2004), *Country Programs: Serbia*, MUNEE/ASE, Washington, DC, www.munee.org/go.idecs?i=8.

Nuorkivi, A. (2002), *Institutional Handbook for Combined Heat and Power Production with District Heating*, BASREC (Baltic Sea Regional Energy Cooperation), Stockholm.

OECD (Organisation for Economic Co-operation and Development) (2004), *Key Issues of Tariff Reform in the Water Sector in the EECCA*, OECD, Paris.

Oniszk-Poplawska, A. (2003), *Latvia*, EC Baltic Renewable Centre, Warsaw.

OPET (Organisation for the Promotion of Energy Technologies) (2003), "Directive on Promotion of Cogeneration Based on a Useful Heat Demand in the Internal Energy Market (2004/8/EC)", OPET, European Commission, Brussels, www.opet-chp.net/chpdirective.asp.

PADCO (Planning and Development Collaborative International) (2002), *Options for Private Sector Participation in the Communal Services Sector in Ukraine,* PADCO/USAID, Kiev,
http://tariffreform.padco.kiev.ua/eng/PROJECT/project-e.html.

Peltola, P. (2004), *Pricing of District Heating and Abuse of Dominance in Finland*, University of Joensuu, Merimasku, Finland.

Petersen, E. (1996), *Development of Danish District Heating*, District Energy Library, University of Rochester, Rochester, NY,
www.energy.rochester.edu/dk.

PROCHP (Promoting CHP in the Framework of East-West Energy Partnership) (2002a), *Task 2 – Czech Republic*, SAVE, Brussels, www.prochp.com/Legal Aspects/legal_aspects_related_to_chp_in_czechrepublic.pdf.

PROCHP (2002b), *Task 2 – Poland*, SAVE, Brussels, www.prochp.com.

PROCHP (2003), *Promoting CHP in the Liberalised Energy Markets*, SAVE, Brussels, www.prochp.com/index_html.

PROCHP (2004), *Czech Republic: CHP in a Liberalised Market*, SAVE, Brussels, www.prochp.com.

Rabinovich, S. (2002), "Heat Supply", unpublished paper, KEGOC (Kazakhstani Electric Grid Company), Almaty.

Russian Ministry of Energy (2003), [illegible] (Concept of the Heat Sector Development in Russia, Including Communal Energy Services in the Medium Term), Russian Ministry of Energy, Moscow.

SEVEn (The Czech Energy Efficiency Center) (2003), *District Heating in the Czech Republic,* SEVEn, Prague.

Silvonen, S. and T. Mäkelä (1997), "Combined Heat and Power Production in Finland", ECEEE (European Council for an Energy-Efficient Economy) Summer Study, 9-14 June, ECEEE, Spindleruv Mlyn, Czech Republic.

Soosar, S. (2003), *Development of CEEC DH Systems. Phase 1 – Policy Level – Estonia*, Estonian Energy Research Institute and OPET, European Commission, Tallinn and Brussels.

SYNERGY (2001), *Renewing District Heating Systems in the Baltic Sea Region*, SYNERGY DG XVII/A4/99-06, Final Report, May, SYNERGY, European Commission, Brussels.

Tangen, K. et al. (2002), *A Russian Green Investment Scheme,* Climate Strategies, Brussels, www.climate-strategies.org/gisfinalreport.pdf.

Transparency International (2003), *Corruption Perceptions Index 2002*, Transparency International, Berlin.

UNFCCC Secretariat (2002), *A Guide to the Climate Change Convention and Its Kyoto Protocol,* UNFCCC Secretariat, Bonn, http://unfccc.int.

UNDP/GEF (United Nations Development Programme/Global Environment Facility) (2000), *Problems in Municipal Heat Supply: Results of Sociological Survey*, UNDP/GEF, Yerevan.

UNDP (2004), *Lessons Learned from Heating Sector Projects in the Countries with Economies in Transition,* UNDP, Bratislava (forthcoming).

UNEP/IEA (United Nations Environment Program/International Energy Agency) (2002), *Reforming Energy Subsidies,* UNEP and OECD/IEA, Paris.

Velody, M. (2004), "UNDP/GEF's Present Role in the Romanian District Heating Sector", presentation at *UNDP/GEF Heating and Hot Water Workshop*, 25-26 February, UNDP/GEF, Prague.

Volkova, E. et al. (2002), *The ENERGO21 Forecast of Russia's Electrical Power Industry Development*, The Energy Research Institute, Moscow.

WEC (World Energy Council) (2003), *Towards Local Energy Systems: Revitalising District Heating and Co-generation in Central and Eastern Europe*, WEC, London.

WEC (2004), *Regulating District Heating and Cogeneration in Central and Eastern Europe*, WEC, London.

Werner, S., M. Spurr and C. Pout (2002), *Promotion and Recognition of DHC and CHP Benefits in Greenhouse Gas Policy and Trading Programs",* IEA District Heating and Cooling Implementing Agreement, Göteborg.

Westin, P. and F. Lagergren (2002), "Re-regulating district heating in Sweden", *Energy Policy*, Vol. 30, Issue 7, Elsevier, Oxford.

World Bank (2000), *Maintaining Utility Services for the Poor: Policies and Practices in Central and Eastern Europe and the Former Soviet Union,* World Bank, Washington, DC.

World Bank (2002), *Heat Metering and Billing: Technical Options, Policies and Regulations. Chinese Demonstration Projects and International Experiences*, World Bank, Beijing.

World Bank (2003), *Armenia Urban Heating,* Project Concept Document, World Bank, Washington, DC.

Zeman, J. and S. Werner (2004), *District Heating and Ownership Guide*, DHCAN portfolio, BRE and Euroheat and Power Watford, UK and Brussels, www.euroheat.org/workgroup4/index.htm or http://projects.bre.co.uk/DHCAN/.

IEA PUBLICATIONS, 9, rue de la Fédération, 75739 PARIS CEDEX 15
PRINTED IN FRANCE BY STEDI
(61 2004 26 1P1) ISBN 92-64-10819X - 2004