International Energy Agency

Estonia 2013

Energy Policies Beyond IEA Countries

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Beyond IEA Countries

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One of the fastest-growing economies in the OECD, Estonia is actively seeking to reduce the intensity of its energy system. Many of these efforts are focused on oil shale, which the country has been using for almost a century and which meets 70% of its energy demand. While it provides a large degree of energy security, oil shale is highly carbon-intensive. The government is seeking to lessen the negative environmental impact by phasing out old power plants and developing new technologies to reduce significantly CO_2 emissions.

The efforts on oil shale complement Estonia's solid track record of modernising its overall energy system. Since restoring its independence in 1991, Estonia has fully liberalised its electricity and gas markets and attained most national energy policy targets and commitments for 2020. It has also started preparing its energy strategy to 2030, with an outlook to 2050. Estonia is also promoting energy market integration with neighbouring EU member states. The strengthening of the Baltic electricity market and its timely integration with the Nordic market, as well as the establishment of a regional gas market, are therefore key priorities for Estonia.

Following its accession to the Organisation for Economic Co-operation and Development (OECD) in 2010, Estonia applied for International Energy Agency (IEA) membership in 2011. This review of Estonia's energy policies is part of the IEA accession process. It analyses the energy policy challenges and opportunities facing Estonia, and provides critiques and recommendations for future policy improvements. It is intended to guide the country towards a more secure and sustainable energy future.

9 789264 190795
(61 2013 04 1P1)
ISSN 2307-0897
978-92-6419079-5 €75

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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Netherlands
New Zealand
Norway
Poland
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Sweden
Switzerland
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United Kingdom
United States

The European Commission also participates in the work of the IEA.

International Energy Agency

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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

In the last decade, Estonia has achieved one of the highest medium-term growth rates in the Organisation for Economic Co-operation and Development (OECD), accompanied by rapid improvements in living standards. Following the very deep recession that started in 2008 and continued until early 2010, Estonia's market-based, open economy quickly returned to growth and by 2011 it was one of the OECD's strongest economic performers. Growth slowed in 2012 but is expected to increase in 2013. The country's economic fundamentals remain strong: public finances are robust, there is little public debt; the labour market remains flexible; regulations are business-friendly; the banks are well capitalised and public institutions are strong.

In the energy sector, the Ministry of Economic Affairs and Communications (MEAC) has lead responsibility for the development of energy policy and the current National Development Plan of the Energy Sector until 2020, adopted by the Riigikogu (parliament) in June 2009, co-ordinates the implementation of energy sector-specific acts and regulations. The government has also developed similar plans for the electricity sector, oil shale production, biomass and bioenergy, and energy conservation. At present, the ministry started reviewing this National Development Plan, with the intention of extending it until 2030 and adding an outlook to 2050.

Estonia is unique among European Union (EU) member states in that its energy sector is dominated by one primary source of energy, oil shale. The country is one of the largest producers of oil shale in the world and its domestic energy sector relies heavily on this source, from which the bulk of its electricity is produced. The present State Development Plan for the use of oil shale gives preference to the production of electricity from oil shale, and in 2012, 70% of total primary energy supply was derived from this indigenous energy source. Conversely, almost 80% of the country's greenhouse gas (GHG) emissions come from oil shale combustion at the state-owned Eesti Energia's Narva power plants and it is the largest driver of the high carbon intensity of the economy.

The country is largely self-sufficient in energy terms and is able to meet its electricity and heat needs from domestic sources. The use of oil shale reserves for heat and electricity production provides Estonia with a level of energy autonomy, but oil shale transformation to electricity and heat is by its nature carbon dioxide (CO_2) intensive and thus raises questions of long-term sustainability. Over the longer term, the Estonian government is examining measures aimed at reducing the use of oil shale for electricity production and increasing production of shale oil, which may bring measurable economic benefits and diversify energy supply.

The government's policy priority is to reduce the carbon intensity of the energy sector. Estonia clearly aspires to a more energy-efficient and sustainable economy. Estonia's National Energy Efficiency Action Plan (NEEAP) only covers the period 2007-13 and excludes energy used for transport from the country's final energy consumption. The

NEEAP set an energy savings target of 2.1 terawatt hours by 2016. The plan focuses on the more efficient use of fuels and calls for an investment of EUR 96 million by the end of 2013. In 2008, measures on the energy performance of buildings as well as a National Housing Development Plan for 2008-2013 were adopted. Energy efficiency labels for buildings have been mandatory since 1 January 2009.

Implementation of energy efficiency policy is spread across a number of ministries and institutions, including the MEAC, the Ministry of the Environment and, to a lesser extent, the Estonian Competition Authority. Two executive agencies, the Credit and Export Guarantee Fund (KredEx Fund) (in co-operation with local authorities) and the Environmental Investment Centre, act as implementing agencies of energy efficiency policy measures. The Estonian Development Fund also carries out related work. While the loan programme for the renovation of apartment buildings, implemented by the KredEx Fund in co-operation with the German Development Bank KfW Bankengruppe, has been very successful and delivered strong results, there is a need for greater continuity in support schemes and for moving away from the present stop-start approach.

Estonia's GHG emissions have roughly halved since 1990 and the country has reached its Kyoto target (8% emissions reduction from 1990 during the period 2008-12) by a wide margin. The country's focus is now on meeting 2020 targets: the EU Emissions Trading Scheme applies to around two-thirds of GHG emissions and three-quarters of CO_2 emissions in Estonia, and the EU Effort-Sharing Decision sets a +11% target for GHG emissions from the non-emissions trading sector from 2005 to 2020. Despite its commitment to the EU objectives for energy efficiency, Estonia's policy challenges and opportunities extend beyond the 2020 horizon of EU obligations. It is understood that Estonia aims to use the EU directives as a step on the way to shaping longer-term objectives and the government has started working on the energy strategy of Estonia to 2050.

Reforming energy markets and strengthening energy security

Since joining the European Union in 2004, the country has undertaken a significant programme of reforms in the electricity and natural gas markets. The EU Third Energy Package Directives have been fully transposed. The electricity sector has been liberalised and the country is now part of the Nord Pool wholesale market. A strong independent regulator, the Competition Authority, is in place and the transmission system operator, Elering, is investing in new infrastructure to strengthen regional electricity supply and an emerging Nordic-Baltic regional market. Over the longer term, the country plans to synchronise operation of the Estonian electricity system with the Central European electricity system.

In 2009, the three Baltic states of Latvia, Estonia and Lithuania committed to the development of an open and transparent Baltic electricity market and its integration into the Nordic electricity market in line with the relevant EU legislation. In June 2009, a Memorandum of Understanding on the Baltic Energy Market Interconnection Plan (BEMIP) was agreed by eight Baltic Sea member states. The BEMIP is a European Commission initiative to examine measures to connect Lithuania, Latvia and Estonia better to wider EU energy networks.

The main objective of the Memorandum is the creation of a fully functioning and integrated energy market supported by the necessary infrastructures in order to strengthen energy security in the Baltic Sea region. Effective interconnection of the Baltic region was identified as one of six priority projects on energy infrastructure in the Second Strategic Energy Review adopted by the European Commission in November 2008.

Participation of the three Baltic states in the EU internal market requires, among other things, full implementation of market rules and strengthening of existing infrastructure. In this regard, the European Commission is providing funding for the construction of two electricity interconnections (NordBalt connection between Lithuania and Sweden and EstLink II between Estonia and Finland) between the region and the Scandinavian Peninsula. The European Commission also supports an agreement with Russia and Belarus on the legal framework to operate the electricity networks of the Baltic member states.

In the natural gas market, the country remains isolated from most of the European Union, sharing connections with only nearby Latvia and Russia. The Estonian Parliament recently adopted a law, which requires ownership unbundling of transmission services from supply by 2015. At present, a single privately owned (the largest shareholder is Gazprom) company, Eesti Gaas, is in a dominant position providing gas transmission and distribution services. In 2011, its share of the retail market was 90% and all remaining volumes sold by others were purchased from Eesti Gaas. Estonia is 100% dependent on imported gas from a single supplier (Russia) while winter peak in gas demand is met by access to a storage facility in Latvia. The lack of a properly functioning gas market poses a significant risk in terms of security of supply.

While natural gas forms a relatively small part of Estonia's energy mix, around 10% of total energy supply, a strategic objective of the government is to reduce the share of oil shale in the energy mix over the medium term. One means of doing so will be to replace carbon-intensive oil shale-fired power plants with more efficient biomass-fired capacity, which will also support the expansion of renewable energy by introducing more flexibility into the electricity system. At present, the Estonian gas market is dependent on one source of gas for supply and is isolated from the EU natural gas market. The small size and monopolistic structure of its gas market makes infrastructure development plans and the decision-making process rather challenging.

Nonetheless, the European Council has established an ambitious programme to end the isolation of natural gas markets in the Baltic region by 2015. There is political will in the Baltic states to stimulate the further opening of gas markets through the development of regional interconnections. Estonia, alongside the other Baltic states, Finland, Poland, Germany, Denmark and Sweden, participates in several regional co-operation forums. Prospective projects currently under consideration include a liquefied natural gas (LNG) terminal in the Gulf of Finland, the Baltic-connector, intra-Baltic connections and the gas interconnector Poland-Lithuania (GIPL).

A study initiated by the European Union identified Estonia and Finland as the most suitable locations for a regional LNG terminal, which will satisfy regional demand at a cost of EUR 300 million to EUR 500 million. Estonia and its neighbours will face tough negotiations and decisions in the near future in order to reach agreement on required regional gas projects, including a regional LNG terminal.

Expanding renewable energy supply

Renewable energy provided 14.6% of Estonia’s energy supply in 2012, which is the tenth-highest share among the International Energy Agency (IEA) countries. The use of biomass in the heating sector represents the greatest use of renewable energy, providing approximately 70% of the heat produced. The country has significant biomass and wind potential, as well as opportunities for solar water heating. Its renewable energy policy is mainly driven by its obligation under the European Union’s Renewable Energy Directive to increase the share of renewables in gross inland energy consumption to 25% by 2020 from 16.6% in 2005 and to diversify energy supply. Estonia is on track to meeting this obligation.

Despite these significant achievements, renewable energy policy could be strengthened. The National Renewable Energy Action Plan, adopted in July 2010, sets the target for the share of renewables in electricity production at 17.6% by 2020. At present, Estonia supports renewable electricity by means of a premium added to the market price, and the amount of the subsidy does not depend on the market price of electricity. A recent government proposal aims to eliminate the risk of overcompensating generators (and consequent excessive burden on end-users) by capping the level of support as well as the amount of electricity that will receive support. If adopted, the proposal, which envisages applying the modified scheme to both new and existing installations, could undermine a fundamental objective of a renewable energy policy that is to provide certainty for investors.

A more ambitious, more forward-looking and more stable renewable energy policy would allow the country to go beyond EU-driven obligations and bring about significant environmental and societal benefits in addition to strengthening energy security while reducing costs, especially in the heating sector. Growth in renewable energy can also improve the balance of trade by freeing up domestic oil shale resources for export. Other EU member states could also benefit from Estonia's abundant renewable energy resources through co-operation mechanisms. The government should continue its efforts to encourage such co-operation.

Research, development and innovation are among the government's economic priorities. As a small country, Estonia relies on trade and foreign investment for technology uptake, but there remains a role for national research, development and demonstration (RD&D), too. Over the past decade, the country has strengthened its RD&D and innovation system through market-oriented reform and in recent years it has enjoyed one of the highest growth rates in gross domestic expenditure on RD&D among the OECD member countries. Clear objectives and technological priorities for RD&D are laid out in the Estonian Research, Development and Innovation Strategy 2007-2013 "Knowledge-based Estonia". Under the Strategy, six national programmes are outlined, energy technology being one of them.

The Estonian Energy Technology Programme is a co-operation programme involving research, business and the state to develop oil shale technologies and new energy resources, mainly renewable energy. Wisely, the government has narrowed down the focus to just a few technology areas. This is a rational approach for a country with limited resources. An area where a stronger focus could be considered, however, is efficiency-related RD&D, for example in buildings where a large potential for improvements remains.

Challenges and opportunities

The current review of the National Development Plan of the Energy Sector until 2020 presents Estonia with an opportunity to consolidate its recent progress and policy successes. The government has successfully identified key challenges that need to be addressed. These include delivering a secure energy supply, reducing the carbon intensity of the power sector, setting clear direction for oil shale mining and shale oil production, promoting development of the electricity and natural gas markets, and expanding renewable energy supply.[1]

1. See Boxes 2 and 3 for an outline of the difference between oil shale and shale oil.

Given the significant role that oil shale plays in the energy sector and the overall economic well-being of the country, the new energy strategy should aim to reduce the share of oil shale in the primary energy supply by implementing policies that increase the share of other energy sources such as renewable energy and natural gas; increase the efficiency of the existing oil shale-fired electricity generating fleet; and continue to promote research and development of oil shale technologies.

While the market price of shale oil is lower than that of crude oil in Europe, its production remains profitable at current market prices. Shale oil is generally used as heating oil (as a reserve fuel for gas supply disruption) and a component of special oil mixes, mainly for shipping and the navy. In recent years, shale oil producers have made significant investments in expanding mining, with further plans to increase shale oil production. Plans prepared by the producers suggest that shale oil production can more than double compared to 2011 levels by the end of the decade. Furthermore, in the context of GHG emissions reductions, reducing the production of electricity from oil shale in favour of the production of liquid fuels from the same oil shale would result in a lesser impact on the environment.

Within this context, limitations on mining, set to decrease further from the current cap of 20 million tonnes per year, do not allow the sector to comfortably meet Estonia's electricity needs and encourage much more profitable production of shale oil, other heavy fuel oil and retort gas. These limits should be reviewed taking into account the need to balance environmental concerns with the economic potential of the sector.

Policies and measures that strengthen energy security can be complemented by robust instruments to promote energy efficiency. Estonia has significant potential to reduce energy consumption in the buildings, district heating (DH) and transport sectors. The country should consider steps to restructure and integrate the various agencies and ministries delivering energy efficiency policies and programmes into one central unit. The implementation of government funding programmes for energy efficiency, climate change and DH support appears to be spread over different funding programmes that seem to be driven by donor criteria. This could lead to an overlap if consistent guiding principles are missing.

The relationship between the MEAC, the Ministry of the Environment and operational programmes should be reviewed to avoid operational overlaps and improve consistency. Estonia should consider creating an energy efficiency unit, which would be able to commission, research, evaluate and implement energy efficiency priorities, maximising efficiency of policy delivery, and reporting to the energy policy function in the MEAC. The latter should lead co-ordination of energy efficiency polices across government to ensure the required focus and operational clarity.

Given the dependence on DH in Estonia, there is a need for the country to remain on its current path of diversifying fuel supply for DH needs and increasing the heat generation efficiency with biomass and combined heat and power production plants. Besides utilising low-value energy resources that may have little other economic application, it will ensure that higher-quality energy resources will remain available for high-value domestic end-use applications or for export, but to capitalise on this opportunity requires serious effort on DH system policy and economics. New DH legislation should secure a stable regulatory framework to shift to a more economically and environmentally sustainable DH market. The new energy strategy should contain an effective and commercially sustainable DH policy built on sound economic regulations, complemented by market mechanisms.

Closer integration with EU energy markets is an important policy goal for Estonia and, given the small size of the domestic energy sector, a regional solution is required. To date the country has been an active participant in a number of forums such as the Baltic Sea Region Energy Co-operation and is a party to the BEMIP. This high level of co-operation and regional co-ordination has supported the development of new electricity interconnections in the region, a taskforce to identify a regional LNG terminal in the Eastern Baltic Sea, the long-term objective of synchronous interconnection of the Baltic states and support for the implementation of the regional nuclear power plant in Lithuania. Estonia must maintain structural co-operation at regional level and within existing European mechanisms, as well as with its neighbours in the east in order to enhance security of supply at reasonable cost.

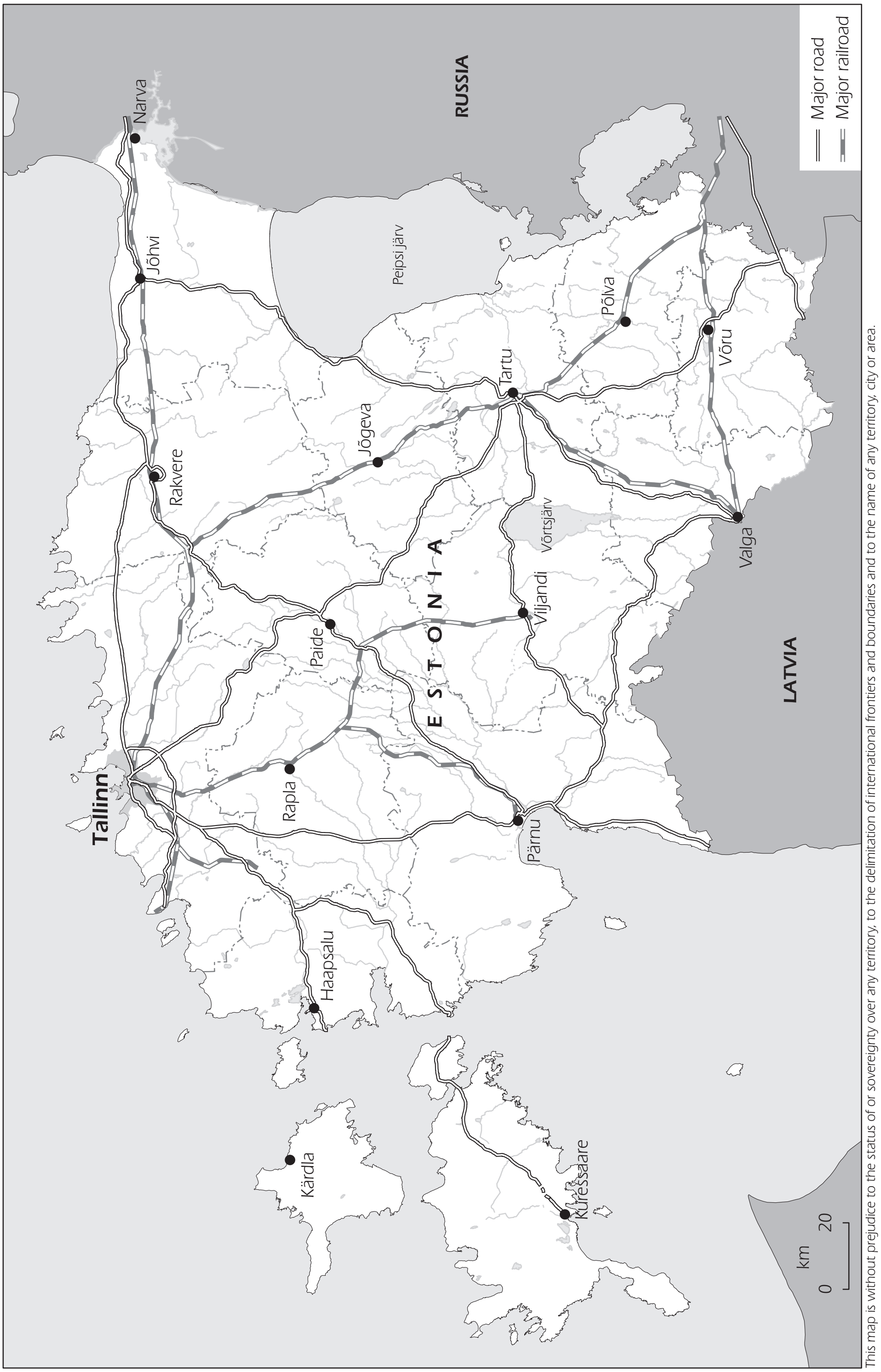
KEY RECOMMENDATIONS

The government of Estonia should:

- ☐ *In completing the new energy strategy, pursue policies that place a priority on securing long-term energy supply by reducing carbon intensity in the energy mix, on promoting a cost-efficient regional approach to natural gas supply, on developing new electricity infrastructure and on increasing the share of renewable energy resources in the supply mix.*
- ☐ *Consolidate existing energy efficiency activities into a single body with long-term funding and adequate capacity to improve the targeting, integration, effectiveness and profile of energy efficiency measures. Upgrading DH systems and the existing buildings stock should remain a high priority.*
- ☐ *Continue to strengthen relationships with neighbouring countries and international bodies to support regional harmonisation and co-ordination of energy policies, necessary for the integration of Estonia into the European and regional natural gas and electricity markets.*

PART I
POLICY ANALYSIS

Figure 1. **Map of the Republic of Estonia**



Note: km = kilometre.

Source: courtesy of MAA-AMET.

2. GENERAL ENERGY POLICY

Key data (2012 estimated)

Total primary energy supply (TPES): 5.7 million tonnes of oil-equivalent (Mtoe) (oil shale 70%, biofuels and waste 13.9%, natural gas 9.5%, oil 8.6%, other renewables 0.7%, peat 0.6%), +21.4% since 2002

TPES per capita: 4.3 tonnes of oil-equivalent (toe) (International Energy Agency [IEA] average: 4.5 toe)

TPES per gross domestic product (GDP): 0.23 toe per USD 1 000 gross domestic product at purchasing power parity (toe/USD 1 000 GDP PPP) (IEA average: 0.14 toe per USD 1 000 GDP PPP)

Total final consumption (TFC) (2011): 2.8 Mtoe (residential 32.8%, transport 26.3%, industry 22.8%, commercial and other services 18.1%), +4.2% since 2002

Electricity generation: 12 terawatt hours (oil shale* 85.3%, biofuels and waste 8.3%, wind 3.6%, natural gas 1%, peat 0.8%, oil 0.5%, hydro 0.4%), +39% since 2002

Inland production: 5.1 Mtoe (oil shale 79%, biofuels and waste 19.4%, peat 0.8%, wind 0.7%, hydro 0.1%), +49.8% since 2002

* Includes negligible amounts of gas works gas.[2]

COUNTRY OVERVIEW

The Republic of Estonia has an area of 45 227 square kilometres and is located in north-east Europe, bordering the Baltic Sea and the Gulf of Finland, between Latvia and Russia (see Figure 1).

The country is divided into 15 counties. Its capital and largest city is Tallinn. Estonia's population is 1 286 540 (1 January 2013)[3] of which ethnic Estonians are 69% (including 5.4% Võros and 0.93% Setos), Russians 25.4%, Ukrainians 2%, Belarussians 1.1%, Finns 0.8% and 1.6% other groups. The official language is Estonian, spoken by 67.3% of the population, followed by Russian at 29.7%.

Estonia restored its independence in 1991 and has become a stable multi-party democracy, operating under the political framework of the 1992 Constitution. It became a member of the North Atlantic Treaty Organisation (NATO) and the European Union in 2004, joined the Organisation for Economic Co-operation and Development (OECD) in 2010, adopted the euro in 2011, and applied for IEA membership in the same year.

Estonia is a parliamentary republic with a single-chamber parliament (the Riigikogu), with 101 members, elected every four years. The President of Estonia is elected by the parliament for a five-year term (with a maximum of two terms) and the Prime Minister, appointed

2. See http://stats.oecd.org/glossary/detail.asp?ID=4597 for a definition of the term "gas works gas".

3. www.stat.ee/main-indicators.

by the President, heads the government. After the March 2011 election, a centre-right coalition of the Reform Party and the Pro Patria - Res Publica Union (IRL) was formed. President Toomas Hendrik Ilves has been in office since 19 October 2006 and Prime Minister Andrus Ansip since 2005. The President of the Parliament is Ene Ergma.

Estonia is notable for its pioneering e-governance, offering the use of information technology as an instrument for increasing administrative capacity and high-quality environment, ensuring innovative and convenient services based on simplicity, comfort and economic savings for its citizens. The rate of internet use (78.6%) in Estonia is one of the highest in the world, and key behind the development of the e-state in Estonia are computer or mobile phone services, including e-voting, e-police, e-health, e-prescriptions, e-shops, e-payment, e-commerce register, payment of utility bills and parking meters among other e-services.

Over the last two decades, Estonia has become one of the world's most dynamic and modern economies, dominated by industry and services. The economic outlook is stable and Estonia's economic freedom score is 75.3, making its economy the thirteenth freest in the 2013 Index. Its overall score is 2.1 points higher than in 2012, driven by notable improvements in the management of government spending, property rights, and business freedom.[4]

The Estonian economy rests on solid foundations, with the rule of law strongly buttressed and enforced by an independent and efficient judicial system. A simplified tax system with flat rates and low indirect taxation, a competitive banking sector, openness to foreign investment, and a historically liberal trade regime all support the resilient and well-functioning economy.

Despite the deep 2008-09 economic crisis, Estonia had a strong rebound over the past two years and achieved one of the highest medium-term growth rates in the OECD, accompanied by rapid income convergence. This strong recovery from the crisis has benefited from the structural strengths of the economy: a flexible labour force, business-friendly regulations, well capitalised financial institutions, a successful transition from the currency board to euro area membership, and sustained credibility of fiscal policy.

Revitalised efforts to move even further towards limited government and to ensure long-term fiscal sustainability have played a notable role in restoring economic vitality. Fiscal adjustments have brought down budget deficits and kept public debt levels among the lowest in the world.

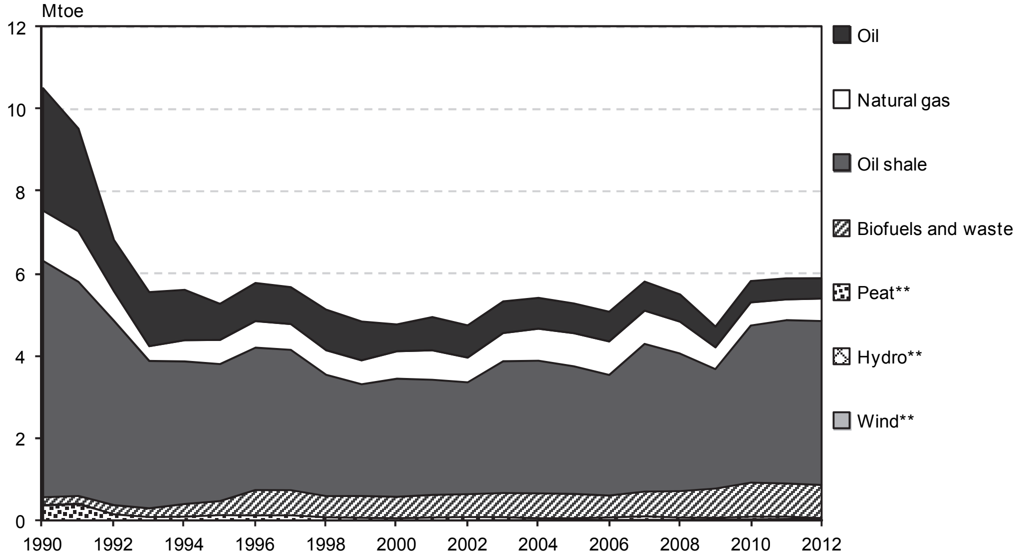
SUPPLY AND DEMAND

SUPPLY

In 2012, TPES in Estonia was 5.7 Mtoe, with oil shale dominant, accounting for 70% of TPES and predominantly used for electricity generation. Biofuels and waste are the second-largest energy source, accounting for 13.9% of TPES. Natural gas accounts for 9.5% of TPES. Energy supply in Estonia has increased by 21.4% since 2002, with the share of oil shale up from 58.3% while the share of natural gas has fallen from 12.6%. Energy from biofuels and waste has increased by a total of 45.2% since 2002, increasing its share from 11.6%.

4. 2013 Index of Economic Freedom, www.heritage.org/index/.

Figure 2. **TPES, 1990-2012***

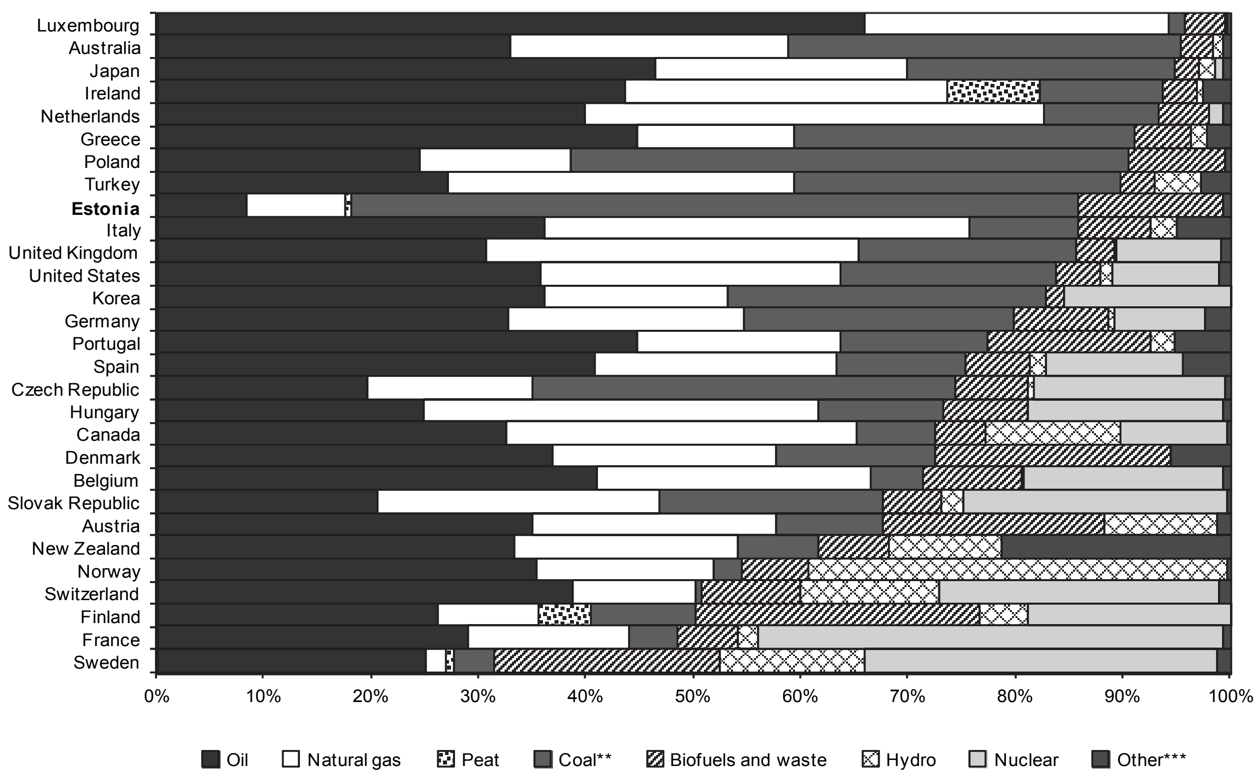


* Estimated for 2012.

** Negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2012; and country submission.

Figure 3. **Breakdown of TPES in Estonia and IEA member countries, 2012***



* Estimated.

** Coal includes oil shale for Estonia.

*** *Other* includes geothermal, solar, wind, and ambient heat production.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submissions.

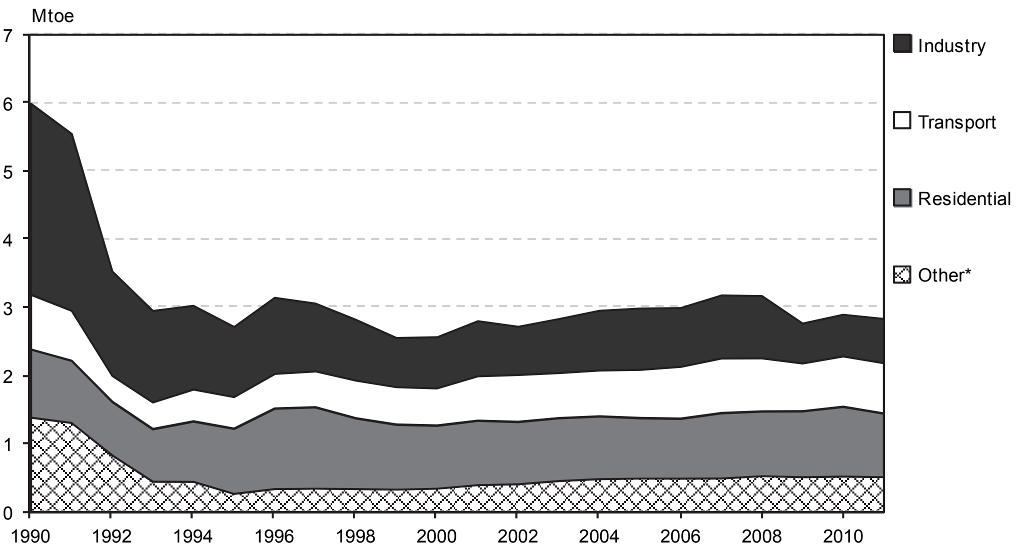
DEMAND

Estonia's TFC was 2.8 Mtoe in 2011. The residential sector is the largest consumer of energy, accounting for 32.8% of TFC. This is a slightly lower share of consumption compared to 2000, when households consumed 35.9% of the total.

The transport sector has a 26.3% share of TFC and the industry sector has a 22.8% share of TFC. Usage in the industry sector has fallen from 29.1% in 2000, while it has increased in transport – up from 21.6%. Commercial and other services represent 18.1% of TFC, also higher than the 13.4% of 11 years before.

Oil products represented 34.3% of fuel in final consumption, with 20% of energy consumption accounted for by electricity. Biofuels accounted for 17.5% and a further 16.7% came from heat. Natural gas usage is more modest, representing 7.1% of TFC in 2011, with coal accounting for the remainder of 4.4%.

Figure 4. **TFC by sector, 1990-2011**



* *Other* includes commercial, public service, agricultural, fishing and other non-specified sectors.

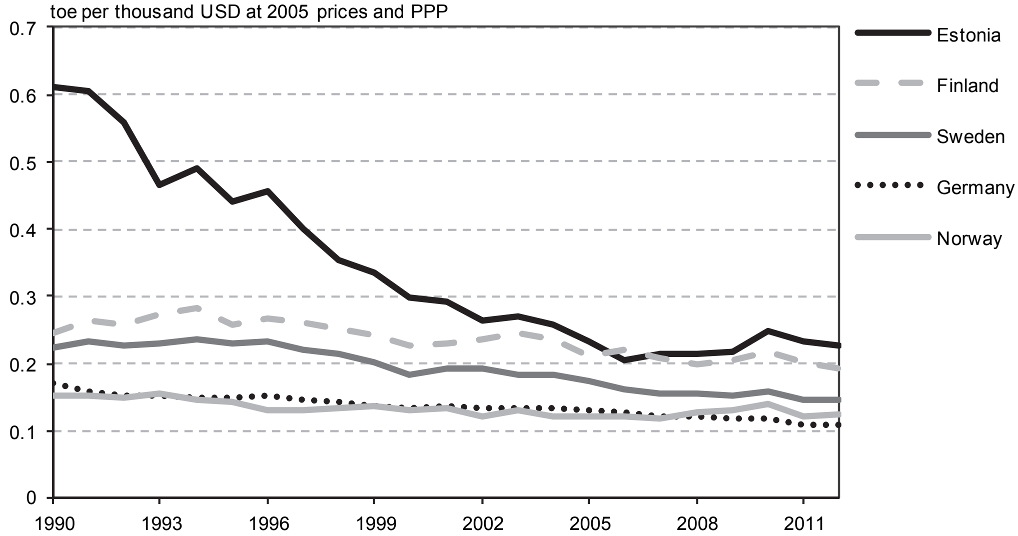
Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submission.

ENERGY INTENSITY

Energy intensity, measured as TPES per GDP PPP, was 0.23 toe/USD 1 000 GDP PPP in 2012. This is considerably higher than the IEA average of 0.14 toe/USD 1 000 GDP PPP. Estonia has significantly reduced its energy intensity over the past two decades, down from 0.61 toe/USD 1 000 GDP PPP in 1990 and 0.3 toe/USD 1 000 GDP PPP in 2000. However, it still remains more energy-intensive than any IEA members.

Total energy supply per capita, measured as TPES per capita, was 4.3 toe per person in 2012. This is slightly lower than the IEA average of 4.5 toe per person. Estonia is ranked eleventh among IEA members with regards to energy supply per capita, behind Luxembourg, Canada, the United States, Finland, Norway, Australia, Belgium, Korea, Sweden and the Netherlands. Since 2002, TPES per capita in Estonia has increased by 23%, while the same ratio has decreased by 9% for the IEA average.

Figure 5. **Energy intensity in Estonia and selected IEA member countries, 1990-2012***



* Estimated for 2012.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; *CO_2 Emissions from Fuel Combustion*, IEA/OECD, Paris, 2012; and country submissions.

INSTITUTIONS

The **Ministry of Economic Affairs and Communications (MEAC)** has overall responsibility for energy policies and is responsible for co-ordinating the implementation of the National Development Plan for the Energy Sector, the Development Plan for Estonian Electricity Sector, the Action Plan for Renewable Energy, and the Energy Conservation Programme for Estonia. The ministry is also responsible for planning, co-ordinating and implementing research and development (R&D) activities and innovation policy related to the energy sector through the Innovation Policy Committee, which is an advisory body to the ministry. National support measures for innovation policy are implemented by Enterprise Estonia, which provides financing products, advice and partnership opportunities and training for entrepreneurs, R&D institutions and the public.

The **Ministry of the Environment** is responsible for the implementation and co-ordination of the National Waste Management Plan, the Water Management Plans, the National Development Plan for the Use of Oil Shale, and the National Development Plan for the Use of Construction Minerals, the Nature Conservation Development Plan and the programme for better implementation of environmental management principles in the public sector. The co-responsible ministries are the MEAC, the Ministry of Agriculture and the Ministry of Education and Research. There are several state commercial enterprises and companies that contribute to the implementation of resource policies such as the State Forest Management Centre and the Private Forest Centre. There are also governmental authorities: the Land Board and the Environmental Board.

The **Ministry of Agriculture** is responsible for the implementation and co-ordination of the Development Plan for Enhancing the Use of Biomass and Bioenergy.

The **Estonian Oil Stockpiling Agency**, established under the Liquid Fuel Stocks Act as a 100% state-owned enterprise, holds and manages the compulsory liquid fuel stocks for the state disposal in the event of oil supply disruptions.

The **Estonian Competition Authority** is the energy market regulator, which exercises state supervision over energy market participants' compliance with the market rules and regulations.

KEY POLICIES

GENERAL

A key feature of the Estonian energy sector is the use of oil shale, which provides for around 85% of its electricity needs. The remaining 15% is a mix of natural gas and renewable sources.

Estonian oil shale industry is one of the most developed in the world, using this indigenous resource for electricity production since 1924. Although oil shale provides a higher level of security for electricity and liquid fuels production, the carbon footprint from using this resource is high and the country's energy policy is structured around sustainable development, application of state-of-the-art energy technologies for improved efficiency in the use of oil shale, and diversifying energy supply sources.

The Estonian energy sector is regulated by a number of energy acts, adopted by the parliament, including the Sustainable Development Act, the Electricity Market Act, the Natural Gas Act, the District Heating Act, the Liquid Fuel Act, the Liquid Fuel Stocks Act, and the Energy Efficiency of Equipment Act.

The current Estonian energy policy agenda is set in a number of strategy documents, including the Estonian Electricity Sector Development Plan to 2018 and the National Development Plan of the Energy Sector until 2020, adopted by the Estonian Parliament in 2009. These policy documents outline the medium-term strategy for the oil shale industry and the direction of the electricity production to balance the overall energy mix. However, the country lacks a longer-term vision and the MEAC has commissions working on a new Energy Strategy to 2030 with the outlook to 2050. The Estonian Development Fund leads the preparation of the initial draft and its approval is foreseen in mid-2014. Estonia aims at setting goals for the diversification of energy supply through the construction of new connections and ensuring a more even distribution of energy sources in the energy balance.

CLIMATE CHANGE MITIGATION

The Estonian Sustainable Development Act[5] forms the basis of the national strategy for sustainable development and the use of natural resources, limiting substantial damage to the environment and maintaining natural diversity. The government targets to limit carbon dioxide (CO_2) emissions are provided in sectoral development plans and policies, as Estonia does not have a separate climate strategy.

The National Reform Programme of Estonia to 2020 sets the target to maintain final energy consumption in 2020 at the level of 2010. The 2009 National Energy Sector Development Plan to 2020 aims at increasing the sustainability of energy supply and consumption. The primary goal is to reduce energy sector-related CO_2 emissions by half from 15.7 million tonnes (Mt) in 2007 to 7.9 Mt by 2020.[6]

5. Sustainable Development Act, www.riigiteataja.ee/ert/act.jsp?id=874359.

6. The Energy Conservation Target Programme for 2007-2013; the National Renewable Energy Action Plan; and the National Energy Efficiency Action Plan.

The National Development Plan for the Use of Oil Shale 2008-2015 provides policies for emissions reductions in the oil shale sector, the largest source of emissions. The share of oil shale in power generation is set to fall, mainly because of the European Union (EU) policy on air quality and climate, but also to decrease the dominance of oil shale in the share of electricity and heat production and to balance the share of the fuel mix.

Other policies and measures[7] to limit energy-related CO_2 emissions are also used for helping Estonia meet its EU 2020 targets for renewable energy and energy efficiency. As part of the effort-sharing of the EU greenhouse gas (GHG) target of -20% from 2005 to 2020, Estonia will have to limit GHG emissions to 11% above their 2005 levels in the sectors outside the EU Emissions Trading Scheme.

The future emission savings from using renewable energy and from energy efficiency have not been quantified in the existing national action plans; however, it is understood that the new Energy Strategy to 2030 with the outlook to 2050 in preparation (at the time of writing) is set to have clearer targets for climate change mitigation.

ENERGY MARKET REFORM

The Estonian electricity market has been fully open and deregulated since 1 January 2013. Before this, the electricity market was opened in phases to eligible consumers: with an eligibility level of 40 gigawatt hours (GWh) until 2009 and 2 GWh from 2009 to 2013, accounting for 35% of total annual consumption based on actual calculations. Since 2013, prices for electricity for all customers have been market-based under surveillance of the Competition Authority.

The natural gas market has been fully open since 1 July 2007; however, the legal and regulatory framework for the market opening did not trigger efficient market functioning. In June 2012, the Estonian Parliament amended the Natural Gas Act, deciding not to apply the exemption provided by Directive 2009/73/EC and required ownership unbundling of the gas transmission network operator from 2015 to facilitate the development of a functional gas market. The existing system operator and the transmission network owner were given a three-year transitional period to minimise the risk of infringement of their rights and to allow for organising full compliance with this law. Full ownership unbundling of the natural gas market is due by January 2015.

INFRASTRUCTURE PLANNING

Estonia has strong interlinked energy systems with Russia and the Baltic states. However there are relatively few connections between the Baltic states and other EU member states. Estonia has power transmission connections with Russia and Latvia and has had a direct current link (submarine cable) with Finland since 2007; it also has operational gas interconnections with the Russian gas transmission system and with the Inčukalns underground gas storage facility in Latvia.

The Estonian energy system is undergoing significant restructuring, enhancement and expansion, aimed at replacing ageing energy infrastructure, deploying higher energy-efficient technologies for fossil fuel combustion, enhancing grid integration of renewable energy resources and developing interconnections with other EU member states and regional markets.

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7. *Ibid.*

Among these interconnections are the EstLink II project, the second high-voltage direct current interconnection between Estonia and Finland, which will triple the transmission capacity between the Baltic and Nordic regions, and the Baltic liquefied natural gas terminal, developed under the Baltic Energy Market Interconnection Plan, which will improve security of gas supply of Estonia, Latvia and Lithuania.

TAXATION

Estonia has simple flat corporate and income tax rates (at 21%) and undistributed profits are not taxed. Other taxes include the value-added tax and excise taxes, with an overall tax burden equal to 34% of total income.

Environmental taxes are grouped into four categories: pollution taxes, resource taxes, energy taxes and transport taxes. Resource taxes include the mineral resources extraction charge, the water abstraction charge, the fishing charge, the forest stand cutting charge and the hunting charge.

A mineral resources extraction charge is paid for the extraction, use or rendering unusable of mineral resources belonging to the state. The minerals subject to the mineral resources extraction charge include peat and oil shale.

ASSESSMENT

The most remarkable – and almost unique – feature of Estonia's energy sector is the high use of oil shale. In 2012, 70% of TPES derived from this indigenous source. The second-largest primary energy source is biomass (13.9%). Natural gas accounts for 9.5%, oil and gasoline for 8.6%. The share of other renewable energy in TPES is less than 1%.

According to the Estonian Competitiveness Strategy 2020, the final energy consumption in 2020 shall not be higher than it was in 2010. Nonetheless, according to business as usual trends, the TFC between 2012 and 2020 of energy is forecast to rise annually by 2.3% on average, with projections of decreasing use of delivered heat and gas. The share of the commercial or service sector in final energy consumption is likely to increase.

Energy use is dominated by residential and commercial buildings at 50.9% of TFC. The share of households in TFC is 32.8% and commercial and public services 18.1%. Approximately 26% of total energy is used in the transport sector while industry uses 22.8% of TFC.

Estonia is developing new energy policies and taking decisions about resources, infrastructure, investment, competition, trade and innovation. This should enable higher levels of social welfare and economic performance to 2030, with a perspective to 2050. Estonia's strategy of energy market transparency is commendable as it empowers consumers and suppliers to take informed decisions for the future. Transparent energy pricing is a core policy principle that enables long-term security, innovation and prosperity to emerge.

Estonia has several electrical interconnections to neighbouring countries and is currently working to expand them so as to establish sound integration in an emerging Nordic-Baltic regional market.

Estonia's overall energy import dependence is around 15%. It is largely self-sufficient and able to satisfy its own power and heat needs from domestic sources. It exported 5 252 GWh of electricity in 2011. It is, however, 100% dependent on imported gas from a single supplier, Russia, while winter peak gas supply is met by a storage facility in Latvia.

Both of these could be regarded as significant risks in terms of security of supply. Transport fuels are imported from global markets and Estonia has effective storage and a number of sea- and land-based routes for supply.

The use of oil shale reserves for heat and electricity production provides Estonia with a level of energy autonomy, but oil shale transformation to electricity and heat is intrinsically CO_2-intensive and thus raises questions of long-term sustainability. Over the longer term, the Estonian government is aiming towards a reduction in the use of oil shale for electricity production and is partially shifting the use of oil shale in favour of the more environment-conscious production of shale oil,[8] which may bring measurable economic benefits.

A single company, Eesti Gaas, is a dominant provider of gas transmission and distribution services. In 2011, it held a 90% share of the retail market; furthermore, all remaining volumes sold by others were purchased from Eesti Gaas. The Estonian Parliament recently adopted a law which requires ownership unbundling by 2015.

The electricity sector is dominated by the state-owned power generator Eesti Energia, which accounts for 89% of production and also owns the distribution network. In January 2013, the electricity market was opened to full retail competition. Given the current structure of the electricity sector and, more significantly, the gas sector, it is questionable whether market liberalisation will generate optimal benefits for consumers. Responsibility for the development and implementation of energy policy, and supporting legislation, lies within the MEAC. Other ministries are involved with respect to particular topics (*e.g.* the Ministry of the Environment has a role in the management of oil shale reserves, and is responsible for climate policy).

The Estonian Competition Authority functions as energy regulator alongside its other responsibilities. With a staff of 62 and an annual budget of just below EUR 1.83 million (2011), it is questionable whether it is able to fully monitor market behaviour in the gas and the electricity retail sectors and, furthermore, whether it has the necessary resources to enforce adequate behaviour, if need be.

Much of the historical development of the present energy system stems from the former Soviet administration and the lack of practical alternatives to oil shale. This history of centralised planning, subsidies and necessary reliance on a single primary energy resource suggests that significant steps will be required to adapt the system to enable future economic applications of new cleaner energy technologies in the demand-side and supply sectors. The Estonian government is pursuing a commendable agenda of market-based policies that should open up Estonian energy markets to necessary innovation and diversification.

Several governmental plans exist for the development of the energy sector. At present, a group of experts is reviewing the National Development Plan of the Energy Sector until 2020, with the intention of extending it to 2030 and adding an outlook to 2050. The government has identified the following key challenges that need to be addressed:

- security of electricity supply, reduction of carbon intensity of the power generation mix;
- future of domestic oil shale power generation;
- oil shale mining and shale oil production;
- diversification of natural gas supply sources;

8. See Boxes 2 and 3 for an outline of the difference between oil shale and shale oil.

- opening of the electricity market;
- more efficient energy consumption;
- district heating (DH);
- higher share of renewable energy.

As most challenges that shape Estonia's energy future are interlinked, a prioritisation exercise may be necessary in order to identify those areas where Estonia is a policy maker versus areas where it is merely a policy taker.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Complete the current review of energy policy, in consultation with all stakeholders and establish a long-term energy policy framework containing clear objectives for both the demand and the supply sides.*
- ☐ *Prioritise policy actions in those sectors where government decisions have the most impact: electricity market design, energy efficiency and DH, and more ambitious renewable energy uptake.*
- ☐ *Ensure effective co-ordination between all ministries and agencies charged with policy development and implementation, including the Ministry of Finance on matters relating to taxation.*
- ☐ *Continue to develop an energy sector based on market principles to enable efficient investments, operational decisions about energy use and system operations.*
- ☐ *Ensure that the Estonian Competition Authority is adequately resourced.*
- ☐ *Continue to integrate with and support the development of regional gas and electricity markets.*

PART II
SECTOR ANALYSIS

3. ENERGY AND CLIMATE CHANGE

Key data (2011)

Total greenhouse gas (GHG) emissions excluding land use, land-use change and forestry (LULUCF)*: 20.1 million tonnes of carbon dioxide-equivalent (Mt CO_2-eq), -48.3% since 1990

Total GHG emissions including LULUCF*: 16.7 Mt CO_2-eq, -47.3% since 1990

2008-12 target: -8% from 1990

CO_2 emissions from fuel combustion: 19.3 million tonnes (Mt), +32% since 2002

Emissions by fuel: oil shale 77.2%, oil 15.7%, natural gas 6.1%, other 1%

Emissions by sector: power generation 79.2%, transport 11.6%, manufacturing and construction 4.8%, commercial and services 2.5%, residential 1%, other energy 1%

* Source: United Nations Framework Convention on Climate Change (UNFCCC).

OVERVIEW

Estonia is a signatory to the UNFCCC and a Party to the Kyoto Protocol. It had an individual target to reduce its GHG emissions to an average of 8% below their base-year (1990) levels in the first commitment period (2008-12). In the second commitment period (2013-20), Estonia will contribute to meeting the European Union's overall target of -20% from 1990.

According to Estonia's national inventory submission to the UNFCCC, total GHG emissions in 2011, excluding LULUCF, amounted to 20.1 Mt CO_2-eq, which is 48.3% less than the base-year emissions of 40.5 Mt CO_2-eq.

On the basis of preliminary data, Estonia met its Kyoto Protocol target up to 2012 by a wide margin. Revenue from sales of surplus carbon credits (assigned amount units [AAUs]) has provided significant earmarked funding for carbon-reduction projects in the country.

Emissions have collapsed since the fall of the Soviet bloc and the subsequent restructuring of Estonia's economy, in particular its heavy industry. Since 1990, emissions have been reduced also through improving economic efficiency and gradually switching from oil shale to other fuels in power and heat generation.

In 2011, carbon dioxide (CO_2) accounted for 89.7% of GHGs, nitrous oxide (N_2O) for 4.8%, methane (CH_4) for 4.6%, and the F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) for 0.8%.

As part of the effort-sharing of the European Union (EU) GHG target of -20% from 2005 to 2020, Estonia will have to limit GHG emissions to 11% above their 2005 levels in the sectors outside the European Union Emissions Trading Scheme (EU-ETS). The Emissions Trading Scheme (ETS) sector has a single European Union-wide target of -21% from 2005 to 2020.

ENERGY-RELATED CO_2 EMISSIONS

In 2011, energy-related CO_2 emissions in Estonia totalled 19.3 Mt, according to International Energy Agency (IEA) data. This is the highest level since the early 1990s and 31.6% more than in 2009, a year of deep recession.

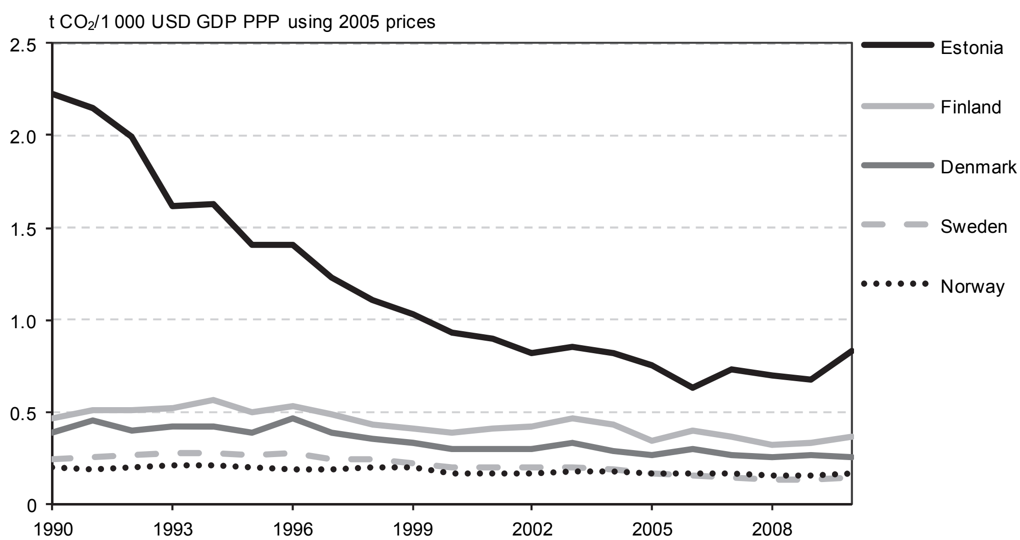
Despite roughly halving the emission levels since 1990, Estonia remains a CO_2-intensive country (see Figure 6). In 2011, it produced 795 grams of CO_2 per USD 1 000 gross domestic product at purchasing power parity (g CO_2/USD 1 000 GDP PPP), while the IEA average was 327 g CO_2/USD 1 000 GDP PPP.

CO_2 emissions per capita in Estonia amounted to 14.4 tonnes (t) in 2011, higher than the IEA average of 10.6 t. In 2011, Estonia's CO_2 emissions per capita ranked fifth-highest among the IEA member countries.

Estonia's high CO_2 emissions are linked to the dominance of CO_2-intensive oil shale in energy supply. The carbon intensity of oil shale-fired electricity generation exceeds that of coal, with 1 100 grams of carbon dioxide per kilowatt hour (g CO_2/kWh), because of the combined effect of oil shale combustion and decomposition of the associated carbonate rock material. In 2011, oil shale was the source of 77.2% of energy-related CO_2 emissions, oil for 15.7% and natural gas for 6.1% (see Figure 7).

Oil shale accounted for 70% of total primary energy supply in 2012 and 71.2% in 2011. In 2011, it generated 87.9% of the country's electricity and heat and 94.2% of CO_2 emissions from power generation. At 794 g CO_2/kWh generated in 2011, the CO_2 intensity of electricity and heat generation in Estonia is nearly twice the IEA average and one of the highest in the world – a result of high-carbon oil shale and low-efficiency plants (see Figure 8).

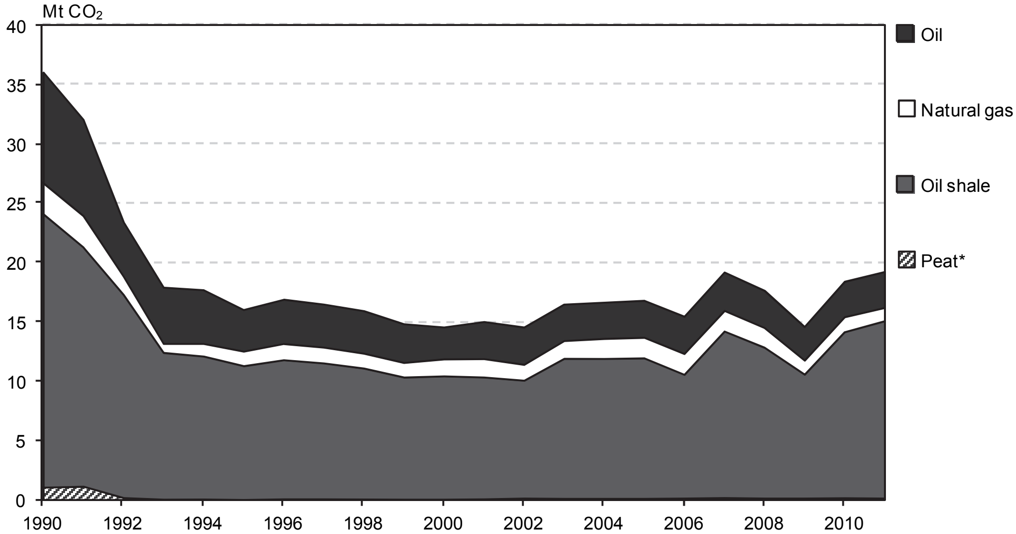
Figure 6. **Energy-related CO_2 emissions per GDP in Estonia and selected IEA member countries, 1990-2011**



Note: t CO_2 = tonne of carbon dioxide.

Sources: *CO_2 Emissions from Fuel Combustion* IEA/Organisation for Economic Co-operation and Development (OECD), Paris, 2012; and country submissions.

Figure 7. **CO_2 emissions by fuel, 1990-2011**

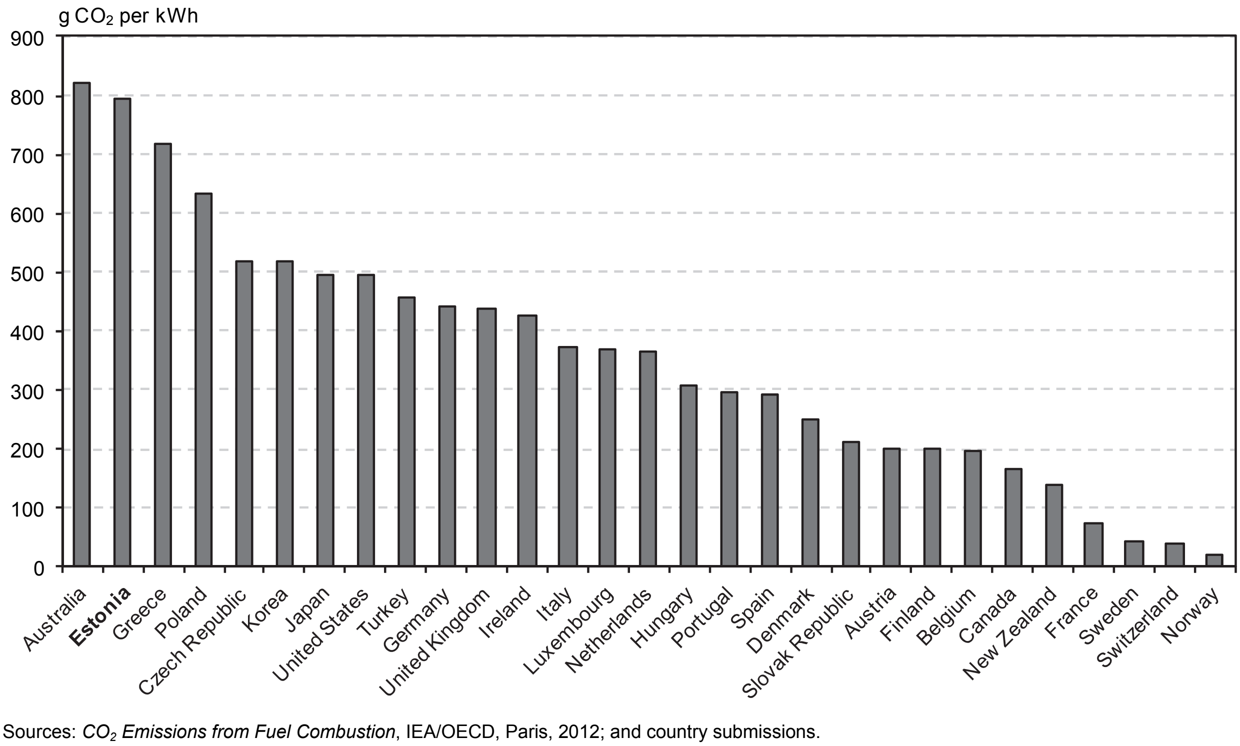


* Negligible.

Note: Mt CO_2 = million tonnes of carbon dioxide.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD, Paris, 2012; and country submission.

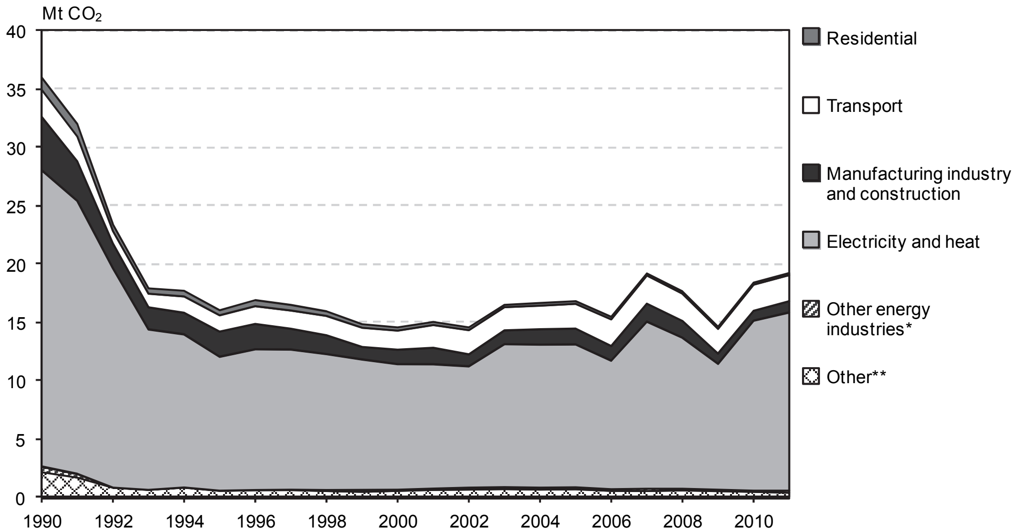
Figure 8. **CO_2 intensity of electricity generation in Estonia and IEA member countries, 2011**



Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD, Paris, 2012; and country submissions.

Looking at CO_2 emissions by sector, electricity and heat generation produced almost four-fifths (79.2%) of all emissions in 2011, followed by the transport sector with 11.6% and industry and construction with 4.8% (see Figure 9). Of note, emissions from the residential sector accounted for only 1% of the total.

Figure 9. **CO_2 emissions by sector, 1990-2011**



* Negligible.

** *Other* includes emissions from commercial and public services, agriculture/forestry and fishing.

Sources: *CO_2 Emissions from Fuel Combustion*, IEA/OECD, Paris, 2012; and country submission.

INSTITUTIONS

The responsibility for climate and energy policy is shared between the Ministry of the Environment and the Ministry of Economic Affairs and Communications (MEAC). The **Ministry of the Interior** is in charge of the risk analyses of emergency situations and relevant response plans.

The **Ministry of the Environment** is primarily responsible for the implementation of the UNFCCC, the Kyoto Protocol and relevant legal acts of the European Union. It elaborates Estonia's climate policy by preparing environmental strategies and action plans, and drafts legislation for implementing climate policy. It also supervises the preparation of annual GHG inventories, national communications to the UNFCCC, implementation of joint implementation projects under the Kyoto Protocol and the EU-ETS.

The **MEAC** elaborates and implements national economic policy. It prepares economic development plans in sectors that have a direct impact on climate change: industry, trade, energy, housing, building, transport and traffic management. Examples include Estonia's Electric Energy Development Plan, the Fuel and Energy Management Long-Term Development Plan, the Energy Saving Programme, the Development Plan for the Housing Sector and the Transport Development Plan.

POLICIES AND MEASURES

OVERVIEW

Estonia's obligations to limit GHG emissions from energy use are derived from the EU target of reducing emissions by 20% from 1990 to 2020. This target, in turn, is divided into two sub-targets. The EU-ETS caps the total combined CO_2 emissions from thousands of industrial facilities, including Estonian ones, to 21% below their 2005 levels by 2020. The obligation applies to emitting facilities in the sector, not to the EU member states.

Outside the EU-ETS sector, the 2009 Effort-Sharing Decision sets national targets for EU member states for limiting the emissions of the six Kyoto Protocol GHGs (CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride). The target for Estonia is +11% from 2005-20.

The ETS sector accounted for 76.5% of Estonia's CO_2 emissions and 66% of GHG emissions in 2005-08, according to Estonia's second National Allocation Plan (NAP) of September 2011. European Union-wide, the ETS sector covers around half of CO_2 emissions. This means that national climate policy has relatively less importance in Estonia than in other countries in meeting the 2020 target.

Estonia does not have a separate climate strategy, but sectoral plans and strategies contain targets to limit CO_2 emissions. The National Reform Programme "Estonia 2020" sets the target to maintain final energy consumption at the level of 2010 in 2020. The 2009 National Energy Sector Development Plan to 2020 aims at increasing the sustainability of energy supply and consumption. To this end, primary energy use should be reduced and CO_2 emissions from the energy sector halved from 15.7 Mt in 2007 to 7.85 Mt by 2020. At the time of writing (February 2013), the government is updating the Plan to 2030 and beyond.

Estonia's most recent GHG emissions projections date from 2013 and were included in the 2013 submission to the European Commission regarding the implementation of the Kyoto Protocol (Decision 280/2004/EC). Total GHG emissions excluding LULUCF were projected to decline from 20 Mt CO_2-eq in 2010 to 17.1 Mt CO_2-eq in 2020 with existing measures, while, with additional (planned) measures, emissions were projected to decline to 16.6 Mt CO_2-eq in 2020.

The most important emissions reductions are projected to originate in the oil shale sector, the largest source of emissions, for which the country has the National Development Plan for the Use of Oil Shale 2008-15. The share of oil shale in power generation is set to fall, mainly because of the EU air quality and climate policy, but also because of profitable prospects for increasing the upgrading (refining) of oil shale into light and heavy fuel oil and gasoline.

Many of the policies and measures to limit energy-related CO_2 emissions are also used for helping Estonia meet its EU 2020 targets for renewable energy and energy efficiency. In 2010, using renewable energy avoided 3.3 Mt of CO_2 emissions, according to government estimates. Two-thirds of the total came from the heat sector and one-third from electricity generation. The future emission savings from renewable energy use and energy efficiency have not been quantified in the related national action plans, however.

THE EU-ETS

The EU-ETS is a mandatory cap-and-trade system established in 2003 by Directive 2003/87/EC. It was launched in 2005 and its first commitment period ran until the end of 2007. The second phase ran from 2008 to 2012. Initially, it covered CO_2 emissions from installations in nine energy-intensive sectors: combustion installations (power and heat generation), refining processes, coke ovens, metal ores, steel, cement, glass, ceramics, and cellulose and paper. For the third phase, 2013-20, the EU-ETS was expanded to cover aluminium and chemicals. Aviation was included in the system in 2012. Power and heat production in Estonia generates more than 80% of all emissions in the ETS sector.

Installations in the EU-ETS can meet their obligations either by implementing emissions reduction measures of their own, or by purchasing allowances from other installations covered by the EU-ETS, or by purchasing credits generated under the Kyoto Protocol's flexible mechanisms (joint implementation or the Clean Development Mechanism).

From 2005-12, allowances were allocated by EU member states through NAPs that had to be approved by the European Commission. Estonia's NAP for 2005-07 covered 43 installations. It granted them emission allowances equalling a total of 56.9 Mt of CO_2, or around 19 million tonnes per year (Mt/yr). This was more than the actual emissions from the ETS sector.

The second NAP, for the years 2008-12, covered 47 installations and granted allowances equalling a total of 66.5 Mt of CO_2, or 13.3 Mt/yr and 30% less than in the first NAP. The second NAP came into force only in December 2011. Estonia had submitted the NAP to the European Commission already in 2006 and, in May 2007, the European Commission had reduced the volume of allowances to 12.6 Mt/yr, or 48% less than in the NAP for 2005-07. Estonia contested this decision, and in September 2009, the Court of First Instance of the European Communities annulled it. Estonia then submitted a revised NAP to the European Commission for approval in February and, following several rounds of negotiations, the European Commission finally approved the NAP in December 2011.

From the beginning of 2013, new rules for the EU-ETS apply. NAPs have been replaced by a European-wide cap, and all allowances for the power sector are auctioned. The manufacturing industry, however, receives part of its allowances for free, on the basis of stringent European Union-wide benchmarks. Trade-exposed energy-intensive sectors will receive 100% of the benchmark value, while other industrial sectors will receive 80% of the benchmark, phasing out to 30% in 2020.

Estonia, and several other new member states, however, were eligible for temporary exemptions from the auctioning requirement for the power sector, provided they ensure that investments are made in modernising the sector, including retrofitting and upgrading the infrastructure, promoting clean technologies and diversifying the energy mix and sources of supply. The overall amount of the investments must match the market value of the allowances allocated free of charge.

Estonia submitted its national plan of investments for modernising power generation to the European Commission in September 2011. The plan was closely linked to the restructuring plan of the oil shale sector for the years 2007-15. The European Commission approved the plan in May 2012. Estonia may thus allocate a gradually decreasing number of emission allowances free of charge, starting from almost 5.3 Mt CO_2-eq in 2013 and falling to 0.76 Mt CO_2-eq in 2019. In 2020, allowances will no longer be allocated for free.

The allocation decision for other sectors (mainly heat and mineral industry) by the European Commission was still pending in late 2012. Estonia's law on the allocation of allowance auction revenue was also pending.

At the company level, the state-owned Eesti Energia, which owns the 2.4 gigawatt oil shale-fired Narva power plants and is by far the largest power generator in the country, is restructuring its operations to reduce the use of oil shale for power generation. At the same time, Estonia is moving ahead with ambitious plans for using oil shale as feedstock for oil product upgrading/refining, instead.

The modernisation of the Narva power plants was started more than a decade ago in a drive to meet Estonia's international and EU obligations to reduce air pollution (sulphur dioxide [SO_2], nitrogen oxides [NO_x], particulate matter). Switching from old pulverised combustion boilers to circulating fluidised-bed combustion (CFBC) units also increased plant efficiency and reduced the average CO_2 emissions.

To meet the air pollution standards under the EU Large Combustion Plants Directive (2001/80/EC), Eesti Energia will shut down old units before 2016 and replace them with new, more efficient CFBC units which also enable biomass co-firing. Eesti Energia intends to reduce the CO_2 intensity of power generation by 30% from 2007 to 2015 and, as more oil shale-fired units are shut down, by 70% from 2007 to 2025. Future CO_2 emissions will also depend on the international competitiveness of oil shale-fired power, as in the next few years Estonia and the other Baltic states become more closely integrated with the generally low-carbon Nordic electricity market.

Measures to promote renewable energy to meet the country's 2020 renewable energy target will help reduce CO_2 intensity in the ETS sector. These measures include subsidies for biomass use at combined heat and power (CHP) plants and for wind power generation (see Chapter 7 on renewable energy). Also, the country's first municipal waste incineration unit (50 megawatts thermal, 20 megawatts electrical) was commissioned at the Iru CHP plant in 2013.

DOMESTIC MEASURES OUTSIDE THE EU-ETS

Under EU law, Estonia is obliged to limit the growth in GHG emissions from outside the EU-ETS sector to 11% from 2005 to 2020. According to the second NAP for 2008-12, the non-ETS sector accounts for around one-third of the country's total GHG emissions. Around half of these are emissions of CO_2. As the combined emissions of CH_4 and N_2O are projected to decrease from 2005 to 2020, CO_2 emissions from the non-ETS sector could increase by around one-third and Estonia would still meet its 2020 target. Around two-thirds of the CO_2 emissions in the sector come from transport and the rest from primary energy use in the residential and commercial sectors (services, small and medium-sized manufacturing enterprises and agriculture) as well as small heat plants.

Domestic measures to limit CO_2 emissions outside the EU-ETS sector focus on promoting renewable energy and energy efficiency. Because of the low volume of fossil fuel use, there is limited scope for these measures, mainly in heating and processes. Subsidies for biomass use at small heat plants will also reduce emissions in the sector. Households and the commercial sector use much more secondary energy (electricity and district heating [DH]) than primary energy, but as the carbon-intensive forms of secondary energy are by and large all produced at facilities in the ETS sector, reducing their use does little to help reduce CO_2 emissions in the non-ETS sector.

A pollution charge for emitting CO_2 applies to heat producers within the DH system. Since 2009, the rate is EUR 2 per tonne. Enterprises can avoid the charge by choosing to invest in environmental protection measures which reduce pollutants or waste. A pollution charge used to apply also to electricity generators, but since January 2008 these are subject to an excise duty instead (at EUR 4.47 per megawatt hour, as of 1 March 2013).

Transport is the main source of CO_2 emissions in the non-ETS sector. Its emissions increased by 37% from 2000 to 2010, when they accounted for 12% of all energy-related CO_2 emissions in the country. Without ambitious measures, emissions are set to rise further, as the country grows wealthier. The private car ownership rate is one-fifth lower than in the wealthier EU15 countries (407 cars per 1 000 inhabitants in Estonia versus 503 in EU15 in 2009) and has plenty of room to expand. Freight transport, in turn, typically increases in tandem with gross domestic product (GDP). The 2010 National Renewable Energy Action Plan projects energy use in the sector to increase by 13% from the average of 2005-08 to 2020.

Excise taxes on transport fuels are the major indirect way to limit emissions, while emission intensity of new passenger cars is limited under an EU regulation. The fleet-wide average CO_2 emissions from new cars may not exceed 130 grams of CO_2 per kilometre (g CO_2/km) in 2015 and 95 g CO_2/km in 2020. The regulation started being phased in at the beginning of 2012. Estonia is promoting the latter as part of its EU-related efforts to increase the share of renewable energy in total energy use in the transport sector from zero in 2005 to 10% in 2020.

Measures to help limit future emissions are also included in the government's Transport Development Plan for 2006-13. They include developing the traffic management and co-ordination system; enhancing the competitiveness of public transport; and promoting light transport.

INTERNATIONAL MEASURES

Under the Kyoto Protocol, Estonia has been using two flexible mechanisms: International Emissions Trading (IET) and joint implementation (JI). Estonia, as other former economies in transition, has had significant volumes of excess AAUs, which are carbon credits to sell internationally. Estonia started selling AAUs in 2009, under the Green Investment Scheme (GIS), and has earmarked the proceeds for projects that facilitate emissions reductions. Examples include wind farms, CHP installations, improving DH networks, retrofitting boiler houses, improving energy efficiency in buildings and industry, and introducing more efficient buses and trams and electric vehicles.

By the end of 2011, Estonia had sold around 60 million AAUs (net) and by October 2012, the value of total AAU sales was nearing EUR 400 million, according to the government. This corresponds to almost 1% of the country's GDP for each of the three years in which the GIS has been in full swing. The major purchasers include the governments and/or companies of Japan, Switzerland, Spain, Luxembourg and Austria.

By the end of 2012, Estonia had 12 JI projects in operation, mostly on biomass and wind power. The first projects had been initiated already in 2002, and the two most recent ones in December 2010. Since their initiation until the end of 2012, the projects were expected to reduce emissions by around 1.9 Mt CO_2-eq. Investors in the projects are Austria, Finland, the Netherlands, Sweden and the Nordic Environment Finance Corporation (NEFCO), an international finance institution established by Denmark, Finland, Iceland, Norway and Sweden.

ASSESSMENT

Estonia's GHG emissions have roughly halved from 1990 and the country has reached its Kyoto target (-8% from 1990 during the period 2008-12) by a wide margin. The focus is now on meeting the targets for 2020. These come in two forms. First, the EU-ETS applies to around two-thirds of GHG emissions and three-quarters of CO_2 emissions in Estonia. Secondly, the EU Effort-Sharing Decision sets a +11% target for Estonia's GHG emissions from the non-ETS sector from 2005 to 2020.

Within the ETS in Estonia, the focus is on electricity generation, which produces around 80% of the emissions. Those emissions, in turn, come almost all from oil shale combustion at the state-owned Eesti Energia's Narva power plants. The dominance of high-carbon oil shale as a fuel for power generation also helps explain the rather high, although steadily decreasing, carbon intensity of the Estonian economy.

For the government, reducing the high carbon intensity of the energy sector is a policy priority. Carbon concerns are being weighed against the value of oil shale as a national resource and its contribution to the country's energy security. The IEA supports Estonia's plans to reduce carbon intensity and welcomes the significant funding for a shale oil pilot upgrading plant that is now being built (see Chapter 9 on research, development and demonstration).

More specifically, Estonia has ambitious plans for restructuring the oil shale sector. Gradually, Eesti Energia will phase-out oil shale use in electricity generation and increasingly process the shale oil into lighter oil products. This will also reduce unit-specific CO_2 emissions from oil shale use by two-thirds. The business case for oil shale oil seems sound.

Moving away from oil shale-generated electricity appears well-founded, too, because it will face intensifying competition, as Estonia and the other Baltic states become more closely integrated with the Nordic market area. Cheaper hydro and nuclear dominate the Nordic power mix, and fossil fuel-fired condensing plants are typically the marginal generators.

Eesti Energia continues to modernise the Narva power plants in order to meet new EU air pollution standards before 2016, as required under the Large Combustion Plants Directive. The company plans to close more oil shale capacity after 2020 as plants reach the end of their operational life. All this will reduce CO_2 emissions, too. At the same time, new capacity will likely be mostly wind- and biomass-fired, depending on subsidies and market conditions. All in all, these efforts will help Estonia to meet its 2020 renewable energy targets and Eesti Energia to purchase the least possible emission allowances under the EU-ETS.

Turning to energy-related CO_2 emissions beyond the ETS sector, meeting the +11% GHG target from 2005 by 2020 should not pose a challenge for Estonia. The latest projections show that the combined emissions of CH_4 and N_2O will decrease slightly from 2005 to 2020. This implies that energy-related emissions from the non-ETS sector could be allowed to increase by around one-third.

CO_2 emissions in the non-ETS sector come mostly from transport, but also from buildings, small heat plants and agriculture. It is safe to assume that as the buildings stock is being refurbished, any increases in energy use in the residential and commercial sectors are likely to be in the form of electricity, and to a lesser extent heat, bioenergy or solar (water heaters), and therefore emissions from direct fossil fuel use are not going to increase.

A rough calculation tells that, even if emissions from the transport sector were to increase by 50%, Estonia would still meet its 2020 target. The government has several existing and planned policies and measures that should limit the increase in transport to much lower levels. This suggests that Estonia will have excess allowances to sell by 2020.

Under the Kyoto Protocol, Estonia, as other economies in transition, has had it easy and it may seem that great efforts will not be needed in the second commitment period, either. Emissions have decreased primarily not because of climate policy, but more as a positive consequence of economic restructuring and air pollution requirements. This in no way reduces the legitimacy of Estonia's policies, many of which have helped to limit emissions, but it is important to be aware that as the country grows richer, limiting emissions will become more difficult, as the low-hanging fruit gets picked first. A long-term perspective for limiting GHG emissions is needed.

As a basis for effective medium- to long-term climate policy, the government should update its current GHG emission projections. It is updating the long-term energy strategy in the first half of 2013, and so provides an opportunity for updating the emission scenarios, too. This would also help ensure the consistency of policies and measures for meeting both energy and climate policy objectives in the medium and long term in a cost-effective manner.

An integrated approach to long-term energy and climate policy could help Estonia save energy and money. The long-term perspective is warranted also because of the long lifetime of infrastructure investments, which are essential for a growing economy, such as Estonia's. In many fast-developing countries, also in Europe, urban planning and transport solutions have effectively locked in future carbon emissions for a long time.

As a Party to the Kyoto Protocol, Estonia has been able to sell carbon credits (AAUs) abroad. As many other economies in transition, it has had a huge surplus of these credits, thanks to the collapse of its industrial base and, as a result, CO_2 emissions, in the early 1990s. The revenue has been significant compared to the size of the national economy, almost 1% of GDP per year in 2010-12. Commendably, Estonia has earmarked this revenue, close to EUR 400 million in total, for projects that limit GHG emissions in the country. The IEA acknowledges the responsibility Estonia has demonstrated by this approach.

In the second commitment period of the Kyoto Protocol (2013-20), revenue from AAU sales is set to radically decline. The results of the international climate negotiations (at the 18th Conference of the Parties in Doha) in December 2012 indicate that the Parties to the Kyoto Protocol will be fewer than in the first commitment period and, more importantly, they have pledged not to buy AAUs that have been carried over from the first commitment period. EU member states form the bulk of the Parties and they will be using existing EU instruments under the ETS and the Effort-Sharing Decision to meet the EU 2020 Kyoto target. Estonia should therefore prepare for significantly lower revenue from carbon credit sales, with the implications this has for the funding of renewable energy and energy efficiency projects.

One way of filling part of the looming funding gap for low-carbon energy projects is to earmark the revenue from auctions of ETS allowances. Electricity generators will have to buy an increasing share of the needed emission allowances. The European Commission is yet to decide on the possible free allocation of allowances for the other sub-sectors within the ETS. In any case, the pending law on the use of allowance auction revenue should include earmarking the revenue for projects that limit emissions.

Under the Kyoto Protocol, Estonia has been successfully using the JI mechanism for attracting investments in low-carbon energy capacity in the country, mostly in bioenergy and wind power. The government should evaluate the opportunities for continuing to use the JI mechanism after 2012. It should also evaluate opportunities for exceeding the non-ETS sector targets and for joint projects under the EU Renewable Energy Directive that could reduce emissions. From a climate policy perspective, an ideal project would be to help Estonia meet, or even exceed, its GHG targets, so it would have to be in the non-ETS sector, for example replacing fossil fuel with biomass in small heat plants.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Update emissions projections and extend them beyond 2020: by synthesising data from all sectors, including projections from power plant fleet and energy company business plans, and by compiling a comprehensive set of possible emission pathways; use them to optimise the use of carbon and EU renewable market mechanisms; ensure that these projects meet rigorous additionality criteria.*
- ☐ *Maintain and monitor efforts to meet the +11% by 2020 target of the non-ETS sector; consider exceeding this target for selling excess allowances; devise emission pathways and accompanying policies and measures for the sector without delay.*
- ☐ *Ensure by law that revenue from allowance auctions may be earmarked for emission abatement and efficiency projects.*

4. ENERGY EFFICIENCY AND DISTRICT HEATING

Key data (2012 estimated)

Energy supply per capita: 4.3 tonnes of oil-equivalent (toe) (International Energy Agency [IEA] average: 4.5 toe), +23% since 2002

Energy intensity: 0.23 toe per USD 1 000 gross domestic product at purchasing power parity (toe/USD 1 000 GDP PPP) (IEA average: 0.14 toe/USD 1 000 GDP PPP), -13% since 2002

Total final consumption (TFC) (2011): 2.8 million tonnes of oil-equivalent (Mtoe) (oil 34.3%, electricity 20%, biofuels and waste 17.5%, heat 16.7%, natural gas 7.1%, coal 4.4%)

TFC by sector (2011): residential 32.8%, transport 26.3%, industry 22.8%, commercial and other services 18.1%

FINAL ENERGY USE

Estonia's TFC was 2.8 Mtoe in 2011, slightly lower than 2.9 Mtoe in the previous year. Since 2002, TFC has increased by 4.2%. In 2011, 32.8% of consumption was accounted for by the residential sector, while transport represented 26.3%. Industry accounted for 22.8% of TFC and commercial and other services for 18.1%. In the industry sector, TFC has decreased by 8.1% since 2002, while usage in the commercial and residential sectors combined contracted by 8.6%. Consumption in the transport sector has increased by 7.1% in the past ten years.

Estonia's share of industry in TFC ranked fifth-lowest among IEA member countries in 2011, reflecting a low level of industrial activity. The share of transport is mid-range in the group, while the share of residential consumption is the highest, just above Denmark and Hungary, reflecting high heating demands in a cold climate and an ageing housing stock. Commercial and other services sector's share in TFC ranks seventh highest, behind Japan, Hungary, France, Denmark, the Netherlands and Switzerland.

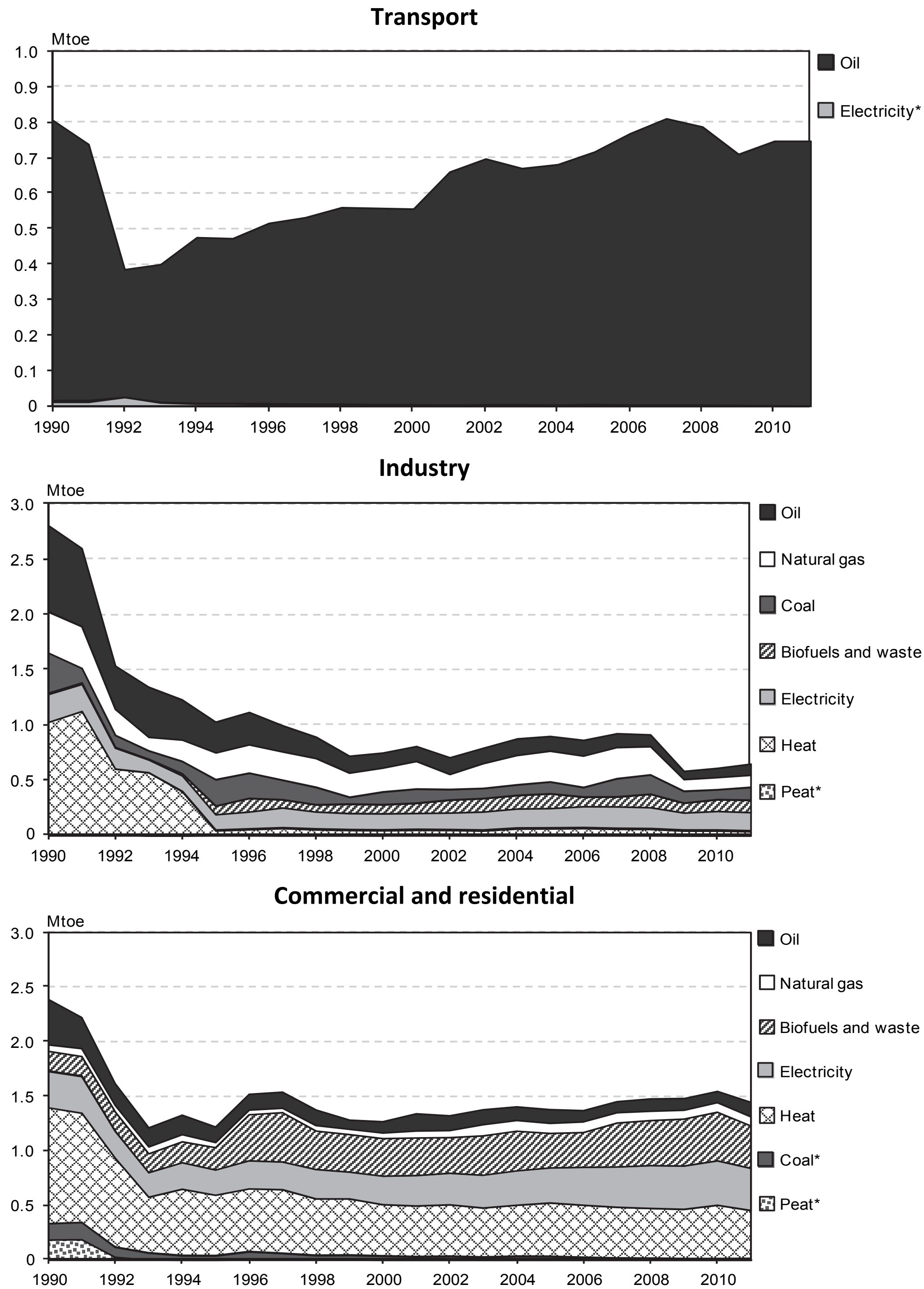
Oil and oil products represent 34.3% of TFC, with more than 75% consumed by the transport sector. Electricity accounts for 20%, and is primarily used in residential, commercial and industry sectors. Biofuels and waste account for 17.4% and heat for 16.7%, with more than 80% used in households and the commercial sector. Natural gas represents 7.1% of TFC, spread between industry and residential and commercial. Coal is used in industry but makes up only 4.4% of TFC.

ENERGY INTENSITY

Energy intensity is measured as the ratio of energy supply to GDP PPP. Estonia has the highest level of energy intensity compared to IEA member countries, at 0.23 toe/USD 1 000 GDP PPP in 2012. The IEA average was 0.14 toe/USD 1 000 GDP PPP in the same year. Much of this high energy intensity is explained by the large role that oil shale (a low-quality indigenous primary energy resource) plays in primary energy mix.

Countries with reliance on low-grade primary resources, like geothermal energy, show similar intensities. Significant improvements in energy intensity have been made since the 1990s.

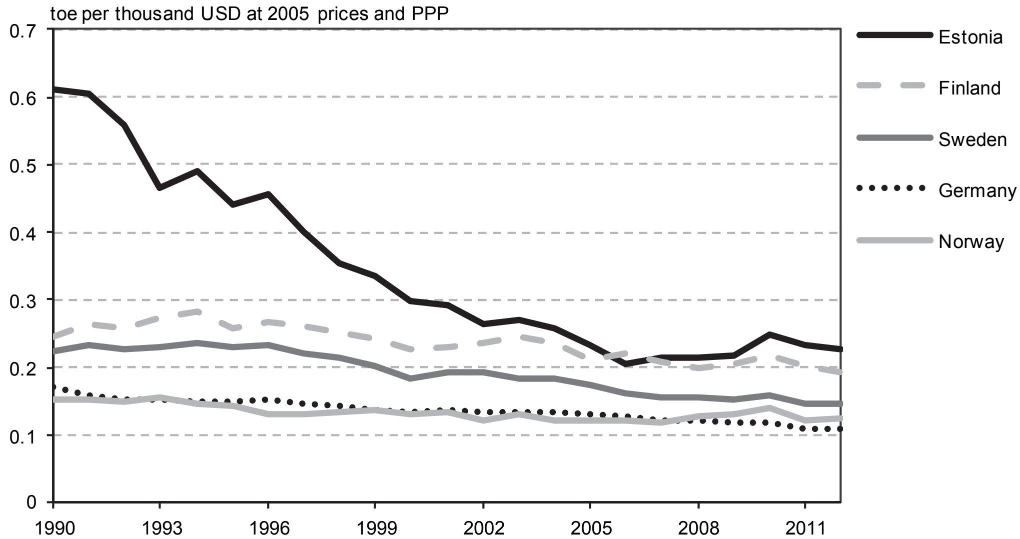
Figure 10. **TFC by sector and by source, 1990-2011**



* Negligible.

Sources: *Energy Balances of OECD Countries*, IEA/Organisation for Economic Co-operation and Development (OECD), Paris, 2012; and country submission.

Figure 11. **Energy intensity in Estonia and selected IEA member countries, 1990-2012***



* Estimated for 2012.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and *National Accounts of OECD Countries*, OECD, Paris, 2012.

INSTITUTIONS

The **Ministry of Economic Affairs and Communications (MEAC)** holds the overall accountability for energy efficiency policy as part of the energy policy mandate. The **Energy Department** and the **Building and Housing Department** within the ministry are responsible for most of the matters related to energy efficiency, district heating (DH) and renewable energy policies.

The ministry collaborates with two executive agencies acting as implementing agencies of energy efficiency policy measures. The Credit and Export Guarantee Fund (**KredEx Fund**) works with measures targeted to residential sector and electromobility; the **Environmental Investment Centre** implements the measures targeting public infrastructure, particularly heat and electricity generation, energy distribution systems and street lighting. Both agencies have specialised units for energy measures, working on issues closely linked to the promotion of energy efficiency.

The **Ministry of the Environment** is responsible for the development of green public procurement rules and guidelines for the purchase of energy-efficient goods. It is increasingly involved in energy policy. Given the historical dependence on oil shale electricity driving climate emissions, there is a need for close co-ordination of energy and environment policy developments. Policies on local air and water quality are driven by European Union (EU) requirements and are based on emission taxes for local water and air discharges, including mining activities. These are useful complementary drivers for a more sustainable development.

The promotion of energy efficiency through energy tariffs is carried out by the **Energy and Water Regulatory Division** of the **Estonian Competition Authority**.

The **Estonian Development Fund** has a unit working on green economy issues that also carries out the analysis of long-term development in the energy sector.

POLICIES AND MEASURES

Estonia has developed energy efficiency policies and measures to save energy and reduce greenhouse gas (GHG) emissions within both EU and national policy contexts. EU regulations are directly applicable in all member states, while EU directives give member countries leeway to decide on how to implement them.

The Estonian government has clearly defined targets for the medium term, and current progress suggests that it can meet the objectives set for 2020. While Estonia lacks the long-term strategy necessary for a more energy-efficient economy beyond 2020, the government is developing a new Energy Strategy to 2050. It is also examining the possibility of designing a more useful structure to integrate various ways of developing energy efficiency.

Policies to develop climate adaptation are as yet unavailable in detail, but the MEAC and the Ministry of the Environment are both aware of the climate impacts on the country's infrastructure systems. Current efforts to encourage transparent pricing in markets, energy efficiency, the use of more biomass and reduced dependence on oil shale are all powerful means to make energy systems resilient to climate change impacts.

EU AND NATIONAL POLICIES AND MEASURES

The National Reform Programme Estonia 2020 sets the target for keeping final energy consumption at the level of 2010 in 2020. The Estonian government has made tangible progress in meeting the targets set so far. In 2010, final energy consumption in Estonia was 119 petajoules (PJ), and in 2011 fell to 115 PJ. According to the estimates that backed the setting of this target (baseline without new measures), final energy consumption for year 2011 was projected to be 122 PJ. The goal to cap final energy consumption in 2020 at the level of 2010 seems therefore achievable.

According to Article 14(2) of the 2006 EU Directive on Energy End-Use Efficiency, EU member states were required to submit their first National Energy Efficiency Action Plan (NEEAP) to the European Commission by 30 June 2007.[9] A detailed overview of domestic energy efficiency targets was provided in the second NEEAP, and the government of Estonia submitted a notification to the Commission in September 2011. Estonia has not updated its assessment on progress towards the target of this directive since this submission, and it does not expect to have to introduce additional policies and measures after the transposition of the new Energy Efficiency Directive.

The second NEEAP listed 99 energy efficiency measures in eight policy areas, including 34 measures in the buildings sector; seven in the public sector (except buildings); 12 in industry; 14 in the energy sector; 17 in transport; four in household appliances and the service sector; four in agriculture and seven in other areas. The largest reductions in energy use are expected to come from the following sectors:

- buildings: 3.5 PJ;
- industry: 2.2 PJ; comprising 0.9 PJ ordinary fuels, 0.7 PJ electricity and 0.6 PJ heat;
- transport: 2.5 PJ from changing motor fuels to biofuels.

The full opening of the electricity market since January 2013 resulted in an increase in electricity prices (by approximately 20%) and this should encourage a reorientation in electricity use relative to other energy supply options, and investment in building

9. Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on Energy End-Use Efficiency and Energy Services; and repealing Council Directive 93/76/EEC.

insulation and more efficient appliances. Data collection required for the assessment of energy efficiency indicators is available on a broad scale.

POLICIES BY SECTOR

BUILDINGS

Estonia has finalised the transposition of the Energy Performance of Buildings Directive 2010/31/EU. New levels of the minimum energy performance standards (MEPS) are set to be adopted which determine almost zero-energy performance levels.

Policy measures targeting energy efficiency improvements in public and private buildings are being carried out, using the funds available under the scheme for financing multi-apartment buildings. The renovation of the existing building stock will be one of the key areas addressed in the next period of Structural Funds (2014-20). New support schemes have now been explored to stimulate the renovation of detached houses.

Household and commercial buildings

Buildings make up around 50% of total TFC. Households account for 32.8% of TFC, commercial and public services for 18.1%. Estonia's most significant energy efficiency challenge is to upgrade the efficiency of its buildings stock to provide essential social well-being and to reduce energy waste.

Estonia has 630 000 dwellings. The energy intensity of the Estonian building stock is 200 kilowatt hours of heat per square metre per year ($kWh_{heat}/m^2/yr$), typical for cold-climate European countries with building stocks dominated by older multi-story commercial buildings and apartment housing. Electricity is generally used only for appliances and lighting. Heat is provided by DH services for 70% of the population. The target is for comprehensive renovations to bring heat intensity of existing buildings down to 150 $kWh_{heat}/m^2/yr$.

Building codes have been in place since 2008. These have recently been revised to achieve a 20% to 30% improvement in stringency. At present, new single-family dwellings need to achieve a 160 kilowatt hour per square metre (kWh/m^2) total annual weighted energy consumption, and multi-apartments to achieve total weighted energy levels of 150 kWh/m^2 per year. New stricter energy performance requirements for all the buildings have been in effect since 9 January 2013.

Retrofitting energy efficiency in buildings

Energy efficiency improvements in existing buildings are currently driven by funding programmes. The MEAC, in close collaboration with municipalities, is supporting the construction of four public buildings (three kindergartens and one nursing home for elderly people) in order to demonstrate energy performance standards of new buildings. These have been very useful large-scale pilots, but should be critically evaluated and redeveloped to overcome continuity problems and improve the targeting of measures.

The current renovation rate of funded energy efficiency programmes is 500 to 600 buildings per year at an average of 1 500 square metres per building.

The energy efficiency potential is concentrated in housing estates dating back to the former Soviet Union. Rural dwellings are less accessible to energy efficiency services, district heating and combined heat and power (CHP)[10] options and are complicated be regional differences as construction is occurring mostly in larger towns and rural areas.

Although there is a higher level of cost-effectiveness in targeting large buildings, it is easier to initiate projects in smaller buildings as fewer individuals need to agree to the intervention. The government is exploring new support schemes to stimulate renovation of detached housing.

In the public sector (except buildings), a large-scale project to renovate street lighting in seven cities was launched in September 2012.

Box 1. **Building retrofit schemes**

Apartment buildings house 75% of the population. There are clear examples of principal-agent problems. For example, the need for all parties to agree before committing to any energy efficiency improvements is a barrier. Progress with government financing programmes for energy efficiency retrofits was slow until 2007, with inadequate progress on measures, largely maintenance. Improved efforts to encourage energy efficiency retrofits started in 2009, when new grants and loan measures were developed.

The Estonian government copied a successful German KfW scheme where finance from different funds was offered to private banks to make loans to home-owner associations. Essential elements were in place. For instance, energy audits were required as part of granting the loans. This started in 2009 but ended in summer 2012 when the scheme ran out of funds. Interest rates are fixed for ten years at less than commercial rates (4.4% maximum with loan average interest at 4%). Grants are 15% to 35% of the cost of the project, scaled to the effort, and 35% grant for comprehensive retrofits, including heat, ventilation and air-conditioning upgrades and triple glazing.

In 2009, a EUR 4 million grant programme for energy efficiency improvements to privately owned houses, funded by the sale of GHG credits, was initiated. Interventions included the installation of photovoltaic panels, wind turbines, and improvements to apartment buildings. Savings are estimated at 40% reduction in energy demand.

Appliances and equipment

Requirements for MEPS and energy labelling of appliances are based on EU law, in particular Directive 2009/125/EC on Ecodesign and related project-specific regulation, and Directive 2010/30/EU on Energy Labelling, representing the basis for Estonian appliance and equipment policy.

Estonia has harmonised its national measures with EU regulations to a large extent in order to improve the efficiency of common household and office appliances on a feasible and cost-effective basis, acceptable for all stakeholders. Since 1 September 2012, imports of incandescent light bulbs have been banned.

TRANSPORT

Approximately 26% of TFC of energy is used in transport, of which 24.7% is used in road transport and 1.3% in other modes of transport. The total transport fuel consumption mix in 2011 was 758 kilotonnes (kt), of which gas/diesel oil was 462 kt, motor gasoline 261 kt, and jet fuel and kerosene 34 kt.

10. Also known as co-generation.

In 2006, vehicle ownership reached average European levels. Around 60% of the population in some main towns, and at least 40% of the country rely on light motor vehicles for both personal mobility and freight. Vehicles are often sized for rural driving in an extreme climate.

A key policy document adopted by the government is the National Spatial Plan 2030+. This document recognises the need to address the growing use of private transport and shapes general recommendations to reduce transport needs. The principles of the National Spatial Plan 2030+ are elaborated at county-level planning.

In March 2010, Estonia launched an electromobility programme. Within the programme, 500 Mitsubishi iMiev electric cars were intended for use in the public sector (especially to provide social care services) and grants were provided to private persons for the acquisition of electric cars. Quick charging infrastructure (over 3 200 fast-charging stations every 40 miles) for electric cars has been completed across the country.

Investments in transport infrastructure, including public transport infrastructure and vehicles, are planned. From January 2013, the city of Tallinn has provided free public transportation for all its citizens. The Association of Driving Instructors provides training courses on eco-driving and 26 driving instructors are certified to provide eco-driving courses.

Other policy efforts such as voluntary agreements, vehicle tax and/or rebate systems to improve fuel efficiency of cars are under discussion.

EU policy has driven a 2006-13 programme of transition from one mode of mobility to another mode, plus a sustainability approach, with an increased share of public transport. The new transport policy for 2014-20 anticipates a major shift to sustainable modes in urban transport. This, however, would be more challenging in low-density towns with small populations.

The Estonian government has the ambition to make rail a preferred mode of travel between large centres, including speeding up passenger rail travel. The government plans to renew rail rolling stock and Tallinn's tramways – currently freight is reliant on heavy trucks and public transport on buses. While options such as converting part of the truck fleet to gas are envisaged, Estonia is reliant on external technology developments.

INDUSTRY AND UTILITIES

Industry is diffuse and, apart from a few large plants, mainly consists of small and medium-sized enterprises (SMEs); 19% of TFC is accounted for in industrial end uses, 5% in non-metallic minerals, 3% in timber processing, 2% in food, 1% in chemicals, and 8% in other industries.

The energy consumption of industries is made more rational thanks to measures related to the wider energy policy, such as the opening of the electricity market; a renewable energy charge; fuel and electricity excise duties; and reducing differences in excise duty rates. Therefore, energy conservation measures for industries must focus primarily on improving the skills and awareness of specialists working in relevant companies. Yet, currently there are no major policy developments to present in this area, as most attention has been focused on those fields with greater energy efficiency potential in Estonia and also on those fields which have concrete obligatory measures bestowed by the European Union (transport, building, and so on).

Nevertheless, the issue of energy efficiency in industry has been raised by the authorities in order to work out better financing opportunities for energy conservation measures in industries and small enterprises. For example, policy makers are proposing a support scheme for carrying out energy audits and putting in place energy surveillance databases for companies from EU Structural Funds for the next period (2014-20). However, it should be noted that this scheme is in anticipation of the new Energy Efficiency Directive, which will propose concrete measures.

Investment support schemes have been implemented as planned, with allocations made to improve DH systems and to increase the use of CHP generation. In May 2012, the European Commission accepted Estonia's application, pursuant to Article 10c(5) of Directive 2003/87/EC of the European Parliament and of the Council, to give transitional free allocations for the modernisation of electricity generation. Preparations for the transposition of the new Energy Efficiency Directive and its provisions on energy efficiency in transformation and supply will start in December 2012.

Utilities

Energy utilities (electricity, gas and heat services retailers) are ideally placed to deliver energy efficiency services and products to consumers. They have operational, technical and financial capabilities but these often have no direct relationship with consumers. Estonia is actively developing a liberal electricity market. In doing this, the fundamental incentives for all consumers, utilities and energy suppliers will be put in place. Once this liberal market is in place, the challenge for the Estonian government will be to encourage utilities to develop value-added energy services for consumers as a function integrated with their primary energy retailing activities.

Power generation

With a specific enthalpy of 5 megajoules per kilogram (MJ/kg) to 8.4 MJ/kg, oil shale is a low-quality primary energy resource compared to wood (9 MJ/kg to 12 MJ/kg) or coal (18 MJ/kg to 22 MJ/kg). As for many low-grade primary resources, its transformation into end-use energy is a low-efficiency process. For the dominant oil shale resource, 117 PJ of oil shale (18 million tonnes per year x 6.5 MJ/kg = 117 PJ) is used to produce end-use energy products (10.4 terawatt hours [TWh] or 37 PJ generated electricity). The transformation efficiency is 34%. At this level of efficiency, a 10% improvement in oil shale transformation would gain either a further 1 TWh of electricity or a 10% reduction in mined shale and emissions. According to Tallinn Technical University, a 10% efficiency gain is possible.

The owner of the oil shale power plants, Eesti Energia AS, has reported that it is actively improving the energy efficiency of the oil shale process. Reported measures include efforts to analyse and optimise the overall mine face to output process, upgrading of boiler plant to circulating fluidised-bed combustion technology, re-firing stockpiled process waste which has previously been incompletely utilised, improved analysis and blending control to manage oil shale variability. Eesti Energia has also identified how to co-fire oil shale plants with biofuels to decrease the emission levels of conventional thermal plants.

CHP and DH

The share of CHP in Estonia is 10.4% of total electricity generation; 50% of gas primary energy resources, or 2.5 PJ, is currently applied to electricity generation, all of it through CHP plants. The Development Plan of the Estonian Electricity Sector to 2018 states a target for a CHP share of 20% by 2018. Achieving this target depends on the dynamic between growth in demand for electricity and a potential decline in demand for DH from CHP as DH investors move to bioenergy, and the retirement of oil shale power generation units. A transparent process in DH pricing will be important in attracting investment in new CHP plants.

Summary of IEA 25 Energy Efficiency Policy Recommendations

Table 1 summarises the IEA 25 Energy Efficiency Policy Recommendations and plots Estonia's priorities against the 25 recommendations and should be regarded as a framework for a comprehensive portfolio of policies.

Table 1. **IEA 25 Energy Efficiency Policy Recommendations**

Summary of energy efficiency recommendations	Priority	Notes
To improve ***energy efficiency*** across all sectors, the IEA recommends action in the following areas:		
Energy efficiency data collection and indicators.	Med	Statistics Estonia has reasonable end-use data.
Strategies and action plans.	Med	Review energy efficiency strategy.
Competitive energy markets, with appropriate regulation.	Low	Strong market approach in energy policies in Estonia.
Private investment in energy efficiency.	Low	Continue strong private funding of existing schemes.
Monitoring, enforcement and evaluation of policies and measures.	Med	Important to learn from energy efficiency funding programmes.
To achieve savings in the ***buildings sector***, the IEA recommends:		
Mandatory building energy codes and minimum energy performance requirements.	Med	Regular review, upgrade cycle and pilot activities are important.
Aiming for net zero-energy consumption buildings.	Med	Promote zero/low-energy buildings.
Improving energy efficiency of existing buildings.	High	Rationalise and extend existing schemes for this priority end-use, integrate with DH policies.
Building energy labels and certificates.	Low	Work with EU labelling.
Energy performance of building components and systems.	Med	Align local manufacturers with EU standards.
To achieve significant energy savings in the ***appliances and equipment*** sector, the IEA recommends:		
Mandatory energy performance standards and labels for appliances and equipment.	Low	Reasonable for a country not producing appliances and systems to rely on EU processes.
Test standards and measurement protocols for appliances and equipment.	Low	
To achieve significant energy savings in the ***lighting*** sector, the IEA recommends:		
Phase-out of inefficient lighting products and systems.	Low	Reasonable for a small technology-taking country to rely on EU processes.
Energy-efficient lighting systems.	Low	
To achieve significant energy savings in the ***transport*** sector, the IEA recommends:		
Mandatory vehicle fuel efficiency standards.	Low	Reasonable for a small technology-taking country to rely on EU processes.
Measures to improve vehicle fuel efficiency.	Low	
Fuel-efficient non-engine components.	Low	
Improving operational efficiency through eco-driving and other measures.	Med	Cost-effective energy and safety from eco-driving.
Improving transport system efficiency.	Med	Pursue transport energy efficiency plans.

To achieve significant energy savings in the ***industry*** sector, the IEA recommends:		
Energy management in industry.	Low	Reasonable incentives already in place.
High-efficiency industrial equipment and systems.	Low	
Energy efficiency services for SMEs.	Med	Explore options with industry associations.
Complementary policies to support industrial energy efficiency.	High	Reasonable incentives already in place.
To achieve significant energy savings in ***energy utilities*** and end-use efficiency, the IEA recommends:		
Governments should establish regulatory and other policies to ensure that energy utilities support cost-effective, verifiable end-use energy efficiency improvements.	Med	Explore options with utility industry.

DISTRICT HEATING

OVERVIEW

DH is defined as heat produced at centralised sites (such as CHP plants, heat-only boilers, industrial waste heat) and transported via heat networks. CHP saves about 30% of the fuel compared with separate production of heat and power. DH systems also provide opportunities to use local heat sources that would otherwise be wasted such as industrial waste heat, municipal waste or biomass.

DH plants can also offer flexibility by using various fuels such as natural gas, fuel oil and renewable fuels, thereby playing an important role in energy security. DH systems can meet residential, commercial and industrial needs for heat. Typically, buildings need space and water heating, while industrial companies need steam and hot water.[11]

In Estonia, DH accounts for a relatively large part (over 30%) of household energy consumption.[12] Approximately 70% of the population has access to its DH systems, which are provided by approximately 200 utilities in 230 heating districts. The sector is predominantly operated by privately owned entities, although in some areas the municipality provides heat. The principal energy sources used are biomass, natural gas and shale oil.

Estonia is actively developing diversity in new DH plants by utilising different low-grade energy resources such as biomass, municipal waste, and reject heat from CHP plants. Recent progress includes new biomass CHP plants in the major cities.

PRODUCTION AND SUPPLY

Data provided by Statistics Estonia indicate that the total volume of heat produced in 2011 was 9.1 TWh, of which 3.5 TWh was produced in power plants and 5.6 TWh in heat plants. The volume of heat produced for DH systems in 2011 was 6.3 TWh, compared to 7.1 TWh in 2010 and 7.6 TWh in 2005. Approximately 3.9 TWh of heat was consumed by households in 2011 compared to 4.2 TWh in 2010.

Losses in the heat network are approximately 22%. Better insulation and greater energy efficiency measures have reduced demand for heat but this has been offset by growth in the number of customers.

11. *Coming in from the Cold: Improving District Heating Policy in Transition Economies*, IEA, Paris, 2004.

12. *Quarterly Bulletin of Statistics Estonia*, Statistics Estonia, 2013.

LEGAL AND REGULATORY FRAMEWORK

The District Heating Act (DHA) regulates the activities related to the production, distribution and sale of heat by way of DH networks and connection to networks. The DHA entered into force in February 2003 and has been amended a number of times since. It requires a heating company to maintain separate accounts for the production, distribution and sale of heat and for other areas of activity, including for the costs incurred in electricity co-generation.

The DHA also stipulates that the price of heat produced in co-generation processes is subject to approval by the Competition Authority. According to the Electricity Market Act (EMA), a producer in a dominant position as defined in the Competition Act and who generates electricity in a CHP plant shall, at the request of the Competition Authority, submit information on the allocation of revenue, and on expenses, separately for the generation of electricity and of heat together with the relevant reasons. The task of the Competition Authority is to approve the price of heat in a manner in which cross-subsidising of electricity is avoided in the allocation of costs.

On the basis of the DHA, a heating company may apply to the Competition Authority for approval of a price formula for a period of up to three years. This price formula is used if factors which are beyond its control and which affect the price of heat become evident. At the end of 2012, the weighted average of DH maximum prices was EUR 57 per megawatt hour (EUR/MWh); the lowest price was EUR 27.48/MWh (excluding 20% VAT) and the highest price was EUR 90.3/MWh. As a rule, the maximum price is considered as the actual selling price.

The procedure or methodology for approving the maximum price was developed by the Competition Authority and, since November 2010, all DH providers must seek approval of their maximum prices from the Competition Authority.[13] Previously, only providers with annual consumption of over 50 gigawatt hours (GWh) required approval by the Competition Authority, while others needed to co-ordinate their prices with local municipalities.

The regulation of maximum price is based on *ex ante* cost-based principles. If the price does not cover all of the costs and a reasonable profit, the company must propose a new price. When the actual price is 5% or more below the approved price, a new maximum price must be approved.

Subsidies are excluded from the approved price and are paid only in the form of investment aid. The Environmental Investment Centre (KIK), a subordinate body of the MEAC subsidises the renovation and construction of CHP units, boiler houses and heat distribution pipelines.

In Estonia, district heat supply providers may be in a dominant market position for several reasons: either because conversion to another type of heat supply is technically complicated and often even impossible; or installation of an individual source of heat requires obtaining of an emission licence; or extra power capacity is not available owing to limitations in the electricity supply system. Furthermore, many municipal authorities have established district heat supply areas that make local DH a monopoly with exclusive rights in which a change in the type of heat supplied is totally impossible. For suppliers of district heat, the average debt capital risk premium shall indicate the debt capital risk premium of district heat supply providers.[14]

13. Principles of approval of maximum heat price, www.konkurentsiamet.ee/file.php?15431.

14. Guidelines for the Determination of Weighted Average Cost of Capital, Estonian Competition Authority, 2013.

DH REGIONS

Pursuant to the DHA, a local government is entitled to establish DH regions within the boundaries of its administrative territory. The only permitted heating option to be used in these regions is DH (except for persons who did not use DH at the time DH regions were established); consumers cannot choose alternative heating methods and the heating company obtains a monopoly status.

Pursuant to the Establishment of Price Limitations to Monopolies Act, only the Competition Authority oversees implementation of the DHA and approves the maximum prices of heat sold by heat suppliers.

The maximum prices for heat are approved for each DH region. The economic prosperity and efficiency of suppliers depend, above all, on the volume of sales in these regions, the fuel used, technical efficiency (the efficiency coefficient of heat production and heating pipeline losses) and the supplier's ability to make investments to ensure the higher efficiency and sustainability of DH.

As the prices of primary fuels, notably natural gas and oil shale, have increased in recent years, small-scale heating suppliers, which have fuel costs amounting to 70% or more of their expenses and which had previously been under the regulation of local governments, became more active in applying for the approval of heating limit prices.

HEAT PROCUREMENT ORGANISATION

Section 14^1 of the DHA allows heat producers and network operators to conclude contracts of up to 12 years to ensure investment security. To conclude such contracts, network operators must first organise procurement tenders in case there is a need for new production facilities and/or several heat producers have provided the network operator with a written declaration of their interest in concluding a contract. The Ministry for Economic Affairs and Communications has developed a procedure for the organisation of procurement tender and the assessment of the bids submitted, which network operators must comply with in the process of organising heat procurement and tenders.

ASSESSMENT

Energy efficiency

Estonia is recognised for its rapid reforms following its independence, with a clear preference for liberal economic policies well engaged with regional and international efforts to advance sustainable energy and efforts to address climate change challenges. Estonia's active participation in regional energy forums and its clear policy frameworks for energy decision making are robust foundations on which to develop the nations' energy efficiency.

Estonia clearly aspires to a more energy-efficient and sustainable economy. Notwithstanding sound commitment to the EU objectives for energy efficiency, Estonia's policy challenges and opportunities extend beyond the 2020 horizon of EU obligations. It is understood that the government aims to use the EU directives as a step on the way to shaping longer-term objectives and has started working on Energy Strategy of Estonia to 2050.

Many aspects of Estonia's energy system are at a crossroads: market liberalisation, effective co-operation with neighbouring countries via transparent energy markets, diversification into sustainable energy resources and technologies. Regardless of the economics and practicalities of supply-side options, realising energy efficiency is central to all aspects of future energy policy.

In Estonia, 23.6% of gross domestic product is created in the industry sector and the government seeks to develop from a reliance on labour-intensive activities to higher value-added services in its economy. The energy industry (oil shale extraction, biomass harvesting, electricity, heat, and gas production and distribution and delivery) represents 4.6% of economic activity.

Export structure is made up of 28% machinery and equipment, 18% mineral products, 8% metals and metal processing, 8% timber, 7% wood products, 5% vehicles. This diversity, along with the obvious entrepreneurial activities in information and communication technologies, suggests an emerging heterogeneous activity base. Resilient and diverse ranges of high-quality consumer energy products are required to underpin future economic development.

Estonia continues to pursue an agenda of liberalising energy markets and is identified as a smart adopter of information and communication technologies. An open market approach is essential to enable efficient energy transactions with neighbouring countries, as well as to ensure that domestic sustainable energy policy provides efficient signals for all decision makers and investors. This is critical to establishing the right drivers and investment signals for energy efficiency, security of supply and other opportunities in sustainable energy, and can be effectively complemented by carbon pricing.

Regardless of the economics and practicalities of supply-side options, realising energy efficiency is central to all aspects of future energy policy. Prioritising those few actions that deliver the most significant economic returns is important for meeting both Estonia's cost-effective priorities and achieving EU objectives.

Given the small size of the country and its administration, it is far more important for Estonia to focus on a few critical priorities in energy efficiency, than to attempt a broad portfolio of activities. Recognising that some areas of energy efficiency policy are driven by EU regional processes, as a small country, these will create demands on operational resources. For a small country it can be difficult to manage the internal priorities with external requirements. It is important that Estonia minimises the effort and overheads in delivering energy efficiency policies.

While renewable energy is on track to achieving Estonia's EU targets, and a liquid fuel law is under development to place biofuel sales obligations on oil companies, progress on energy efficiency is less clear. Reported energy demand reductions and intensity changes are not easily related to changing structure or reduced activity. It is useful for Estonia to understand why the gains have or have not occurred.

Estonia can more usefully structure and integrate the various functions delivering energy efficiency policies and programmes. The management and integration of operational activities in energy efficiency and the relationship with the MEAC are unclear. The implementation of government funding programmes for energy efficiency, climate change and DH support appears to be spread over different programmes that seem to be driven by funders' criteria and to overlap without consistent guiding principles. The relationship between the MEAC, and the Ministry of the Environment and operational programmes should be restructured to remove operational overlaps and improve consistency. Estonia should consider creating an energy efficiency unit, which would be able to commission, research, evaluate and implement energy efficiency priorities maximising delivery efficiency, reporting to the Energy Department in the MEAC. The latter should lead co-ordination of energy efficiency policies across government to merit required focus and operational clarity.

DH

DH is a natural choice of heating in densely built areas in colder climates and an efficient system can play an important role in improving living standards and reducing greenhouse gas emissions. As a result of its cold climate, demand for heat in Estonia is strong and 70% of heating is provided as DH. The country has a comprehensive, but ageing DH pipeline system over 1 400 kilometres long. There are 230 DH zones in Estonia and delivered heat energy ranges from 0.25 GWh to 1 585 GWh in Tallinn. Most networks are old and inefficient. The government has set a goal to minimise heat losses from 22% at the moment to 15% in 2017 and there are plans to draw up heat development plans for DH regions with less than 50 GWh of consumption by 2015.

DH is used in all bigger cities, including in the capital Tallinn where a new waste-to-heat energy plant is being built. The waste collection system is effective and 450 kt of municipal waste is collected each year. Starting in May 2013, the new waste-to-energy CHP plant will be operating, which will consume 220 kt of municipal waste each year. The plant is rated at a capacity of 17 megawatts (MW) of electricity and 49 MW of heat. The project is a good example of how Estonia can actively develop diversity in new DH plants by utilising different low-grade energy resources such as biomass, municipal waste, and reject heat from CHP plants.

The 2003 DHA gave a mandate to local governments to establish DH regions where there are no practical alternatives for heat supply, *e.g.* no local gas supply. Municipalities have an interest in ensuring that their communities have reliable access to utility services and are interested in achieving social outcomes as well as economic and environmental sustainability. The use of DH is compulsory in these local government "mandated" DH areas. Heat users can be exempted from the compulsory connection requirement if they use renewable resources for heating.

Nonetheless, new technical solutions and energy efficiency gains in the future may increase the amount of economically justified alternatives such as solar PV heating. As other space-heating options become more competitive with DH, customers with obligatory connections to DH systems owing to zoning regulations may be prevented from having access to new high-efficiency or renewable heating options. The current DH regime is limiting economic, environmentally sustainable options.

The present DH pricing principle is that its price should support sustainable development. The weighted average of DH maximum prices is currently EUR 57/MWh and, as a rule, the maximum price is considered as the selling price. At this price, Estonia's consumers are spending EUR 400 million per year on DH services. There is variation in the cost of these services: in 36 of the 164 DH systems audited by the National Audit Office in 2009, DH was more expensive than electric heating. The causes of the high cost of heating are linked to higher fuel prices, ageing boilers and heat losses caused by the poor state of heat networks. On average, between 10% and 30% of all heat is lost in pipelines before it even reaches consumers.

In the heat networks of 28 local governments, the proportion of heat loss recently exceeded 25%. According to the assessment of the National Audit Office, consumers paid more than EUR 44 million to cover heat network losses in 2009. This implies a national system-wide cost of losses of approximately 10%. Nonetheless, in some systems, the real cost of operating the system (including losses) is being reflected to consumers.

It is difficult for the different players in the system to take economic decisions without reasonable transparency of the costs and efficiency opportunities in the system. In Estonia, as elsewhere, there is a real and urgent need to improve both the reliability of ageing systems and economic and thermal efficiency, and this difficulty in understanding stable costs and revenues is a significant barrier to necessary investment. There is a risk of stranded assets when new housing moves to low-energy buildings, and comprehensive insulation retrofits reduce the demand for heat services.

Householders, tenants and owners have limited options for alternative or improved heating systems while compulsorily tied to their own system, or to a system with inadequate price signals. For owner-occupants, apartment buildings are not easily retrofitted with insulation or heating efficiency improvements, and for tenants it may be difficult to seek improved performance from landlords, or DH service providers. In terms of buildings energy efficiency, this is probably one of the most widespread and least tractable examples of institutionalised principal-agent failure.

System operators, building owners and governments all face significant challenges to funding improvements to these systems. In times of recession, governments are forced to reduce expenditure, and private investors receive an inadequate return on investment from systems without cost transparency and the capacity to bill for services. Inadequate returns are expected to kill any incentive to efficiently modernise the system.

Technical challenges and opportunities, such as co-firing biomass with fossil fuels or insulation retrofits exist, but these challenges are small in scale and face fewer barriers when compared to the systemic problems mentioned above.

Given Estonia's dependence on DH, these are very important policy considerations. Proceeding on the current path of diversified fuels for DH and improving the heat generation efficiency with biomass and CHP plants is a very sound policy. And by utilising low-value energy resources that may have little other economic application, it will ensure that higher-quality energy resources will remain available for high-value domestic end-use applications or for export, but to capitalise on this opportunity requires serious efforts on DH system policy and economics.

There are ongoing discussions on how to reform the DH sector and a legislative proposal is being drafted, which is encouraging. It is clear that many systems will become increasingly unsustainable with the availability of new independent heating systems, and higher energy prices; therefore urgent measures are needed. The IEA encourages a system-wide approach, including the introduction of demand-side measures.

Estonia is a country that embraces market competition, which is also the government's aim in the DH market. The new legislation should secure a stable regulatory framework to transit to a more economically and environmentally sustainable DH market. An effective and commercially sustainable DH policy needs to be built on sound economic regulations, complemented by markets under the threat of substitution.

In addition to DH, or CHP, efficient means of heating such as heat pumps can support and facilitate a more efficient use. Estonia is among the leading countries in the world for the use of heat pumps per capita. The Environmental Investment Centre co-operates with the MEAC to finance the construction of DH systems, including the conversion of boilers from fossil fuels to biomass, financing heat producers for using CHP. In 2009, the centre started by offering funding for a total of EUR 40 million for 60 DH projects over a two-year period, after which time the funding was exhausted. The funding programme is now awaiting a new funding allocation, and the Environmental Investment Centre is holding requests for funds.

There is a lack of policy strategies to address some of the challenges set out above. A more dynamic "end-use comfort to fuel supply" value chain approach needs to be explored if sensible incentives for the different actors involved in DH systems are to be developed. The IEA encourages an overall perspective on heat services and DH. Developing the DH system's ability to reflect prices to end-users and developers is key to motivating economic investments in the DH system. There appears to be a clear demand for funding DH improvements. The government should review the outcomes, the economics of the achieved outcomes and determine whether and how the scheme has delivered as expected. The assessment addresses cost-effectiveness by explicitly using some form of cost-benefit methodology that takes account of the wider social/public policy dimensions to the extent feasible. Any decision to continue with a support policy should address the stability of the policy and variability in any support funding.

DH systems have high upfront infrastructure costs: heating boilers and fuel handling plants, piping networks that double up on existing electricity and gas networks, building heating distributions systems. Variable operating costs can be low, often by using cheap low-grade fuels with few competing applications. Any billing system for users faces challenges in sensibly reflecting long-run and marginal costs.

Many DH systems have inadequate or no metering, at both building and household levels. Even where end-user metering is not economic, users should still receive a regular bill with a regular indication of the real cost of the service they use. As DH systems change to CHP plants, the demand for heating energy can affect and in some cases dictate the merit order of the electricity generation mix. This is driven by a need to produce heat on demand, and fixed heat: electricity ratios in CHP plants. In countries with extensive DH systems, the "must run" nature of DH CHP systems (often fuelled by gas) now compete head on with "must run" renewables like wind farms. Every effort should be made to ensure that prices in both heating and electricity sectors are cost-reflective to provide strong incentives for a more efficient development of CHP capacity and operation of CHP plants.

RECOMMENDATIONS

The government of Estonia should:

Energy efficiency

- ☐ *Further elaborate priorities for energy efficiency demand-side measures. Consider an integrated resource planning analysis of demand-to-supply-side value chains to identify the most economic life-cycle policy options.*
- ☐ *Focus on energy efficiency policies and programme activities that meet both Estonia's cost-effective priorities and the requirements of the EU directives.*
- ☐ *Consolidate existing energy efficiency activities in an operational unit focused on deploying high-priority actions for energy efficiency, with adequate capacity to improve*

the targeting, integration, delivery efficiency and profile of energy efficiency targets. The unit should have clear accountability to a central policy ministry.

- ☐ *For new buildings, strengthen building codes with staged improvements in stringency and adopt a more ambitious pathway to zero- and low-energy buildings. Complement this with capacity-building measures.*
- ☐ *For the existing building stock, develop an integrated programme of fiscal and funding measures that enable priorities in the building stock to be improved over a defined time period. Increase the ratio of private-sector funding.*
- ☐ *Integrate building measures with policies on DH to ensure that end-use efficiency improvements in buildings are taken up and that consumers exposed to unsustainable DH systems have priority for insulation and high-efficiency local heating, such as a heat pump.*
- ☐ *Review the proposed energy efficiency policy options in the transport sector and develop a strategy of prioritised measures to improve mobility in passenger and freight transport in order to minimise transport fuel demand. Apply EU policies to advance the efficiency of the vehicle fleet, meeting the unique mobility needs and characteristics of Estonia's vehicle fleet. Develop effective policies to improve mobility in cities and towns. Ensure that priorities are economic and that realistic funding is identified.*
- ☐ *Develop a strategy to ensure that freight transport effectively supports the economy and improves efficiency with efficient vehicles, modes and logistics management systems.*
- ☐ *Review the potential for cost-effective efficiency improvements in businesses, and develop a strategy enabling industry confederations to advance energy efficiency.*

District heating

- ☐ *Continue to review and implement new DH legislation to ensure that all stakeholders, including household consumers, receive effective price signals that motivate energy efficiency improvements.*
- ☐ *Implement a DH action plan consistent with the broader energy policy framework. This should take an integrated approach on how to bring improvements in end-use energy efficiency as well as in interactions between the DH system and the electricity system. Ensure that consumers are urgently supported with energy efficiency improvement and cost-effective heating alternatives if their existing DH system becomes uneconomic.*
- ☐ *Investigate if regulatory action, such as separation of network ownership and heat plant ownership, is required in order to encourage efficient pricing and fair access to new heat providers.*

5. NATURAL GAS

Key data (2012 estimated)

Production: none

Share of natural gas: 9.5% of total primary energy supply (TPES) and 1% of electricity generation

Inland consumption*: 632 million cubic metres (mcm) (district heating [DH] 48%, local heating 25%, industry 24%, electricity generation 4%)

Net imports (2011): 0.5 million tonnes of oil-equivalent (100% from Russia)

* Source: country submission.

POLICY OVERVIEW

Estonia has no gas production. It is fully dependent on gas imported directly from Russia by pipelines or drawn from storage facilities in Latvia. The Estonian natural gas market has been fully open since 1 July 2007. However, it is a *pro forma* opening, since existing legal and functional separation rules have failed to provide the necessary incentives to encourage competition or further developments in the gas market. In order to ensure more efficient market development, the amendments of the Natural Gas Act were introduced and implemented on 8 June, 2012.

The Natural Gas Act, in force since 2003, provides regulations for all economic activities related to natural gas import, transmission, distribution, sales and connection to networks. These regulations allow for free third-party access and limit the possibility of denying network services to any market participant.

Implementing state control, supervision and monitoring of the natural gas market is the responsibility of the Estonian Competition Authority, which regulates both electricity and gas markets. The Competition Authority provides the methodology for calculating tariffs for transmission and distribution network services, which are uniformly applied to all network operators regardless of their size. Gas price is not regulated and all customers buy gas at market price. The Competition Authority applies *ex post* control or price supervision.

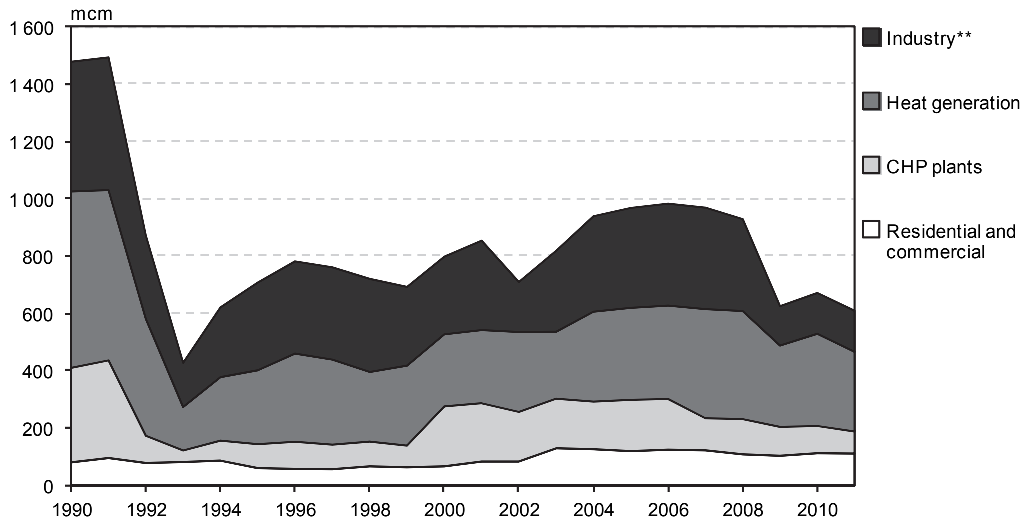
Rising concerns over security of natural gas supply have prompted the need to establish a fully operational/functional gas market with more competition and liquidity and the obligation to comply with European Union (EU) directives. This has led to discussions within the Estonian government on further stimulating the gas market opening so as to support the introduction of alternative gas supply sources. On 6 June 2012, the Estonian Parliament amended the Natural Gas Market Act, requiring full ownership unbundling within a transitional period of three years, in order not to infringe the rights of the system operator and of the transmission network owner. The system operator is given three years to organise full compliance with this law and was required to submit a plan for restructuring by 1 January 2013. Full ownership unbundling of the natural gas market is due by January 2015.

SUPPLY AND DEMAND

The share of natural gas in TPES in Estonia is 9.5%, used for heat and electricity production. The Estonian gas market is dominated by a single vertically integrated operator, Eesti Gaas, whose key shareholders are Gazprom OAO (37.03%), E.ON Ruhrgas International GmbH (33.66%), Fortum Heat and Gas OY (17.72%), and Itera Latvija (9.99%).

According to the Estonian government, gas consumption fell from 1 003 mcm in 2007 to 632 mcm in 2012, a decrease of approximately 37%. This was partly due to the general economic downfall, but the greatest impact came from the economic failure of the fertiliser producer Nitrofert AS in February 2009. In 2008 the share of industrial consumption was 39.7% of the total, while in 2009 it fell to 21.3%. The share of gas consumed by Nitrofert was close to 20% of the national consumption of gas. Nitrofert resumed operations in December 2012, although it remains to be seen whether it will scale up its ammonia and urea production to pre-2009 levels.

Figure 12. **Natural gas supply by sector*, 1990-2011**



* TPES by consuming sector.

** *Industry* includes non-energy use.

Sources*: Energy Balances of OECD Countries*, IEA/Organisation for Economic Co-operation and Development (OECD), Paris, 2012; and country submission.

Natural gas is primarily used for heat generation in Estonia. The use for electricity generation is extremely modest, as only 4% gas goes into electricity production. Natural gas consumption for DH is 48%, residential heating 25%, and industry 24%.

The Tallinn region is the largest consumer of gas, amounting to approximately 70% of total consumption. The largest consumers (Tallinna Küte AS, Eesti Energia AS) account for 45% of daily consumption.

Other factors contributing to the decrease in gas consumption are the decisions of a number of large heat-producing companies to switch to local renewable fuels because of high gas import prices, as well as the start of commercial operation of new wood- and peat-fired co-generation plants in Tallinn and Tartu. For example, Eesti Energia's Iru power plant has significantly reduced its gas consumption owing to the new commercial operations by Tallinna Elektrijaam OÜ, which is a combined heat and power plant using wood chips. The Iru plant also plans to cease using natural gas for electricity generation.

Peak demand and seasonality

Estonia uses up to five times more gas in winter than in summer because of its primary application for heat generation. From May to October, the gas system is fed mainly with gas directly from Russia. From November to April, gas is supplied from the Inčukalns underground gas storage in Latvia through the Karksi gas metering station (GMS) with a capacity of 7 mcm per day (mcm/d) or from Russia through the Värska GMS with a maximum capacity of 4 mcm/d.

Peak demand for gas in winter can rise to over 7 mcm/d, which is more than the installed supply capacity from the Inčukalns gas storage facility. Such increases could be triggered by temperature drops below minus 20 degrees Celsius, where DH companies operating on wood chips or peat switch to natural gas as a backup fuel without giving advance notice to the supplier in order to cover the peak load in a timely manner.

The daily quantities of gas delivered from Inčukalns depend on the season and technical limitations. Demand increases due to extremely cold winters affect supplies to large consumers from the Inčukalns gas storage not only in Estonia but also in Latvia, Lithuania and Russia (Pskov). The most critical period for the Estonian gas supply from the Inčukalns gas storage is spring, when the drop in the volume of gas causes a drop of pressure on the Estonian border, hindering the delivery of the required quantities. Gas importers therefore need to buy additional volumes of natural gas directly from Russia through pipelines.

The maximum daily consumption during the past 20 years was in winter 2006 with 6.678 mcm/d. In spring (April) 2010, it was 2.147 mcm/d. The minimum daily consumption, 0.496 mcm/d, was in July 2010. In February 2012, there was a record peak of 5.7 mcm, representing the highest daily consumption for the last five years.

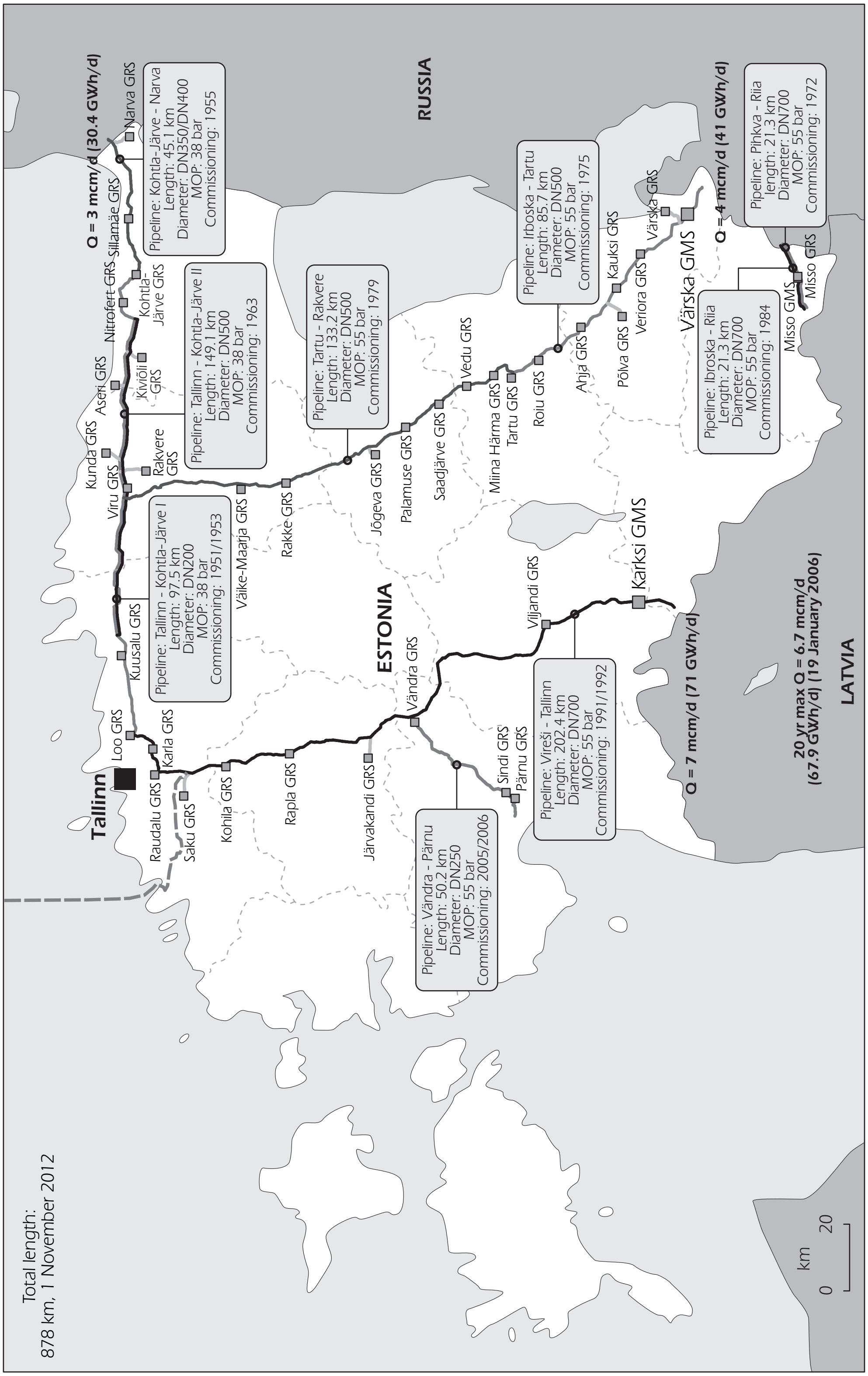
IMPORTS AND EXPORTS

Estonia imports 100% of its gas from Russia. The major owner of Estonia's market dominant trader, Eesti Gaas AS, is the Russian gas exporter Gazprom. Although Estonian legislation permits any market participant to import gas, Eesti Gaas is essentially the only gas importer and trader/re-seller in the country. Although the fertiliser producer Nitrofert AS imported gas until 2009, and later resumed from December 2012, all its imports are exclusively for its own use.

INDUSTRY STRUCTURE

The Estonian gas transmission network was built between 1951 and 2006, and is part of the former Soviet Union's transmission network. Estonia has operational interconnections with the Russian natural gas network in Värska, and with Latvia in Karksi, with a maximum capacity of 11 mcm/d. The interconnection with the Russian network in the south-east is provided through the Izborsk-Tartu-Rakvere transmission pipeline and the Värska GMS. It is connected with Latvia through the Vireši-Tallinn transmission pipeline and the Karksi GMS. Although designed as a continuous bidirectional gas flow transmission system, at present it only operates unidirectionally, from Latvia to Estonia. The Estonian gas system has another interconnection with Russia in Narva (in the north-east, through the Kohtla-Järve-Narva double pipe transmission and the Ivangorod GMS), which has been closed because of limits in maximum pressure on the Estonian border and is used only by special agreement with Gazprom Transgaz Sankt-Petersburg, depending on the operation regime of its gas system. But according to a Gasprom Transgaz statement made in late autumn 2012, they have recently performed reconstruction work in Russia, which allows a decrease of gas pressure in pipes of up to 29 bars, making it also possible to use gas through the Narva interconnection (maximum 3 mcm/d) in winters.

Figure 13. **Gas transmission network of Estonia**



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Note: Q = installed capacity; MOP = maximum operating pressure; km = kilometre; GWh/d = gigawatt hours per day; yr = year.

Source: country submission.

PIPELINES

The gas network in Estonia is 2 314 km long, of which 878 km are for transmission and 1 436 km for distribution. There are three GMSs in Värska, Karksi and Misso and 36 gas distribution stations. The system is owned by Eesti Gaas, and operated by EG Võrguteenus, which provides transmission and distribution services, and operates the gas metering systems on the Estonian border.

In addition to EG Võrguteenus, which provides distribution services to 90.1% (or 43 500) of customers, there are also 25 natural gas distribution companies, which operate 631 km of distribution pipelines, providing services to the remaining 9.9% of customers.

Eesti Gaas AS owns the entire gas transmission and distribution system and supplies gas to all the wholesale markets and the majority of the retail markets. The only exception is the large chemical industry Nitrofert, a Kohtla-Järve company producing mineral fertilisers, which imports gas for its own use. Nitrofert halted operations in February 2009 and resumed in December 2012.

TRANSIT

There are two small transit pipelines (Izborsk-Inčukalns and Valdai-Pskov-Riga) in the southern part of Estonia, supplying gas between Russia and Latvia. Metering takes place in the Iborsk GMS (Russia) and in the Korneti GSM (Latvia). Misso gas distribution station is the only outlet and serves only a small network of Misso village.

COMPRESSORS, METERING AND BALANCING SERVICES

The necessary pressure level in the Estonian gas system is maintained either by the Russian transmission system's compressor stations or from the Inčukalns storage facility in Latvia. From April to October the Estonian gas system pressure is maintained by the compressor stations of the Russian transmission system, and from November to March, by the Inčukalns facility. Metering of incoming gas and determination of its properties is carried out at the Värska and Karksi GMSs.

The system operator EG Võrguteenus is responsible for the balance of the whole system. The Competition Authority approves the methodology for balancing gas price and standard conditions for balance contracts. The balancing gas price and the charge for gas transit are not subject to approval. For these prices, the Competition Authority applies *ex post* regulation, *i.e.* supervision of the price.

STORAGE

There are no gas storage facilities in the country. Estonia uses the Inčukalns underground gas storage facility in Latvia, which supplies gas to major consumers in Estonia, Latvia, Lithuania and north-west Russia (Pskov), primarily for heat generation.

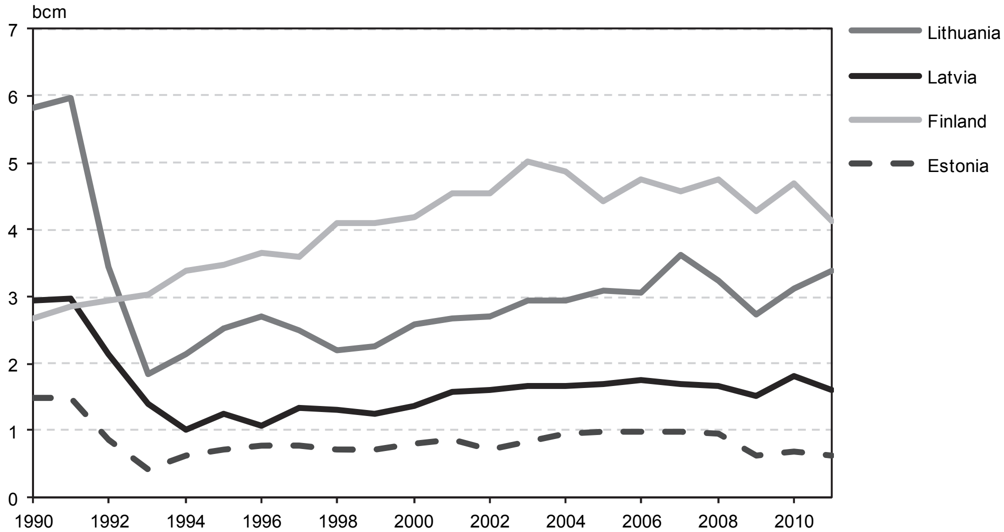
As the only functioning natural gas underground storage facility in the Baltic states, Inčukalns has a total 4.47 billion cubic metres (bcm) capacity, of which 2.32 bcm is active at present. According to the owner of the Inčukalns underground gas storage facility, JSC Latvijas Gāze, it is possible to increase active capacity to 3.2 bcm, which would ensure the Baltic region's needs for natural gas or to expand it even further to store natural gas volumes required by Finland.[15]

15. JSC Latvijas Gāze, www.lg.lv/index.php?id=194&lang=eng.

DIVERSIFICATION OF GAS SUPPLY SOURCES: LNG AND OTHER REGIONAL INITIATIVES

Estonia, as a net importer of natural gas from a single source, is working closely with other governments in the region to diversify gas supply sources. Prospective projects currently under negotiation include a liquefied natural gas (LNG) terminal in the Gulf of Finland, the Baltic-connector, Intra-Baltic connections and the gas interconnector Poland-Lithuania (GIPL).

Figure 14. **Natural gas consumption (annual) in the Baltic region and Finland, 1990-2011**



Sources: *Gas Information*, IEA/OECD, Paris, 2012; and country submissions.

There are a number of port locations eligible for the construction of the LNG terminal in the Baltic states: Muuga, Paldiski and Sillamae in Estonia, Riga and Ventspils in Latvia, Klaipeda in Lithuania, and Inkoo in Finland, all requiring similar investment (in the range of EUR 440 million to EUR 500 million) for the construction of a terminal. The key economic differences would however be the costs of connecting the LNG terminal to the grid.

According to the European Commission study on the cost and benefits of a regional LNG solution in the east Baltic area under the Baltic Energy Market Interconnection Plan (BEMIP),[16] Estonia and Finland are identified as best placed for a regional LNG terminal. The overall estimate for the LNG terminal and proposed pipeline connections is around EUR 1.3 billon, covering the potential wider regional demand of 11 billion cubic metres per year (bcm/yr) by 2030, with almost 6 bcm/yr share of the Baltic states' demand.

These energy infrastructure projects are potential candidates to receive funding under the European Union's Connecting Europe Facility for 2014-20, but any investment decision is contingent on the agreement by Estonia, Latvia, Lithuania and Finland on the location of the terminal site. Consensus, however, is still pending, and the Estonian government is urging the region's governments to avoid further delay in securing EU aid for this vital regional infrastructure project.

Estonia's Eesti Gaas long-term natural gas supply agreement with Gazprom expires at the end of 2015 and the government is committed to finding a feasible solution to secure alternative sources of natural gas supplies to Estonia and to the region. There is less

16. http://ec.europa.eu/energy/infrastructure/doc/20121123_lng_baltic_area_report.pdf, by Booz & Company, November 2012.

urgency on the Finnish side since Finland's gas supply agreement with Gazprom, with a take-or-pay obligation, runs until 2025. The Finnish grid operator Gasum Oy and the Estonian transmission system operator (TSO) EG Võrguteenus have however voiced their preference for a joint Baltic-Finnish LNG terminal to be built at the Finnish town of Inkoo.

The Lithuanian government is actively promoting a floating LNG terminal in Klaipėda, developed by Klaipedos Nafta. Designed at 2 bcm capacity, this terminal is scheduled to be built by late 2014 to reduce the country's import dependence on a single supplier, which has substantially increased following the shut down of Lithuania's Ignalina nuclear power plant on 31 December 2009. Norway's Hoegh LNG signed a USD 250 million loan with four banks for this project in November 2012; however the final investment decision is still pending because of concerns raised over tender procedures in late 2012. Although the terminal is designed for domestic use, project developers maintain that its capacity could eventually be expanded to serve other countries in the region.

MARKET OVERVIEW

The Estonian gas market has been open since 1 July 2007, but essentially it is a *pro forma* market opening where there is no competition. The vertically integrated operator Eesti Gaas is a dominant player for both wholesale and retail markets. Eesti Gaas established the independent system operator EG Võrguteenus, which leases Eesti Gaas's assets for the provision of transmission services. The only other gas importer in Estonia was the large fertiliser producer Nitrofert, which halted operations from February 2009 to December 2012.

WHOLESALE MARKET

Eesti Gaas, the only wholesaler in Estonia, imports gas from a single supplier, Gazprom, under a long-term contract. Supply volumes of natural gas in the current contract represent up to 7 mcm/d until the end of 2015. Eesti Gaas sells gas at negotiated prices on an equal basis to eligible customers connected to its own network, and to other network operators for reselling.

The long-term contract contains clauses regulating gas supply technical conditions (pressure, calorific value, etc.), volumes of supply and storage (annual and monthly), gas storage and transmission charges, gas price calculation issues, conditions of payment, conditions for revisions of contracts when required, other liabilities, etc.

The annual amount of natural gas, its quarterly breakdown and other issues are specified in additional agreements. Natural gas purchase prices in long-term contracts are linked to the price of oil and calculated according to formulas. In order to guarantee gas price competitiveness with other fuels, the price calculation is based on nine months average of heavy fuel oil price (with 1% sulphur content) and gasoil price in north-west Europe quoted in US dollars, with an exchange rate between the euro and the dollar. The formula of gas purchase price is usually subject to revisions at the end of each year.

RETAIL MARKET

As in the wholesale market, Eesti Gaas holds a market dominant position in the retail market. In 2011, Eesti Gaas's share in the retail market was 90.1%, and the remaining 9.9% was purchased from Eesti Gaas by other network operators. In 2011, 25 licensed gas traders were active on the gas market and there were no retail sellers independent of the network operator. There were 1 576 retail sales recorded in 2009; 1 674 in 2010 and 1 778 in 2011.

The gas system operator in Estonia is EG Võrguteenus, which provides both transmission and distribution services. There are 878 km of gas transmission lines (with a pressure level above 16 bar) and altogether 1 436 km of distribution lines in Estonia that belong to both the system operator and the distribution operators. In addition to EG Võrguteenus, there are 25 natural gas distribution operators in Estonia, the largest being Adven Eesti AS, Gaasienergia AS, Tehnovõrkude Ehitus OÜ, and Sillamäe SEJ AS.

REGULATORY INSTITUTIONS

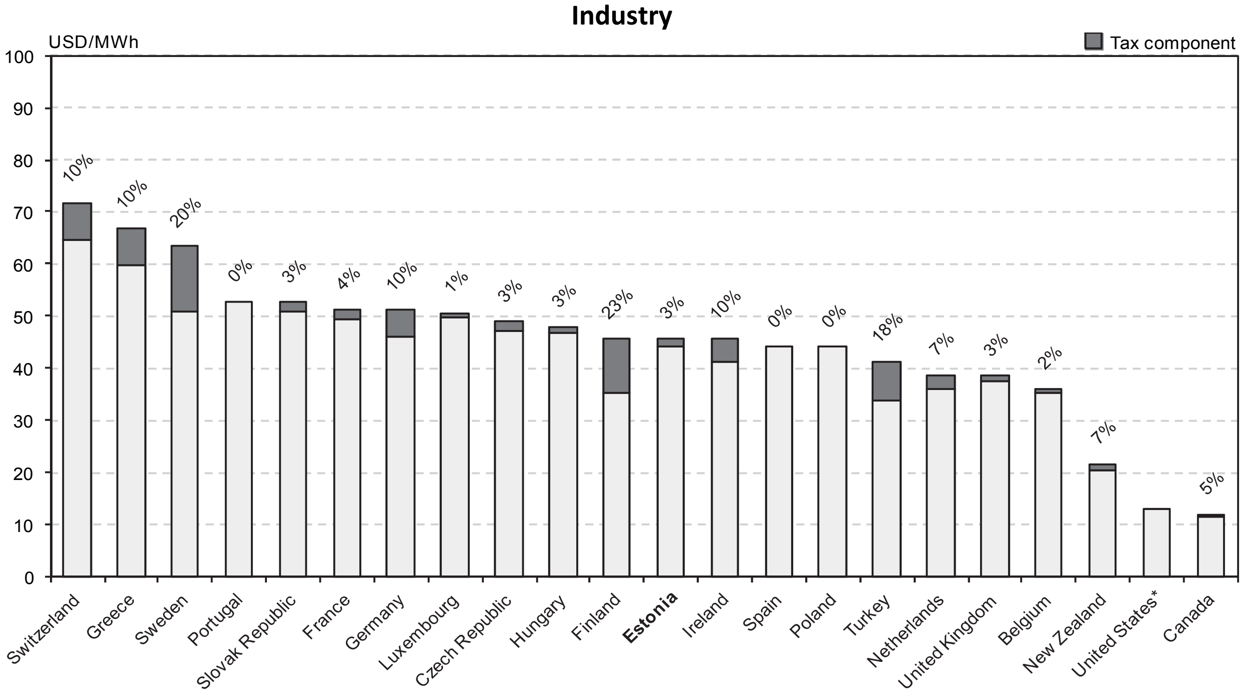
The Estonian gas market is regulated by the Natural Gas Act and the Competition Act. The Estonian Competition Authority is responsible for implementing state control, supervision and monitoring of the fuel and energy markets. The Competition Authority is independent and has a legal obligation to exercise its powers impartially.

Pricing policy

The Estonian Competition Authority is responsible for network tariffs and methodologies for calculating connection fees, which it approves in accordance with the Natural Gas Act. The price of balancing gas and the fees for gas transit do not require approval. The Competition Authority applies so-called *ex post* control or price supervision.

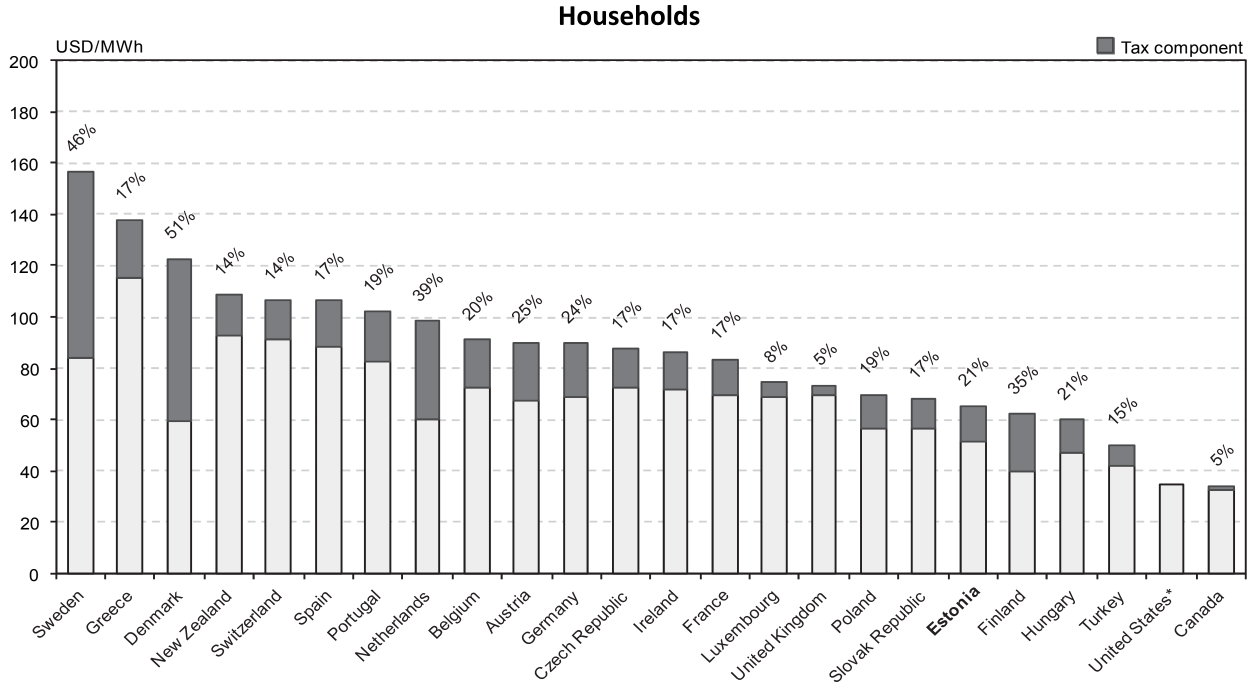
Gas price is not regulated and all customers buy gas at the market price. The wholesale gas price is calculated by a formula that considers the average prices of heavy and light fuel oil in US dollars per tonne over the previous nine months, at the current exchange rate.

Figure 15. **Gas prices in Estonia and IEA member countries, 2012**



* Tax information not available for the United States.

Note: data not available for Australia, Austria, Denmark, Italy, Japan, Korea and Norway.



* Tax information not available for the United States.

Note: data not available for Australia, Italy, Japan, Korea and Norway.

Sources: *Energy Prices and Taxes*, IEA/OECD, Paris, 2012; and country submissions.

Natural gas pricing for households is based on the weighted average price of gas sold including the import price and the sales margin. Eesti Gaas must obtain approval of the value of the sales margin for household customers from the Competition Authority. Eesti Gaas itself forms its sales price on the basis of import price and approved margin. At the end of each calendar year, the company makes a settlement of accounts (recalculation) based on the actual volume supplied to its household customers. The Natural Gas Act requires household consumers to be notified of changes in price one month in advance.

The Competition Authority audits the activities of Eesti Gaas, and recent audits have not recorded any market violations, all legally required obligations having been fulfilled.

CHANGES IN THE NATURAL GAS MARKET

The Estonian gas market opening in 2007 did not trigger efficiency in its functioning and therefore, after careful consideration, the government has concluded that models other than ownership unbundling will not ensure factual competition.

Estonia, along with Latvia, Lithuania and Finland, was exempt from ownership unbundling requirements under the EU Directive 2009/73/EC (Article 49) until it became directly connected to the interconnected systems of the EU member states. The Estonian Parliament, however, took the decision not to apply this exemption and on 6 June 2012, it adopted amendments to the Electricity Market Act and to the Natural Gas Market Act, requiring ownership unbundling of the gas transmission network from supply and distribution by 1 January 2015.

The amended Natural Gas Act requires the Competition Authority to develop and publish the methodology for calculating network service prices and its approval process. It also includes regulations for LNG (terminology, field of activity, market participants, among others), to enable further developments in this sector. The amendments came into force on 20 June 2012, and Estonian legislation is now fully harmonised with both electricity and gas directives.

NATURAL GAS SUPPLY SECURITY

Estonia is fully dependent on imported gas from Russia. In addition to the potential risk arising from reliance on a single supply source, the Estonian gas network has technical limitations related to the challenge of maintaining the required pressure in the transmission system during the peak load in cold winters and in spring, which can drop below the agreed limit.

The Estonian government is exploring all the possibilities for increasing the reliability of natural gas supply. It is co-operating closely with regional governments and key energy stakeholders in promoting regional market integration with neighbouring EU member states, new cross-border interconnections and LNG terminal projects, so as to secure the natural gas supply to countries in the Baltic region. It is also exploring the possibility of using a number of LNG tanks to hold emergency gas reserves.

Regulation No. 994/2010 of the European Parliament and of the Council, which covers the security of natural gas supply, requires maintaining supplies in the event of a disruption of the single largest gas infrastructure, *i.e.* the fulfilment of the N-1 criterion, including events of peak demand.

To secure a continuous energy supply, the Estonian National Development Plan of the Energy Sector until 2020 foresees the need to diversify the use of energy sources and to construct new natural gas and LNG infrastructures in order to fulfil the N-1 rule.

EMERGENCY RESPONSE POLICY

According to Estonian legislation, gas supplies to household customers are not to be interrupted or limited during the period from 1 October to 1 May. The same rule applies to supplies for residential space heating, which uses no fuel other than gas. The only exemption to this rule is in case of risk to people's life, health, property or to the environment, or an agreement between parties. Since 1 July 2008, those heat supply enterprises with an annual estimated production volume of over 500 000 megawatt hours (MWh) per network area are legally obliged to hold fuel for three days of heat supply, in order to secure an uninterrupted heat supply. Since 2012 Tallinna Küte AS is obliged to keep liquid fuel reserves. Until 2012 the same rule applied to Eesti Energia's Iru power plant, but under the new contract, its production volume is projected to fall below 500 000 MWh.

The gas supply quality requirements were established by the amendments to the Natural Gas Act at the beginning of 2007. The amendments set a limit on supply disruptions, which should not exceed 72 hours in sequence, as well as an annual duration of disruptions which are not to exceed 130 hours in total. The records on the duration of disruptions are to be kept by network operators, while the Competition Authority's responsibility is to monitor the fulfilment of quality requirements.

According to data from EG Võrguteenus in 2011, there were in total 708 interruptions: 376 were planned during works, and 255 were requested by the sales department of Eesti Gaas, while 77 cases were emergency disruptions. None of the disruptions lasted over 12 hours.

EMERGENCY RESPONSE (DEMAND-RESTRAINT) MEASURES

The action plan in the event of a crisis situation in Estonia requires a significant reduction in gas use, ceasing the production of electricity from gas, and switching to fuels held in reserve (in Tallinn, Narva and other cities).

According to Regulation EU No. 994/2010, Estonia has prepared the Risk Assessment of Estonian Gas Supply (2010) and, in co-operation with Latvia and Lithuania, the Joint Risk Assessment of Gas Supply of Estonia, Latvia and Lithuania (2012). The Estonian Preventive Action Plan and Emergency Plan were adopted on 5 June 2013.

REGIONAL INITIATIVES

The Joint Risk Assessment of Gas Supply in Estonia, Latvia and Lithuania is carried out in accordance with the requirements of Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010, concerning measures to safeguard the security of gas supply, and repealing Council Directive 2004/67/EC. The Joint Risk Assessment is prepared by the BEMIP Focus Group on Regional Co-operation, composed of representatives of the ministries responsible for the energy industry, of TSOs and regulatory authorities of the member states.

The Joint Risk Assessment provides an outlook for the regional energy mix and the functioning of the regional gas market. It examines the possibilities for physical gas flows, assesses the existing infrastructure of natural gas supply and the political and administrative risks. It describes risk scenarios, risk impacts and response scenarios, establishes a supply disruption risk matrix, and defines mitigation measures in case of a risk of gas supply disruption to be included in the Preventive Action plan.

The share of gas in the Baltic region's overall energy mix is around 26%, but the role of gas varies in these countries. While the share of gas in the total energy mix of Lithuania and Latvia is around 30%, in Estonia it is 9%. In general, gas plays the largest role in the Lithuanian and Latvian energy sector owing to, in particular, large industrial customers (fertiliser company Achema AB) and the power and DH sector, respectively. In Estonia gas plays an important role in the heating sector in both direct residential use and boiler houses and in combined power and heat production. For example, in Estonia’s capital Tallinn, DH is currently up to 70% dependent on gas. Natural gas thus plays a pivotal role in residential heating.

Natural gas consumption in the three Baltic states is forecast to increase slightly over the coming five years, after which gross gas consumption should stagnate until 2020, and then decrease slightly until 2030. Estimated natural gas consumption in 2015 is 6.65 bcm and in 2020, 6.96 bcm.

ASSESSMENT

Natural gas forms a relatively small part of Estonia's energy mix, around 9% of total consumption. The strategic objective, set in the Estonian National Development Plan of the Energy Sector until 2020, is to reduce the share of oil shale in the energy mix. A possible switch from carbon-intensive oil shale-fired to gas-fired power plants in the future will require additional gas supplies. Beside renewable energy sources and energy efficiency improvements, natural gas can further fill the potential capacity gap caused by the phasing-out of shale oil-fired plants. Estonia also plans to integrate a significant amount of wind power into the electricity system, which requires more flexible generating capacity. These challenges point to the potentially bigger role of natural gas in the energy system.

The Estonian gas market is small and is at present fully dependent on Russian gas supplies by the monopolist company Eesti Gaas, which is majority-owned by Russia's Gazprom. Estonia strives to secure alternative gas supply sources to reduce its dependence on a single supplier and to integrate with other European markets. The size and monopolistic structure of its gas market, however, makes infrastructure development plans and the decision-making process challenging.

The gas markets of the Baltic states share similar size and structural limitations, where market-based decisions in one country are exposed to the decisions taken by a monopolistic supplier. If the Baltic markets were associated with the Finnish gas market, however, regional gas demand would be large enough to attract the investment necessary for the diversification of supply, to strengthen the security of energy supply, and to foster competitive market conditions. There is political will in the Baltic states to stimulate the further opening of gas markets by developing regional interconnections. Furthermore, the European Council has set ambitious deadlines to end the isolation of natural gas markets in the Baltic region by 2015.

Estonia, along with the other Baltic states, Finland, Poland, Germany, Denmark and Sweden, participates in several regional co-operation forums. The BEMIP has already delivered results. Estonia and its neighbours face tough negotiations and decisions in the near future in order to reach agreement on the required regional gas projects, including a regional LNG terminal. In addition to political decisions on future regional projects and their exact location, there will be negotiations on the issues of cost allocation along the value chain and other related regulatory aspects.

Changes to the Estonian Gas Act in June 2012 require ownership unbundling by 2015, the very year when Estonia's long-term gas purchase agreement with Gazprom expires. Although Finland does not share the same urgency, its participation in this project is essential, as the three Baltic states' market alone is not attractive enough to allow for new investments without which their prospects remain narrow. The Estonian government is therefore actively promoting a speedy decision on the location of the regional LNG terminal in a bid so as to accelerate the development of this important regional energy infrastructure.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Jointly with other governments in the region, seek diverse sources and routes for natural gas supplies to enhance the security of supply and to develop a more competitive, liquid and secure gas market.*
- ☐ *Continue to seek an agreement with regional partners on decisions related to natural gas infrastructure development, including possible new interconnections and an LNG terminal.*
- ☐ *Speed up the implementation of planning and infrastructure elements identified in the Risk Assessment of Gas Supply completed jointly by the regional gas TSOs.*

6. OIL SHALE AND OIL

Key data (2011)

Oil shale production*: trade oil shale 18.8 million tonnes (Mt); mined 15.86 Mt

Crude oil production and net imports: nil

Shale oil production: 0.6 million tonnes of oil-equivalent (Mtoe)

Oil products production: nil

Net imports of oil products: 1.1 Mtoe, +23.4% since 2000

Inland consumption of oil products: transport 71.7%, commercial and other services 11.7%, industry 9.3%, power generation 6.4%, residential 0.8%

* Source: country submission.

OIL SHALE

OVERVIEW

Estonia holds significant reserves of oil shale and has almost a century-long history of utilising this resource for its energy needs. Its oil shale industry is the most developed in the world and Estonia has been generating electricity from oil shale since 1924.

The use of oil shale has provided Estonia with a relatively high degree of energy security. Around 85% of its mined oil shale is used for electricity and heat generation and it provided for 85.3% of Estonia's electricity in 2012. The remaining 15% is used for the production of shale oil and other valuable chemicals. The oil shale used in production also consists of, to some extent, country rocks (limestone); therefore the term "trade oil shale" is used to count in the resources used in production. The correlation coefficient between the proved and mined reserve and trade oil shale varies from 1.1 to 1.3. In 2011 nearly 14.4 Mt of trade oil shale were consumed for electricity and heat generation, and 4 Mt for shale oil production.

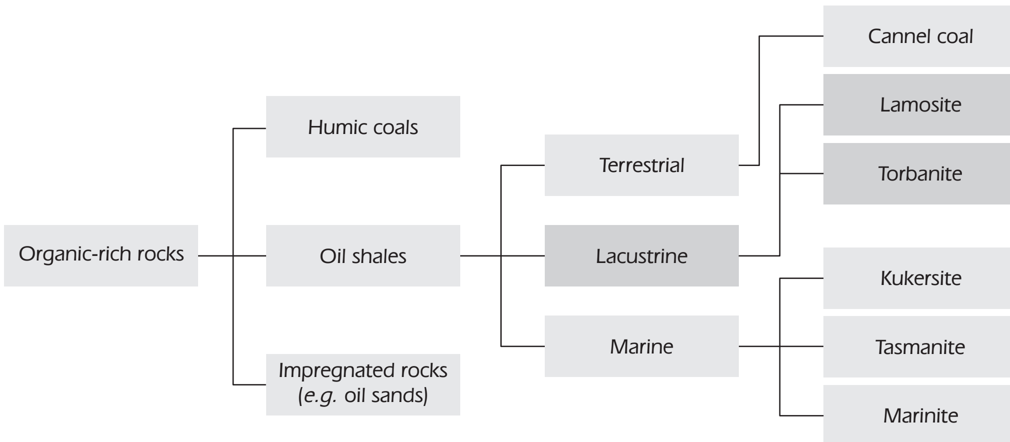
Box 2. **What is oil shale?**

Oil shale is a sedimentary rock containing up to 50% organic matter, rich in hydrogen, known as kerogen. Once extracted from the ground, the rock can either be used directly as a power plant resource, or be processed to produce shale oil and other chemicals and materials. The liquid shale oil can be treated and refined into diesel and jet fuels, as well as into petrol (gasoline).

Oil shales of different deposits differ by genesis, composition, calorific value and oil yield. The origin of the deposits is the base of the classification schema developed by Adrian C. Hutton. The classification reflects differences in the composition of the organic matter and of the hydrocarbons that can be produced from it.

Oil shale mined in Estonia has a high calorific value: 1 tonne (t) of Estonian oil shale can yield 125 kilogram (kg) of shale oil (39 800 kilojoules [kJ] per kilogram) and 35 normal cubic metres of retort gas (46 800 kJ per cubic metre) or 850 kilowatt hours of electricity.[17] Nevertheless, emissions of carbon dioxide (CO_2) from oil shale combustion are the highest among primary fuels, with about 30% more waste than coal.

Figure 16. **Hutton classification of oil shale**



Source: Hutton A.C., "Petrographic Classification of Oil Shales", *International Journal of Coal Geology*, Vol. 8, 1987, pp. 203-231.

While the present environment of high oil prices makes shale oil production in larger quantities very attractive for Estonia, quotas for greenhouse gas emissions impact production levels, which are capped at 20 million tonnes per year (Mt/yr). Owing to the importance of electricity supply security, priority is given to the use of oil shale for electricity and heat generation over the production of more profitable shale oil. One of the objectives of the National Development Plan for Oil Shale Use in Estonia for 2008-15 is to reduce mining of proven reserves of oil shale to 15 Mt/yr by 2015, which requires significant improvement in oil shale technologies to maintain the required levels of electricity and heat generation. In 2011, the oil sector accounted for one-third of public research and development expenditures, and the government of Estonia encourages the deployment of new and more efficient oil shale technologies.

Box 3. **Shale oil**

Shale oil refers to any synthetic oil obtained by *in situ* extraction or by destructive retorting of oil shale. During the *in situ* extraction process, the stable organic matter in the oil shale is thermally cracked and converted into oil, combustible gases and solid ash, and char residue. Composition of shale oil depends on the extraction techniques applied, on the composition of the kerogen and on the presence of non-organic phases such as sulphur, phosphate or nitrates.

Source*: A Study on the EU Oil Shale Industry*, European Academies Science Advisory Council (EASAC), May 2007, p. 37.

17. Eesti Energia, www.energia.ee/en/polevkivi.

At present, Estonia exports most of its shale oil (619 800 t in 2011). New technologies, already in operation, have the potential to double shale oil production from 2013 onwards. Shale oil has not yet been used to propel motor vehicles in Estonia, but production of middle distillates from shale oil is being considered.

Oversight of the oil shale sector is divided between the Ministry of the Environment (licensing) and the Ministry of Economic Affairs and Communications (MEAC) (general supervision over the energy sector).

RESERVES

Global reserves of oil shale are estimated to be over 400 billion tonnes.[18] Estonia holds 1.1% of these and 17% of Europe's deposits. There are two oil shale types in Estonia – dictyonema argillite and kukersite.

The marine-type Estonian dictyonema argillite, also known as graptolite argillite oil shale, dictyonema shale or black shale, is a brown, poorly lithified claystone belonging to the formation of black shales of sapropelic origin. It is found in most of northern Estonia, spread across an area of about 11 000 square kilometres (km^2). Although reserves of the dictyonema argillite surpass those of kukersite, their quality is poor as a source of energy production. The calorific value of the dictyonema argillite is 5 megajoules per kilogram (MJ/kg) to 8.4 MJ/kg and the Fischer Assay oil yield is 3% to 5%.

Kukersite is a light-brown marine-type oil shale, deposited in a shallow marine basin, forming a part of the Baltic oil shale basin with a total area of about 3 000 km^2 to 5 000 km^2. The main kukersite deposit in the country is the Estonian deposit. There is also the Tapa deposit but, because of its quality, the reserves are not exploited. Estonian kukersite deposits are among the world's highest-grade deposits with more than 40% organic content and 66% conversion ratio into shale oil and oil shale gas. The Fischer Assay oil yield is 30% to 47%.

MINING

At present, oil shales are extracted by one of two methods: opencast mining or underground mining. In both cases, the oil shale is excavated and transported to a processing plant where it is crushed, sometimes enriched, and then heated to produce shale oil or put into ovens for heat or power generation.

Both extraction methods have a negative impact on the environment, especially to the groundwater (which has to be pumped off to prevent flooding of the mines). Underground mining is less efficient, as approximately one-third of the resources are left behind in pillars and/or unmined areas.

INDUSTRY STRUCTURE

State-owned Eesti Energia is the largest oil shale processing company in the world, using around 15 Mt of trade oil shale per year in Estonia for electricity and heat generation. There are three shale oil producers: VKG Oil (a subsidiary of Viru Keemia Grupp [VKG]), Narva Oil Plant (Eesti Energia Õlitööstus AS, a subsidiary of Eesti Energia) and Kiviõli Keemiatööstuse OÜ.

18. Dyni, J.R., 2006, "Geology and resources of some world oil-shale deposits", *U.S. Geological Survey Scientific Investigations Report* 2005–5294, p. 42, U.S. Geological Survey, Reston, Virginia, 2006.

The price of the oil shale resource is regulated by the Estonian Environmental Charges Act (resource fee). The price for mined oil shale is subject to negotiations. Resource and water taxes are enforced by the government and are subject to periodic review.

PAST AND FUTURE OF OIL SHALE INDUSTRY

The mining of oil shale in Estonia started in 1918, when the first opencast mine was opened in Pavandu. The oil shale then had a narrow range of uses such as for heating houses, powering locomotives, and a heat source for the cement industry. Six years later, in 1924, the first shale oil plant was opened in Kohtla-Järve. It produced soak oil, low-quality petrol and oil for heating. In the same year, the Tallinn power station was the first to change over to the use of oil shale as its feedstock.

Oil shale production peaked in the early 1980s, with 30 Mt/yr produced. At present the oil industry (including mining, power generation and shale oil production) employs 7 500 people, about 1% of the labour force, and accounts for 4% of gross domestic product.

Estonia has an ageing pulverised combustion-based infrastructure, which is being gradually replaced by boilers using fluidised-bed combustion. It has a commitment[19] to phase-out pulverised combustion boilers by 2015 and to introduce higher-efficiency boilers with supercritical parameters, making ash handling and disposing system harmless, and elaborating on the clean, CO_2-free and integrated gasification combined-cycle technologies.

Large-scale investments required for the reconstruction of power plants and the CO_2 mitigating costs affect electricity prices, already up since the opening of the electricity market in January 2013. In 2012, oil shale-based power constituted over 85% of electricity production in Estonia. Following implementation of the Power Section Development Plan,[20] it should decrease to 70% by 2018.

With current crude oil prices and electricity prices in the region, the production of shale oil/liquid fuels from oil shale is more profitable than using it for power generation. Therefore, shale oil producers aim to increase production to 1.5 Mt by 2015. The main tasks in improving retorting practice consist of making semi-coke harmless or suitable for use, increasing the value of products (production of motor fuels and chemicals instead of heating oil), and optimising the use of retort gas (heating, power production, gas for chemical synthesis). Although the market price of shale oil is lower than that of crude oil in Europe, production remains profitable. Shale oil is essentially used as heating oil (as a reserve fuel for gas supply disruption) and as a component of special oil mixes, mainly for shipping and the navy. Developments related to the production of middle distillates for vehicle motor fuels as an alternative to imported fuel is in progress.

In recent years, shale oil producers have made significant investments in expanding mining with further plans to increase production. VKG has begun construction of the Petroter II plant and is planning a third plant.[21] Eesti Energia recently completed the Enefit280 oil plant and, in December 2012, it produced its first oil. The plant will consume 2.26 Mt of oil shale per year and will produce 1.9 million barrels (mb) of shale oil per year, 75 million cubic metres (mcm) of hydrogen-rich retort gas, and 280 gigawatt hours of electricity. The plant will use new,

19. Directive 2001/80/EC of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from large combustion plants; National Development Plan for the Utilization of Oil Shale 2008-2015, Ministry of the Environment of the Republic of Estonia, Tallinn, 2008.

20. Development Plan of the Estonian Electricity Sector until 2018, Ministry of Economic Affairs and Communications, Tallinn, 2008.

21. www.vkg.ee/est/uudised/304/vkg-teine-olitehas-petroter-ii-saab-nurgakivi.

more reliable and higher-capacity Enefit280 technology, with much lower environmental impact. Eesti Energia aims at building two additional plants to process shale oil into higher-quality products (gasoline, diesel fuel) from 2016.[22] The new plants will also produce electricity.

Development plans, submitted by the producers, suggest an increase of the shale oil production volume by a factor of 2.6 compared to 2011 levels by the end of the decade. In the context of European Union (EU) climate policy, the partial shift in the usage of oil shale for the purpose of producing electricity to that of producing liquid fuels is welcome because of the latter's lower environmental impact. The development of the shale oil industry would furthermore create approximately 8 000 new jobs, and the estimated added value to the economy from the shale oil industry could reach EUR 455 million when also taking indirect benefits into account.

On the other hand, oil shale-based electricity production has been the cornerstone of Estonia's energy security for decades. Thus, what should be carefully assessed is how to ensure the same level of energy security after reorganisation of the oil shale-based electricity production.

The coexistence of oil shale-based electricity production and shale oil production is important for Estonia from a socio-economic standpoint. In accordance with current shale oil production plans and environmental regulations, an adequate annual mining limit would give room for oil shale use to meet the power needs of Estonia as well as ensure shale oil production.

DOWNSTREAM OIL

SUPPLY AND DEMAND

In 2012, total primary energy supply of oil was 492 kilotonnes of oil-equivalent (ktoe), slightly less than 511 ktoe in 2011. Oil products represented 34.3% of Estonia's final energy consumption in 2011. This proportion has varied little over the last ten years and is below the International Energy Agency (IEA) average of 44%.

Oil demand in Estonia declined sharply from 1990 to the end of the decade, as the consumption of heavy fuel oil, which accounted for over 50% of demand, decreased significantly. Since then, oil demand has remained relatively stable averaging 25 thousand barrels per day (kb/d)[23] since 1997. In 2000, Estonian oil demand sank to its lowest level in the last 15 years, recording 21 kb/d. Conversely, in 2007, before the start of the financial crisis, consumption of oil products reached 29 kb/d, its highest level. In 2011, oil demand stood at 26 kb/d and is likely to increase moderately in the coming years.

Diesel consumption has been increasing since the late 1990s. In 2000, it represented 19% of demand (4 kb/d) and reached 32% in 2011 (9 kb/d). At present, it is the only oil product registering growth. According to government estimates, diesel consumption is set to increase at 4% to 4.3% per annum to 2020. Gasoil has averaged 5 kb/d in the last 12 years. In 2011, it represented 19% of oil demand. Combined gas/diesel oil represents the bulk of Estonian demand, accounting currently for 54% of demand.

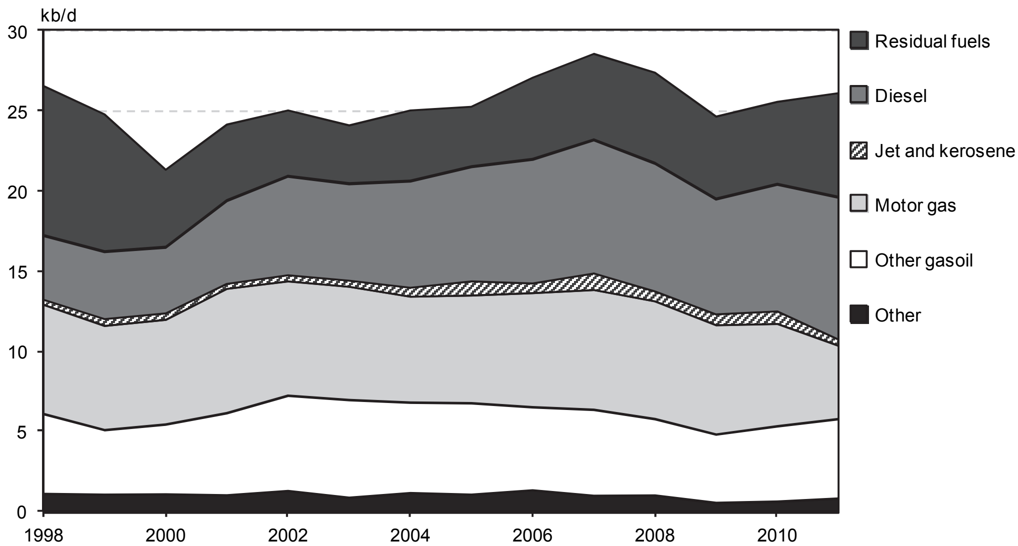
The share of motor gasoline in oil consumption has declined slightly since 2000, when it represented 33% of oil demand, versus 19% (5 kb/d) in 2011. This is partly the result of relatively low oil demand in Estonia but also, as in other European countries, the result of the progressive dieselisation of the vehicle fleet. The Estonian government foresees a continued decrease in gasoline consumption to 2016 by around 0.9% to 1.5% per annum.

22. www.energia.ee/et/pressiteated/-/asset_publisher/c1Bp/content/modalwindow/7180638.

23. Figures in thousand barrels per day shown in this report may diverge slightly from Estonia's own figures because of rounding.

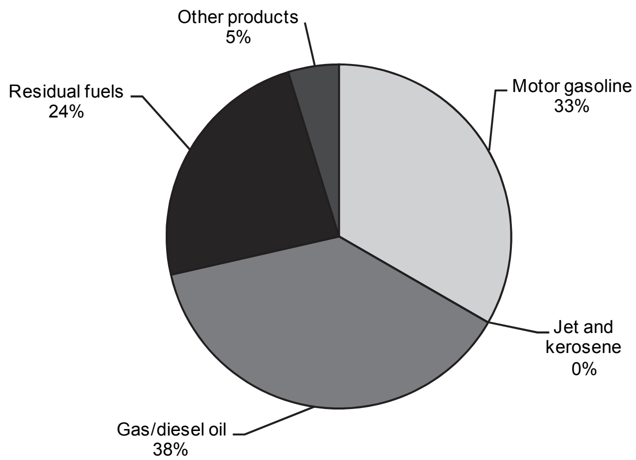
The consumption of residual fuels has averaged 5 kb/d since the turn of the century, currently accounting for 23% of oil demand (7 kb/d).

Figure 17. **Demand for oil products by product, 1997-2011**



Source: *Oil Information*, IEA/Organisation for Economic Co-operation and Development (OECD), Paris, 2012.

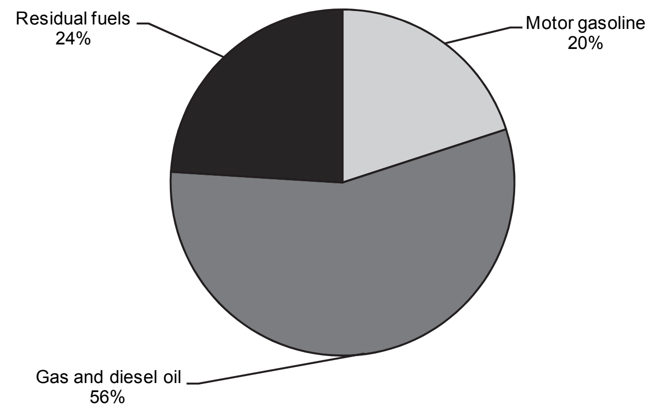
Figure 18. **Demand for oil products by product, 2000**



Source: *Oil Information*, IEA/OECD, Paris, 2012.

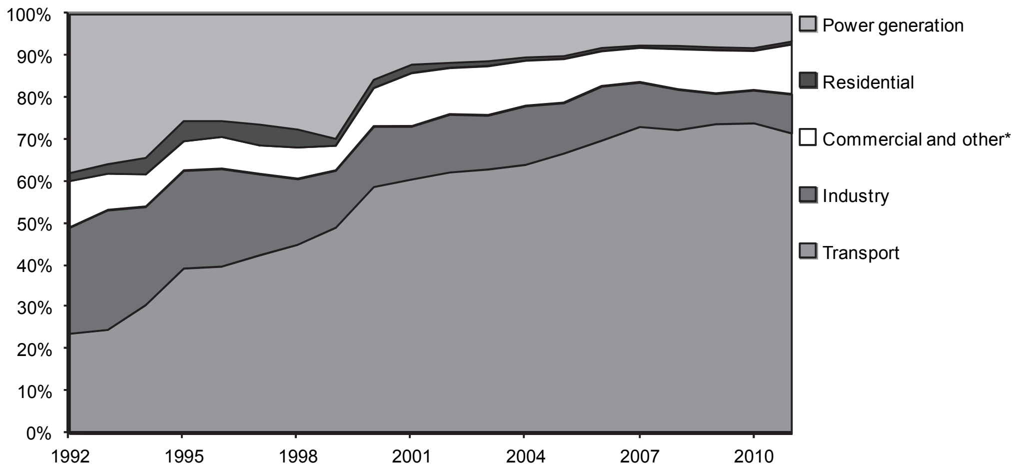
The transport sector is the largest consumer of oil, accounting for 72% of all consumption in 2011. This proportion is considerably higher than the European average of approximately 60%. The share of oil used in transportation has been increasing rapidly since Estonia regained independence in the early 1990s. This is largely the result of a steady decline in the use of oil in other sectors, most notably in power generation and industry. In 1992, these sectors accounted for 38% and 25% respectively of total oil consumption, while the share of oil in the transport sector stood at 24%. In 2011, power generation and the industry sector accounted for less than 10% each. As in other European countries, there is a considerable dieselisation of the vehicle fleet, which has been responsible, both for the increase in diesel consumption and for the decline in the use of gasoline.

Figure 19. **Demand for oil products by product, 2011**



Source: *Oil Information*, IEA/OECD, Paris, 2012.

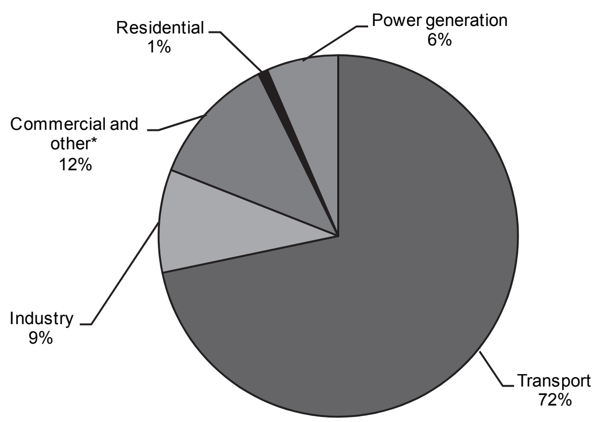
Figure 20. **Share of oil consumption by sector, 1990-2011**



* *Other* includes public service, agricultural, fishing and other non-specified sectors.

Source: *Oil Information*, IEA/OECD, Paris, 2012.

Figure 21. **Consumption of oil by sector, 2011**



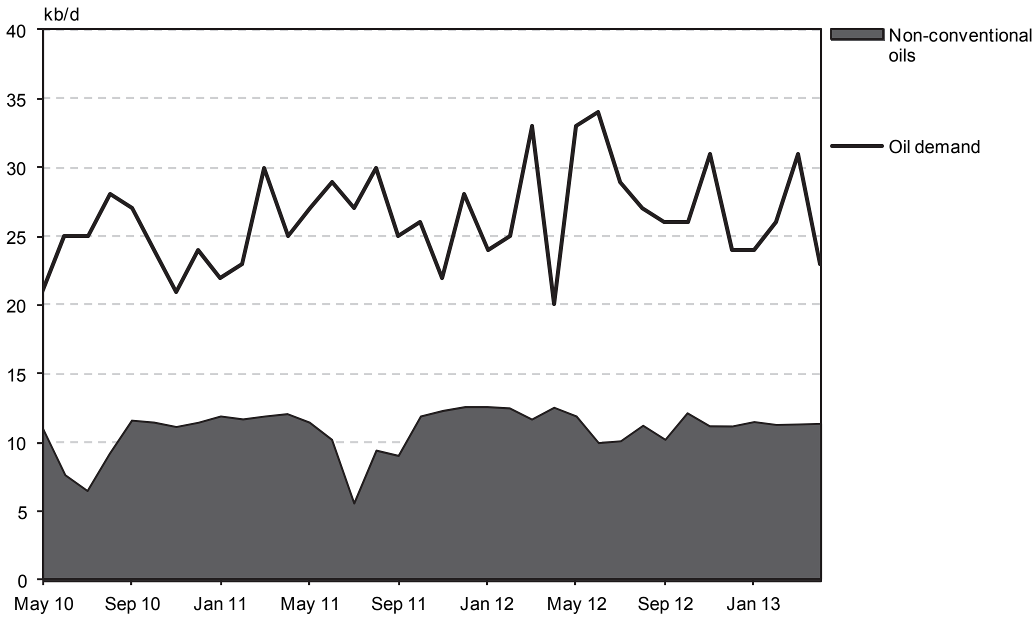
* *Other* includes public service, agricultural, fishing and other non-specified sectors.

Source: *Oil Information*, IEA/OECD, Paris, 2012.

PRODUCTION

Shale oil production averaged 5 kb/d during the 1990s, and 7 kb/d from 2000 to 2009, but has been steadily increasing since the turn of the century. In 2012, production stood at 11 kb/d and volumes are expected to continue to increase. The majority of the shale oil is exported to neighbouring countries and used as bunker fuel or refinery feedstocks. In 2011, 8 kb/d of shale oil was exported: Europe imported 6 kb/d (5 kb/d going to the Netherlands), while the remainder was exported to Lithuania and the Russian Federation.

Figure 22. **Domestic oil production and consumption, May 2010 to March 2013**



Source: *Oil Information*, IEA/OECD, Paris, 2012.

IMPORTS

All oil products consumed in Estonia are imported and originate from refineries located in neighbouring countries. In 2011, Lithuania provided 45% of Estonia's total oil imports, while Finland and other countries from the former Soviet Union sourced 20% and 15% respectively. It is worth noting that Estonia has reduced its reliance on imports from the Russian Federation over the last few years. In 2006, it imported about 46% of its oil from Russia (about 11 kb/d). Since then, imports have been reduced significantly to reach only 1 kb/d in 2011, or less than 5%.

REFINING

Although there are no refineries or crude oil production in Estonia, there are plans to develop two refineries in the coming years to further refine shale oil in order to produce transportation fuels. The first project would have a capacity to process 22 000 barrels per day (b/d) and produce Euro5-quality diesel, naphtha and vacuum gas oil. According to current development plans, this refinery should be operational by 2016 or soon after. The second refinery would have an upgrading capacity of 14 000 b/d to produce diesel fuel. This refinery is planned to be operational by 2016.

INFRASTRUCTURE/PORTS

Most fuels are imported by rail from the Mažeikiu refinery in Lithuania (Orlen Lietuva), which is the only refinery in the Baltics, or by ship from Finland (Neste refinery in Porvoo) and from other countries. Estonia has no international oil pipeline connections and remains an export route for Russian oil products (mainly heavy fuel oil), although trade through Estonia has been declining since 2007. Estonia's main oil terminals are located in Tallinn, Maardu and Paldiski. Fuels are distributed throughout the country by tanker trucks.

Estonia relies heavily on its numerous ports and rail to transport products. The most important ports handling oil products are: the port of Tallinn which handles petroleum products mainly at the Muuga harbour (although to a lesser extent also at Paldiski South and Paljassaare harbours); the port of Sillamäe, which is the eastern-most port in the European Union; the port of Miiduranna; and the port of Kopli. All are equipped with loading and storage capacity. Some of these oil terminals also have developed rail infrastructure connected to the backbone of the Estonian rail network.

The oil terminal operators of the port of Tallinn provide storage services for petroleum and petroleum products, consolidation of large consignments and blending services. The port of Tallinn is used to trans-ship oil products from Russia, Belarus and Kazakhstan to various destinations around Europe. In 2010, the port handled 25.8 Mt of oil products (mostly heavy fuel oil) or 500 kb/d on average. It has the capacity to ship up to 40 Mt of liquid fuels a year.

STORAGE

Owing to the decline in transit cargoes from exporting countries such as Russia, storage availability in Estonia has increased. The port of Tallinn has a total storage capacity for oil products, mainly diesel and gasoline, amounting to 2 mcm. Storage capacity along the Estonian coast stands at little over 3 mcm, or roughly 20 mb (this figure includes all major Estonian ports).

Furthermore, Estonia also has some storage facilities inland concentrated in three sites: Maardu (close to Tallinn), Vijandi and Tartumaa. Together, these three sites have a total capacity of about 130 cubic metres, mostly dedicated to the storage of gasoline and diesel.

MARKET STRUCTURE

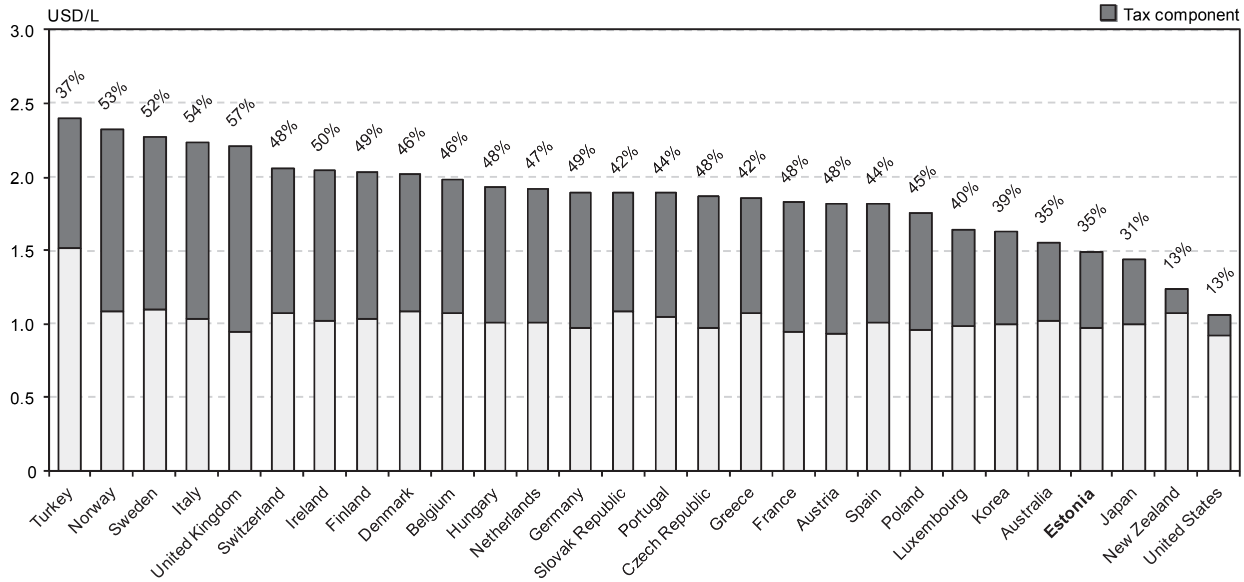
The liquid fuels market is unregulated and competitive. The wholesale market is dominated by three players: Orlen, Statoil and Neste. Together they import about 85% of all oil products. At retail level, the market is characterised by a large number of service stations relative to the size of the country. There are around 500 filling stations (on average only 3 500 citizens per station compared to the EU average of 5 000), of which 128 are unmanned. The five largest operators are Alexela, Statoil, Neste, Olerex and Lukoil, which together operate 65% of all stations. The remaining filling stations are either family-owned or operated by small retailers, many of them unmanned. Statoil has the largest share of the retail market (26.4%), followed by Neste (23.5%), Alexela (14.5%), Olerex (14%) and Lukoil (9.6%). Small stations, representing 35% of retail outlets, account for only 12% of the market.

PRICES AND TAXES

The oil products market is fully liberalised. Wholesale and retail prices are mainly influenced by the relevant quotation prices and exchange rates. Gasoline prices in Estonia are the cheapest in OECD Europe, with taxes representing 48.2%, the second lowest proportion in OECD Europe, with only Luxembourg lower. With regard to automotive diesel prices, Estonia also has one of the cheapest diesel prices in OECD Europe; only France, Luxembourg, Spain and Poland are less expensive.

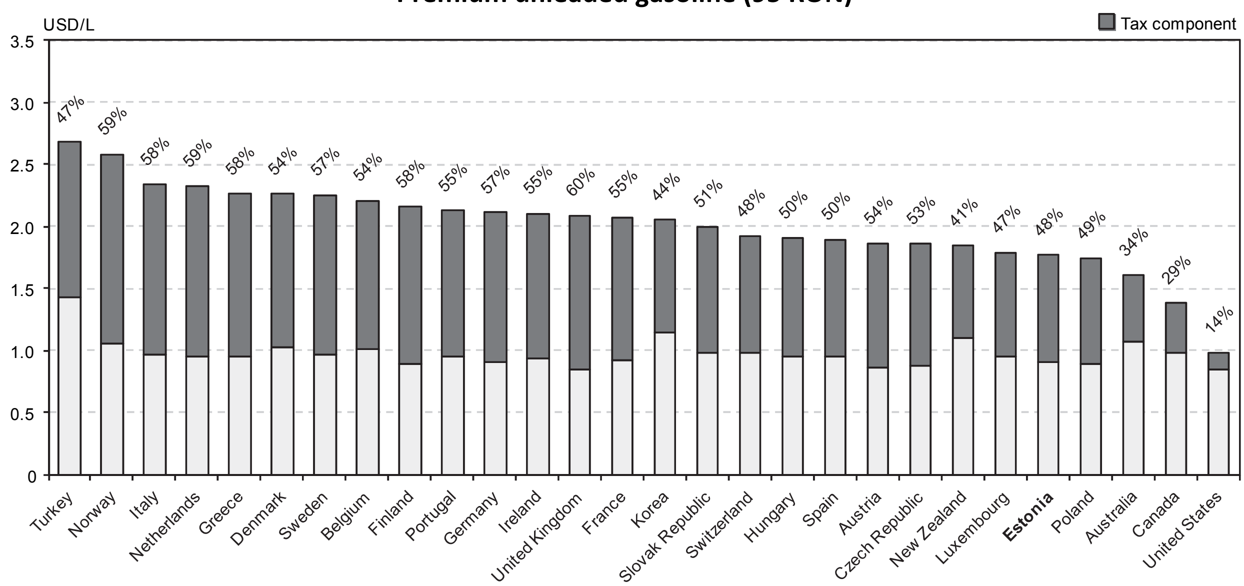
Figure 23. **IEA and Estonia fuel prices and taxes, first quarter 2013**

Automotive diesel



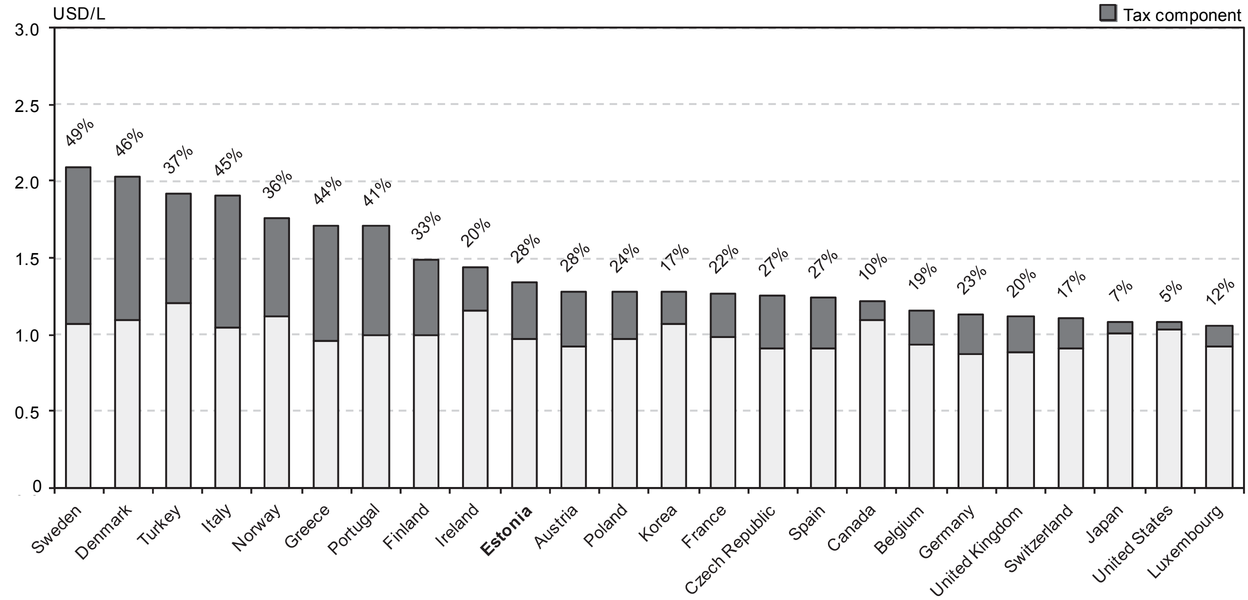
Notes: L = litre. Data not available for Canada.

Premium unleaded gasoline (95 RON)



Note: data not available for Japan.

Light fuel oil



Note: data not available for Australia, Hungary, the Netherlands, New Zealand and the Slovak Republic.

Sources: *Energy Prices and Taxes*, IEA/OECD, Paris, 2012; and country submissions.

EMERGENCY PREPAREDNESS

Estonia is currently developing its demand-restraint plans to ensure it meets IEA membership requirements. This will provide Estonia with additional emergency measures in the event of a crisis, as currently only the release of stocks is a realistic option.

At present, emergency measures available to the Estonian government in case of an oil supply disruption are limited to the release of stocks from its public stockholding agency. Without domestic production (except for shale oil) or refining, short-term surge production is non-existent. There is also no real scope for short-term switching from oil use, as transportation represents nearly three-quarters of all oil consumption.

At the end of February 2013, Estonia's Oil Stockpiling Agency (OSPA) held around 235 kilotonnes of petroleum products in stock. At the end of 2012, according to IEA net-import calculations, Estonia held over 220 days of oil stocks; of these, OSPA held 189 days of net imports, the rest were commercial stocks held by industry, although Estonia does not place a stockholding obligation on industry. OSPA's stocks are held entirely in the form of finished products (diesel oil, gasoline, jet-A, heavy fuel oil). Middle distillates account for about 65% of all oil stocks held by OSPA, and motor gasoline for 34%.

Estonia is in the process of amending its Liquid Fuels Stocks Act, one of the key pieces of legislation on oil stocks and their use. These amendments to the act aim at strengthening Estonia's emergency policies and procedures. They envisage the creation of a National Emergency Strategy Organisation (NESO) to more effectively deal with oil supply crises, and also some enhancements to current practices that will align Estonia with requirements for accession to IEA membership.

Estonia's OSPA, set-up in 2005 to fulfil its international obligations, is tasked with establishing, maintaining and holding 90 days of compulsory oil stocks. It is a very small organisation (with only three employees) but highly competent. It is a legal entity governed by private law, whose capital belongs entirely to the government. Shareholder's rights are exercised by the MEAC represented by the Minister himself. OSPA's stockholding and administration costs are covered through a stockpiling fee paid directly to the agency by oil companies. This fee is included in oil prices paid by consumers. The purchasing costs of oil are provided by the government by increasing the share of OSPA's capital and by using funds received from the sale of oil stocks.

Estonia has bilateral agreements for the storage of oil stocks abroad with Latvia, Finland, Denmark and Sweden where it stores a little over half of its oil stocks. The proportion of OSPA stocks held abroad has been declining and is expected to continue to do so as the agency gradually repatriates its stocks. This is made possible, as storage has become increasingly available, especially in ports, because of the progressive decline in transit cargoes from exporting countries using Estonian ports.

Estonia does not place a stockholding obligation on industry, although the District Heating Act requires district heating suppliers with projected annual heat production above 500 000 megawatt hours to hold liquid fuel reserves equivalent to three days of consumption. At the time of writing, only one company had this obligation.

ASSESSMENT

The oil shale industry holds a key position in the Estonian economy and is crucial for energy security. Its high dependence on oil shale makes the electricity industry vulnerable and the government is exploring all avenues for finding a right balance between energy security and environmental concerns related to this industry. High oil prices make Estonian oil shale attractive to investors for producing shale oil. Mining limits, set to decrease further from current production capped at 20 Mt per year, do not allow the sector to comfortably meet its electricity needs while encouraging much more profitable production of shale oil, other heavy fuel oil and retort gas.

The National Development Plan for the Utilisation of Oil Shale 2008-15 set out the goals for determining the level of mining and the direction of oil shale use. Previously, the Estonian government committed to making oil shale a less dominant part of its energy resources.[24] Having achieved the key objectives set out in the National Development Plans, the government has now embarked on preparing the Energy Strategy to 2030, where it strives to determine the future of the oil shale industry, with full consideration of social, environmental and economic impacts of this crucial industry for the country's energy security.

Like other Baltic energy markets, the Estonian one is small and depends heavily on developments in the region. Energy projects (such as a liquefied natural gas terminal, the reopening of Lithuania's Ignalina nuclear power plant), currently being discussed in the region, have the potential to substantially change regional energy dynamics. The Estonian government is having active discussions with other governments in the region to find sound solutions to increase regional energy security and encourage closer market integration.

Estonia is a relatively small importer of oil products. The country is dependent for its middle distillate imports on two sources: the Mažeikiu refinery in Lithuania (Orlen Lietuva) and the refinery in Porvoo, Finland (Neste). It is thus important for security of supply to explore alternative suppliers in the event of a supply disruption for an extended period

24. The Long-Term Public Fuel and Energy Sector Development Plan until 2015, issued in 2004.

of time. In this respect, plans to refine shale oil and produce vehicle-grade fuels should be seen as a welcome addition to Estonia's security of supply, as indigenous sources could potentially be enough to satisfy internal demand, and even to be exported. However, for the time being, there is significant regulatory uncertainty regarding the plans to produce vehicle-grade fuels as this will be dependent on the EU decision with respect to the Fuel Quality Directive.[25] These discussions are currently under way.

The Estonian OSPA currently holds amounts in excess of IEA stockholding requirements. This would give Estonia a comfortable buffer during a disruption in supplies. Nevertheless, around half of its stocks are held abroad, in countries with which Estonia has signed bilateral stockholding agreements. Recognising this, Estonia is currently in the process of gradually repatriating its oil stocks. This will also strengthen Estonia's capability to deal more effectively with an internal supply shortage, as stocks would be closer to the consumption centres.

OSPA currently holds considerable amounts of oil stocks. This would provide relief during a supply disruption. Nevertheless, in a more protracted disruption of supplies, Estonia would face difficulties in rapidly reducing demand, on the one hand because it currently lacks demand-restraint plans, and on the other hand because almost three-quarters of oil consumed in Estonia are used in the transport sector. Estonia needs to develop robust demand-restraint plans to contribute to efforts to rapidly contain demand during a protracted disruption. Such measures are required in order to become a member of the IEA.

Although Estonia has a centralised source of forecasts for oil demand, these forecasts would benefit from closer consultation across government and thus enable the development of sensible long-term policies.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Encourage deployment of pioneering energy-efficient technologies for oil shale mining, oil shale-based heat and power generation and shale oil production.*
- ☐ *Promote the use of oil shale for purposes other than the production of electricity.*
- ☐ *Explore options for the diversification of middle distillate import sources. This may become less of a concern should Estonia succeed in its plans to refine shale oil to produce transportation fuels.*
- ☐ *Develop sound and robust demand-restraint plans to facilitate the rapid reduction in demand during a supply crisis.*
- ☐ *Develop energy modelling capabilities in close collaboration between ministries in order to produce robust, reliable and periodic forecasts of oil demand, agreed across government.*

25. Directive 2009/30/EC.

7. RENEWABLE ENERGY

Key data (2012 estimated)

Share of renewables in total primary energy supply (TPES): 14.6%

Share of electricity from renewables in total generation: 12.3%

Share of biomass-fired heat in total heat production*: 70.4%

Share of renewable energy in energy consumption in transport (2011): 0.6%

* Source: Estonian Statistics database.

OVERVIEW

Renewable energy provided 14.6% of Estonia's TPES in 2012, which is the tenth-highest share among the International Energy Agency (IEA) countries. This is mainly explained by the extensive use of biomass in the heating sector. About 70% of the heat in the country is produced by firing biomass.[26] The shares of renewable energy in electricity generation (12.3%) and in the transport sector (0.6%) are quite low compared to most IEA countries.

Estonia's renewable energy policy is mainly driven by its obligation under the European Union (EU) Renewable Energy Directive to increase the share of renewable energy in gross final energy consumption to 25% from 16.6% in 2005. Estonia is on track to meeting its overall renewable energy target and is expected to have a surplus that can be sold to other EU member states through flexibility mechanisms. The most challenging task will be reaching the 10% target for the transport sector.

Key policies to support renewable energy in the three sub-sectors include:

- a premium for electricity produced from renewables;
- investment support for projects aiming to use renewable energy for heating;
- a planned biofuel blending obligation for oil products in the transport sector; an electromobility programme; and planned measures to support biogas in transport.

SUPPLY TRENDS AND PROJECTIONS

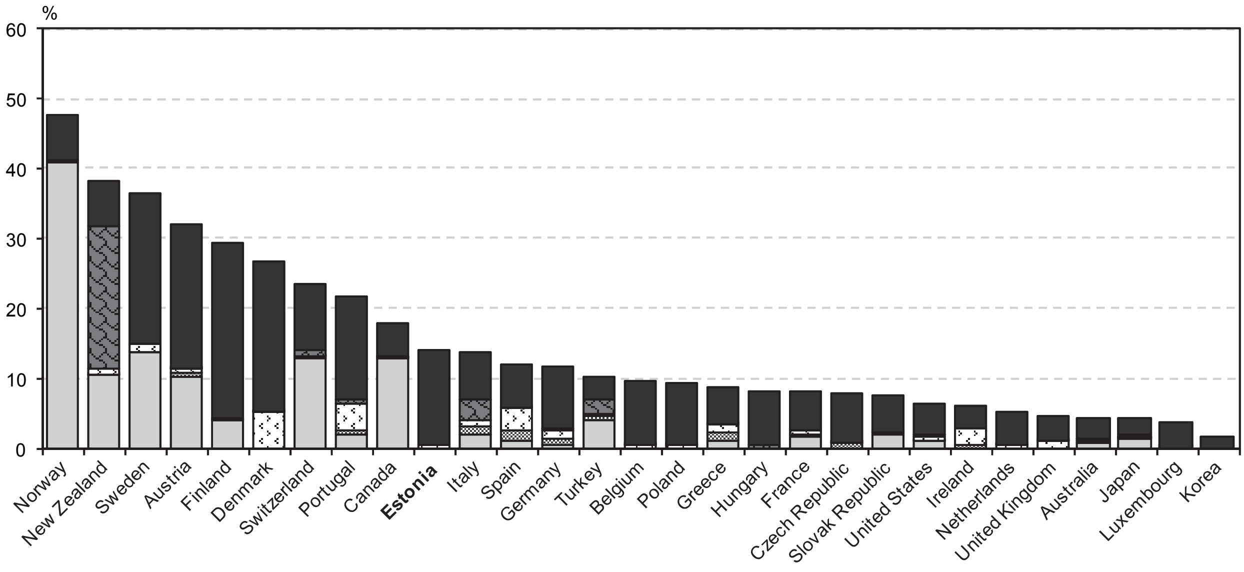
PRIMARY SUPPLY AND FINAL CONSUMPTION

In terms of the share of renewable energy in TPES, Estonia ranks tenth among IEA member countries (Figure 24). This is mainly because of the extensive use of biomass in heat supply. Biomass has been the main renewable energy source used in the country over the last two decades. Its use grew sharply from 0.2 million tonnes of oil-equivalent (Mtoe) in 1990 to 0.8 Mtoe in 2012. Wind made its inroads in the Estonian energy balance in the 2000s,

26. Data from the Estonian Statistics database, Table 24: Energy Balance Sheet, www.stat.ee.

growing from zero in 2002 to 0.04 Mtoe or 0.6% of TPES in 2012. Hydropower provides less than 0.004 Mtoe, accounting for a negligible 0.1% of TPES in 2012 (Figure 25).

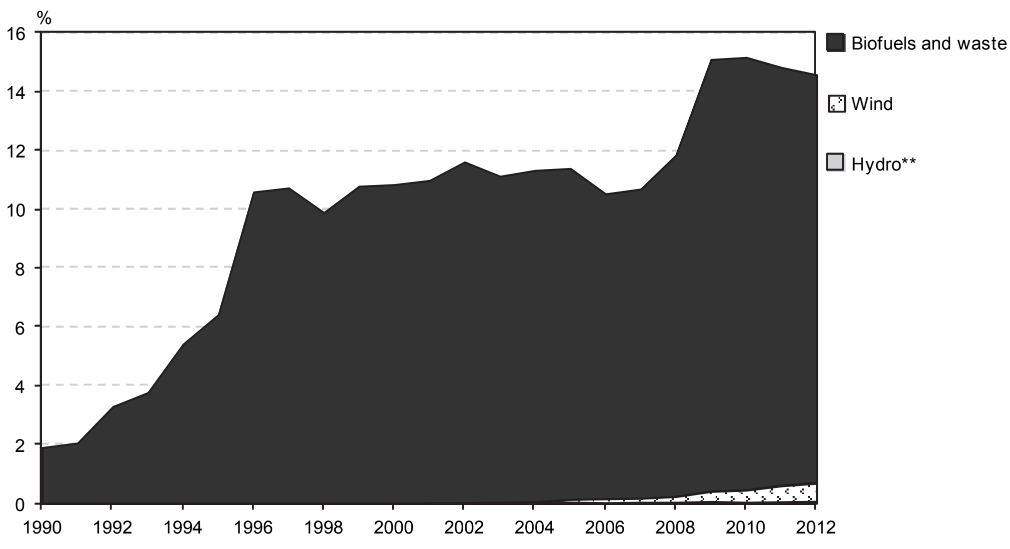
Figure 24. **Renewable energy as a percentage of TPES in Estonia and IEA member countries, 2012***



* Estimated.

Sources: *Energy Balances of OECD Countries*, IEA/Organisation for Economic Co-operation and Development (OECD), Paris, 2012 and country submissions.

Figure 25. **Renewable energy as a percentage of TPES, 1973-2012***



* Estimated for 2012.

** Negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submission.

In 2011, renewable energy accounted for 25.9**%** of gross final energy consumption according to the methodology used by the EU Renewable Energy Directive (see Box 4).

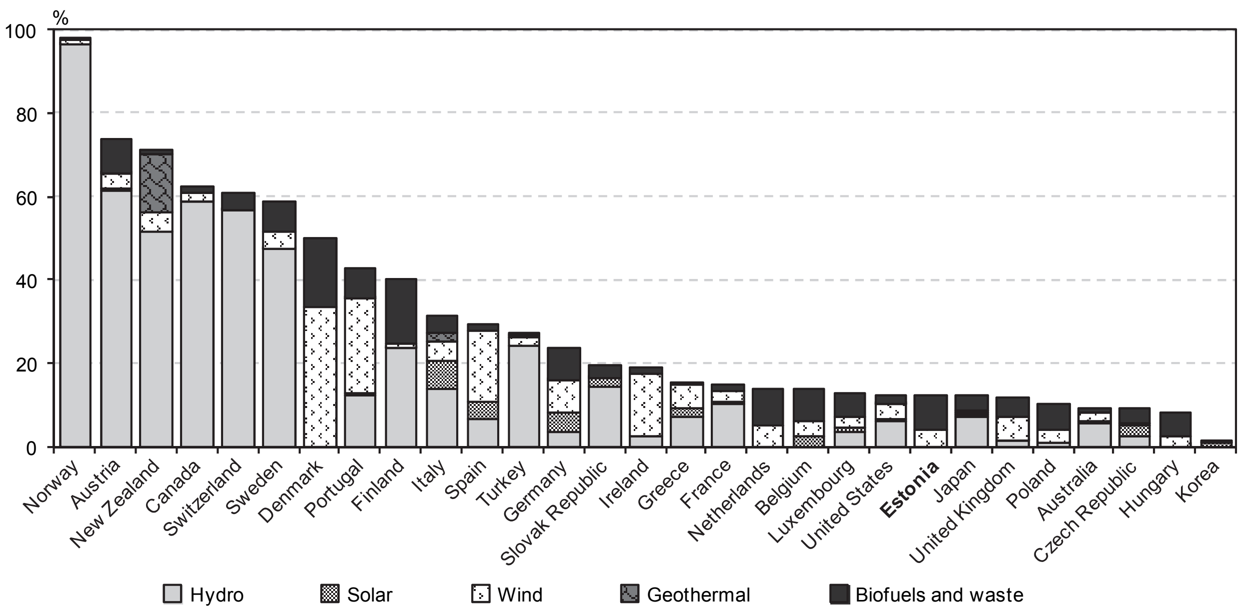
Box 4. **Final energy consumption: statistical differences between IEA and EU data**

The EU Directive 2009/28/EC introduced a target for all EU member states combined to increase the share of renewable energy to 20% of gross final energy consumption by 2020 and set specific binding targets for each EU member state. While the IEA annually publishes detailed energy statistics and energy balances for all EU member states, it uses different statistical methodologies compared to the EU directive. The IEA publications, including this study, report the countries' *net* total final consumption (TFC) of energy. Therefore, the share of renewables in "gross final energy consumption" is not directly available in the IEA statistics. By the definition of the EU directive, "gross final consumption of energy" means the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission. By contrast, the IEA TFC does not include transmission and distribution losses and own use of electricity and heat by the energy transformation sector, as well as consumption for international aviation. On the other hand, it includes non-energy use.[27]

ELECTRICITY

Estonia generated 1 475 gigawatt hours (GWh) of electricity from renewable energy sources in 2012. The country's share of renewables in electricity generation (12.3%) is the eighth-lowest among the IEA countries, which can be partially explained by the limited hydropower potential. Most of the IEA countries with the highest shares of renewables rely to a large extent on traditional hydropower (Figure 26).

Figure 26. **Electricity generation from renewable sources as a percentage of all generation in Estonia and IEA member countries, 2012***



* Estimated.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submissions.

27. More information about the IEA statistics can be found at: www.iea.org/stats/index.asp.

Table 2. **Electricity capacity and generation from renewable energy sources, 2011**

Source	Installed capacity (megawatt [MW])	Electricity generation (GWh)	Share in total electricity generation (%)
Biomass	67	783	6.1
Wind	269	368	2.9
Hydro	6	30	0.2
Total renewables	342	1 181	9.2

Sources: *Renewable Energy Information*, IEA/OECD, Paris, 2012; and www.tuuleenergia.ee/wp-content/uploads/Installeeritud-tuuleenergia-2012.xls.

HEAT AND TRANSPORT

The renewable energy sector is closely interrelated with the heating sector. Over 70% of the heat in the country is produced by firing biomass, including the use of wood by both district heating (DH) systems and small individual or collective boilers.

Table 3. **Boilers and generated heat by type of boilers**

Type of boiler		2008	2009	2010	2011
Boilers total (all fuels)	Number of boilers at end-year	4 053	4 257	4 248	4 407
	Total capacity (MW)	5 565	5 585	5 613	5 424
	Generated heat (GWh)	5 851	5 563	5 771	5 636
Fired by wood	Number of boilers at end-year	810	833	851	853
	Total capacity (MW)	702	776	864	719
	Generated heat (GWh)	1 470	1 557	1 581	1 827
Fired by shale oil gas and biogas	Number of boilers at end-year	6	3	3	3
	Total capacity (MW)	110	4	4	4
	Generated heat (GWh)	15	8	8	7
Fired by vegetable biomass*	Number of boilers at end-year	4	3	2	3
	Total capacity (MW)	3	3	2	2
	Generated heat (GWh)	2	4	3	8

* Including boilers fired by corn, straw and other waste.

Source: Statistics Estonia.

Table 3 shows biomass-fired boilers used in the Estonian DH systems as compared to the total number of boilers. The use of solar water heating (SWH) started to grow over the last few years, from a very low base. Studies carried out in Estonia have shown that SWH can be an economically viable option for the residential sector with a payback period of seven to eight years.[28] Its use is expected to grow significantly in the coming years. The share of renewable energy in gross final energy consumption in the transport sector grew from close to zero in 2005 to 0.6% in 2011.

28. Interview with Eesti Energia, Tallinn, December 2012.

PROJECTIONS

According to the National Renewable Energy Action Plan (NREAP) submitted to the European Commission, total consumption of renewable energy sources is expected to grow from 0.666 Mtoe in 2010 to 0.863 Mtoe in 2020. The highest growth rates are expected in the transport sector (from less than 0.001 Mtoe in 2010 to 0.092 Mtoe in 2020) and electricity (from 0.009 Mtoe in 2010 to 0.165 Mtoe in 2020).[29] Table 4 shows the expected renewable energy consumption in percentage terms.

According to experts' estimates,[30] biomass use in Estonia can grow even beyond the projected levels. In particular, the wastes from the forest industry are not fully utilised. However, internal demand for Estonian biomass will compete with export markets. Estonia is one of the five largest wood pellet exporters in the European Union.

Wind power generation is expected to grow in the coming years when new capacity becomes operational. Wind power producers are entitled for support until the cap of 600 gigawatt hours per year (GWh/yr) has been reached. According to the Estonian Wind Energy Association,[31] 25 onshore and three offshore wind park projects were at different stages of development (three under construction) as of late 2012.

The use of hydropower is not projected to grow because of the limited economic potential but solar energy use is expected to grow in the heating sector.

Table 4. **National 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport**

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RES H&C*	31.3%	38.9%	39.5%	39.8%	39.7%	39.7%	39.7%	39.5%	39.2%	39%	38.7%	38.4%
RES-E**	1.2%	6.4%	7%	8.1%	11.3%	12.0%	13.2%	13.2%	15.2%	16.1%	15.7%	17.6%
RES-T***	0%	0.1%	0.1%	2.4%	4.8%	4.8%	4.8%	5.9%	6.8%	7.8%	8.8%	10%
Overall RES share****	16.6%	20.9%	21.2%	22%	23.3%	23.4%	23.6%	23.7%	24.2%	24.5%	24.5%	25%
Surplus for co-operation mechanisms*****	-	-	1.8%	2.6%	3.2%	3.3%	2.4%	2.5%	1.7%	2%	0.7%	0%

* Share of renewable energy sources in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Articles 5(1)(b) and 5(4) of Directive 2009/28/EC) divided by gross final consumption of energy for heating and cooling.

** Share of renewable energy sources in electricity: gross final consumption of electricity from renewable sources for electricity (as defined in Articles 5(1)(a) and 5(3) of Directive 2009/28/EC) divided by total gross final consumption of electricity.

*** Share of renewable energy sources in transport: final energy from renewable sources consumed in transport (cf. Articles 5(1)(c) and 5(5) of Directive 2009/28/EC) divided by the consumption in transport of *a)* petrol; *b)* diesel; *c)* biofuels used in road and rail transport and *d)* electricity in land transport.

**** Share of renewable energy sources in gross final energy consumption.

***** Percentage of overall share of renewable energy sources.

Source: National Renewable Energy Action Plan.

29. National Renewable Energy Action Plan.

30. Interview with the Renewable Energy Association during the team visit on 6 December 2012.

31. www.tuuleenergia.ee/en/windpower-101/statistics-of-estonia/under-development/.

POLICY AND INSTITUTIONAL FRAMEWORK

INSTITUTIONS

The key responsibility for the renewable energy policy, as well as the general energy policy, lies with the **Ministry of Economic Affairs and Communications (MEAC)**. It is responsible for the implementation of the EU Renewable Energy Directive and other related EU legislation. It drafts legislation proposals related to renewable energy, in consultation with other stakeholders. This ministry also has two subordinate bodies that support renewables. The first one, the **Credit and Export Guarantee Fund (KredEx Fund)**, provides guarantees for loans, mainly for reconstruction of houses and improving their energy efficiency, but also grants for installing renewable energy generation installations for private households (solar panels, wind generators). The second one, the **Environmental Investment Centre (KIK)**, funds larger-scale projects such as reconstructing or constructing combined heat and power (CHP) plants, DH systems and both onshore and offshore wind parks.

The **Ministry of the Environment** is responsible for the policy concerning the use of natural resources and emissions from the energy sector. It also takes care of sustainable development and ecological balance, and has units that work in the field of air pollution. The ministry supervises such state commercial enterprises as the State Forest Management Centre and the Plc. Geological Survey of Estonia. The **Ministry of Agriculture** deals with land-use issues related to agricultural biomass. The **Estonian Competition Authority** supervises the electricity and DH markets. Its responsibilities include ensuring fair competition on the renewable energy market. The **transmission system operator (TSO) Elering** manages the subsidy system for electricity generators. Elering keeps track of the production of renewables-based electricity and takes care of billing the consumers, delivering the subsidies to the producers and reporting to Statistics Estonia.

At the local level, the governments can develop local renewable energy strategies, while ensuring that they are in accordance with the national renewable energy policy.

OVERVIEW OF RENEWABLE ENERGY POLICY

Estonia's renewable energy policy is mainly driven by the country's obligation under the EU Renewable Energy Directive to increase the share of renewable energy in gross inland energy consumption to 25% by 2020 from 16.6% in 2005. Estonia is on track to meeting its overall target by 2020. As Table 4 demonstrates, in 2010, the country reached its 2020 target for the heating sector and made very good progress in the electricity sector. However, the 0.1% share of renewables in the transport sector in 2010 was far below the 10% target for 2020.

Because the use of renewable energy in the heating and cooling sector is surpassing the target, Estonia expects to have an overall surplus of renewable energy up to 2019. The Estonian government is interested in the flexibility mechanisms allowed by the EU Renewable Energy Directive. The MEAC keeps track of EU member states' progress in meeting their renewable energy targets, and pre-packages Estonian proposals to use statistical transfers. As of April 2013, the ministry was developing a scheme that would consider all the co-operation mechanisms stated in the directive.

Estonia has implemented a number of renewable energy projects (mainly biomass) under the Kyoto Protocol's joint implementation mechanism.

Table 5 provides an overview of the policies and measures to support renewables in different sectors.

Table 5. **Overview of existing renewable energy policies and measures**

Measure	Type of measure	Target sector	Target group	Status and timeframe
1. Feed-in premium	Regulatory	Electricity	Producer of electricity	Existing, modifications are planned
2. Guarantee of origin	Regulatory	Electricity	Producer of electricity	Existing
3. Biofuel blending obligation	Regulatory	Biofuels	Oil product retailers	Planned from 2015 (draft law to be developed in 2013)
4. Supporting investments by enterprises for application of wind energy in electricity generation	Financial (implemented by the Environmental Investment Centre)	Electricity	Producers of electricity	Ongoing
5. Support of investment in bioenergy production	Financial (managed by the Ministry of Agriculture)	Electricity/heat/ CHP/biogas	Farmers	Until 2013
6. Diversification towards non-agricultural activity	Financial	Biofuels	Farmers	Until 2013
7. Support for investment in adding value to forestry products	Financial	Biofuels	Biofuel producers	Until 2013
8. National Energy Technology Programme	Financial support	Research and development (R&D) in electricity/heat/transport	R&D institutions	2007-13
9. Development Plan for Enhancing the Use of Biomass and Bioenergy	Financial support	R&D	R&D institutions	2009-14

Note: the table does not include measures that were implemented and stopped before 2012.

Sources: IEA on the basis of Estonia's NREAP; country submission; presentations from the team visit to Tallinn in December 2012; and other sources.

Estonia's renewable energy policy is interlinked with the policies for the development of agriculture and forestry. Several projects support diversification of economic activities in these two sectors towards production of renewable energy. Similarly, the R&D strategy takes into account the country's challenges in the area of renewable energy and has several projects dedicated to renewable energy, particularly in the transport sector (see Chapter 9 on research, development and demonstration for more details).

ELECTRICITY

Feed-in premium

As stipulated in the Electricity Market Act of 2007,[32] the TSO, Elering, is paying a premium added to the market price of electricity. This premium (EUR 0.0537 per kWh [EUR/kWh]) is not technology-specific and applies to electricity generated from all renewable energy sources, including biomass fired in efficient co-generation mode (see Table 6). A different premium (EUR 0.032/kWh) is paid to electricity produced in efficient CHP plants. As of December 2012, the amount of the subsidy did not depend on the actual market price of

32. www.konkurentsiamet.ee/?id=19475.

electricity although a draft law envisages changing this approach (see below for more details on the proposed changes). The subsidy is guaranteed for 12 years.

Table 6. **Electricity capacity and generation from renewable and non-conventional energy sources**

Source of generation	Amount of the premium (EUR/kWh)	Notes
Electricity is generated from a renewable energy source*.	0.054	Biomass-fired electricity generation is eligible for support only if the plant works in the efficient co-generation mode specified by the EU (2004/8/EC). Wind power is supported only until the cap of 600 GWh/yr of total generated wind energy has not been reached.
Electricity produced in efficient co-generation mode from waste, as defined in the Waste Act, peat or retort gas from oil shale production; or when the capacity of the generator does not exceed 10 MW.	0.032	The premium can be set either at EUR 0.054/kWh or EUR 0.032/kWh, as specified by the Estonian Competition Authority, if electricity has been produced in efficient co-generation mode or using peat.
For the use of the net power of an installation using oil shale if the production has started between 1 January 2013 and 1 January 2016.	0.014 to 0.016 depending on the conditions	EUR 0.016/kWh for the use of net power specified under condition 5 if the price of a tonne of greenhouse gas (GHG) emissions is over EUR 20; EUR 0.015 per hour for the use of net power specified under condition 5 if the price of a tonne of GHG emissions is over EUR 15 to EUR 20; EUR 0.014 per hour for the use of net power specified under condition 5 if the price of a tonne of GHG emissions is over EUR 10 to EUR 14.99.

* Renewable energy sources are: hydro, wind, solar, wave, tidal, geothermal, landfill gas, sewage treatment plant gas, biogas and biomass. Biomass includes agriculture, including plant and animal matter, and forestry and the products of related industries, the biodegradable part of waste and scrap, and the biodegradable part of industrial and municipal wastes.

Source: country submission.

The support scheme is financed by all power consumers who pay a "renewable energy charge" in proportion to their consumption of network services. The renewable energy charge is listed separately on the electricity bills so that consumers can see exactly how much is paid in subsidies for renewable energy and efficient CHP production. Value-added tax (VAT) is added to the renewable energy charge. The charge is subject to annual change and in 2012 it was EUR 0.0116 per kWh (20% VAT included). The TSO, Elering, collects the renewable energy charge from the consumers and pays the premiums to the producers.

Total financial support for the electricity sector (including renewables and CHP) amounted to EUR 72 million in 2011. For the year 2012, the consumption of electricity from renewable sources and efficient CHP is forecast at 1 455 GWh. The subsidy for electricity produced from efficient CHP is forecast at EUR 5.2 million and that for electricity produced from renewable sources at EUR 69.4 million, of which 35% will go to wind power, 59% to electricity produced from biomass, and 6% to energy from hydropower, waste and black liquor.

Proposed new support scheme

The MEAC developed a proposal to modify the existing support scheme for renewable energy, reducing the overall level of support and introducing caps – both on the price level and on the volume of electricity benefiting from support. The proposal was submitted to the Parliament of Estonia (Riigikogu) in October 2012. The proposal was approved in the first reading on 31 January 2013 and then was withheld from the second reading. As of mid-April 2013, the proposal was on hold.

The key aspects of the proposed new scheme are as follows:

- The size of support will depend on the free market price of electricity. Electricity generated from renewable energy sources will receive a premium on top of the market price, as in the existing scheme, but only up to a certain level. The total amount of payment (premium plus market price) for electricity from renewable energy will not exceed EUR 93 per megawatt hour (EUR/MWh) and that for CHP will not exceed EUR 72/MWh. The amount of the premium will decrease when the market prices grow. If the market price for electricity exceeds the established cap, no premium will be paid at all. This measure is proposed to avoid overcompensating generators using renewable energy in situations when market prices are sufficiently high.
- The proposal envisages applying the modified scheme to both new and existing installations.
- The amount of electricity that will receive support will not exceed the levels stipulated in the NREAP. The 600 GWh/yr cap for wind power is proposed to be maintained.
- The amount of the premium will be differentiated depending on the technology and resource used in the production. For biomass, the level of the subsidy will depend not only on the electricity price but also on the market price of the biomass used as input fuel.

The draft law has triggered very controversial reaction. On the one hand, there are voices that support the proposal, highlighting the need to reduce the burden of supporting renewable energy on final power consumers. On the other hand, renewable energy sector players complain that the retroactive changes would lead to losses for existing producers of approximately EUR 40 million to EUR 43 million.[33]

Grid issues

Grid access is open to new producers if they comply with the standard technical and administrative requirements set by the TSO, Elering, or the distribution system operators (DSOs) if the new plants are connected to the distribution networks. Under the Grid Code, the distribution network operator must receive an approval from Elering for the connection of all wind-powered generators and power stations with a capacity over 1 MW.

The technical requirements for obtaining a connection agreement are quite complex and frequently changing, especially for units below 1 MW connected to DSOs. The government is aware of these challenges and is discussing possible solutions with the market players. There is a capacity-building programme that helps the DSOs to simplify and streamline the grid connection requirements for small renewable energy installations.

Elering provides authorisations for grid connection on a first-come first-served basis. The renewable energy generators have to pay for all the cost related to the grid connection, including the cost of deep grid reinforcement. This encourages project developers to find locations with the lowest grid connection costs. Reportedly, some companies reserve connection capacity without using it, which impedes the use of best locations by potential other users.

Nearly 260 MW of wind had been connected to the grid by September 2012. Elering had received applications for connecting 1 600 MW more of wind power capacity, all of which cannot be connected. According to Elering's study, it is possible to integrate 900 MW of intermittent wind power capacity with a curtailment rate of 0.1 with the

33. Renewable Energy Association, www.taastuvenergeetika.ee (accessed on 20 February 2013).

condition that all the planned interconnections are built and all Baltic power plants participate in the balancing market.[34] Grid reinforcement in the western part of Estonia (where the wind potential is the highest) would allow integrating more wind capacity into the system. At the same time, Elering recognises that it does not have sufficient analysis of possible implications of growing wind generation in other Nordic countries (for example Finland has a plan to integrate 2 500 MW of wind).

Contrary to many other countries, Estonia has not introduced priority dispatch for renewable power. Therefore, the system operator has enough flexibility and can curtail intermittent wind generation when it is necessary for safe and stable system operation. The dispatch is based on market prices, and wind generators participate generally on the basis of marginal costs.

Guarantee of origin

The TSO is obliged to issue to producers, at their request, guarantees of origin, certifying that the electricity has been generated from a renewable energy source or in an efficient CHP mode. The TSO has to create and maintain the database of the issued guarantees of origin. Some additional features are to be added during 2013 so that the guarantees of origin can be traded internationally.

Investment support

The KIK implements a programme "Supporting investments of the enterprises for the application of wind energy in electricity generation".[35] It is financed from the carbon dioxide (CO_2) quota sales as a Green Investment Scheme (GIS). It is expected that the projects to be financed through this programme will reduce CO_2 emissions by 1.5 million tonnes over the next 20 years.

Licensing and permitting

Space planning and land use are mainly in the hands of the local governments, and thus procedures differ significantly from one municipality to another. The Estonian Renewable Energy Association has drafted a proposal to streamline and centralise the procedures: to have an authority (a one-stop shop) that would facilitate all the processes for renewable energy project developers.

The Estonian government has come up with an initiative to oblige the Baltic Sea littoral countries to develop strategic spatial planning documents for the sea area that takes into account all the economic, environmental and social aspects and interests of the stakeholders in all these countries. The first plans are expected to be developed during 2014.

HEATING AND COOLING

As discussed above, the heating sector and the renewables sector are closely interrelated as over half of the heat is fired by biomass. At the same time, SWH systems are likely to become more and more widely used, thus reducing demand from DH in the warm months. Installation of heat pumps is also expected to increase in the near future. The independent Estonian Geothermal Association plans to assess the potential of geothermal energy in Estonia.

34. Interview with Taavi Veskimagi, Chief Executive Officer of Elering, Tallinn, 5 December 2013.

35. http://kik.ee/en/energy/renewable-energy.

The government is opening a public debate on the strategic development of the heating sector (see Chapter 4 on DH), and the future heating policy stemming from this debate will have serious implications for the biomass sector.

Today, the use of biomass for heating is an economic option in many cases without any government support. Access to financing is a key barrier to increased investment in modernising heat boilers and switching from the use of fossil fuels to firing biomass. Therefore, specific measures to promote renewable energy in the heating and cooling sector are limited to investment support.

The KIK manages a national programme – in the framework of the GIS – "Extended use of renewable energy sources for the generation of energy and reconstruction of district heating networks" financed from the CO_2 quota sales. It supports three activities: construction of CHP plants that use renewable energy; reconstruction of boiler houses; and the reconstruction of DH networks to lower the amount of energy transmission losses.

In 2009, the KIK awarded grants to local governments, non-profit associations, businesses and foundations under the programme "Broader use of renewable energy sources for the generation of energy" that used funding from the European Regional Development Fund (ERDF)". The budget for the 2009 application round was approximately EUR 9.6 million (then 150 million kroons) and 17 projects received grants for the reconstruction of boiler houses and DH networks and the construction of CHP plants. No more application rounds are planned from this ERDF measure.

The KredEx Fund provides grants, funded through CO_2 quota sales, for the renovation of apartment blocks and smaller houses.[36] The eligible tasks include:

- replacement or reconstruction of the heating systems, *e.g.* installation of renewable energy technologies, such as solar water heaters;
- reconstruction of the ventilation system or installation of a system with heat recirculation.

Switching from the existing DH network to an individual or collective heating option is allowed only if the new heating system is based on renewable energy.

TRANSPORT

Overview

Renewable energy policies in the transport sector are driven by the EU regulations regarding renewable energy and fuel quality. Estonia has not introduced any additional requirements apart from those stipulated by the European Union. Until July 2011, the government supported biofuels by giving them an exemption from the excise duties. However, in the absence of demand, the use of biofuels has been growing very slowly.

The government plans to meet the 10% target in the transport sector by a mix of three measures:

- a biofuels blending obligation;
- electric vehicles;
- the use of biogas in transport.

36. http://kredex.ee/grant/.

The support for the last two measures is expected to come from the EU Structural Funds. As of December 2012, the availability of support was in question; therefore, it was difficult to estimate what would be the concrete activities carried out by the government. The main focus is likely to be on the blending obligation and replacing methane (CH_4) with biomethane in natural gas vehicles.

The MEAC estimates that the 10% target can be met with the following breakdown: fuel blending 5%, biogas 3% to 4% and electromobility 1%. If biogas and electromobility measures show the results below the expected level, then the fuel blending will play a greater role in meeting the overall 10% target.

Biofuels

The government plans to introduce an obligation on oil companies to blend biofuels with oil products sold in Estonia. This mandatory biofuel share is expected to grow gradually from 5% in 2015 to 10% in 2020. This percentage can be revised depending on the progress achieved by other alternatives (biogas and electromobility). The Oil Industry Association considers this obligation achievable.

The government is developing policies to support the transition to more efficient second-generation biofuels in compliance with the amendments to the Renewable Energy Directive and to the Fuel Quality Directive of the European Union. The new measures aiming at the transition from fossil fuels to renewable energy in the agricultural sector (for example biomethane) are to be included in the action plan for the next EU budget period 2014-20.

As of December 2012, there were no companies in Estonia that indicated interest in the production of second-generation biofuels, so the government assumed that they will be imported.

Electromobility

Estonia's Electromobility programme (ELMO) is mainly driven by the innovation policy agenda. The declared goal of the programme is to promote emission-free personal transportation in order to achieve better city environment, energy efficiency and fuel independence. The programme has three pillars:

- distribute 500 electric vehicles to public-sector actors;
- provide a compensation (35% to 50%) to businesses, institutions and households for the purchase of an electric vehicle;
- build charging stations every 30 miles to 40 miles.

Individuals and private or public institutions can obtain support for the purchase of electric cars through the KredEx Fund. The grant amount for the purchase of an electric car and down-payment of leasing is up to 50% of the purchase price of the electric car, but not more than EUR 18 000 for a person who is not a VAT payer. For VAT payers, the grant is 35% of eligible costs, but not more than EUR 18 000 per car. As of January 2013, the fast-charging grid has been almost fully developed and the number of cars has reached 600.

The government has also proposed changes to the European Commission to include the possibility of using guarantees of origin for electricity disclosure to the final customer and hence make it possible to use 100% renewable electricity in electric vehicles in the context of the 10% target.

Biogas

The government is considering measures to promote biogas in the transport sector, for example by supporting the construction of infrastructure (biomethane filling stations) and encouraging the conversion of public transport, as well as individual cars, to use CH_4 and eventually allow the replacement with biomethane. These measures are being discussed with different stakeholders.

Agricultural waste represents the most promising potential for biogas production; potential for landfill gas production is smaller. Analysis commissioned by the government shows that Estonia will need to invest EUR 100 million to develop a viable biogas industry. Additional investment will be needed for building the whole infrastructure of filling stations. The government is not planning to finance biogas from the state budget. It has applied for support to the EU Structural Funds.

ASSESSMENT

In terms of the share of renewable energy in TPES, Estonia honourably ranks tenth among IEA member countries. This is mainly due to the high share of biomass in heat supply. However, Estonia's share of renewables in electricity generation is the fifth-lowest among IEA countries.

The country's renewable energy policy is mainly driven by its obligation under the EU Renewable Energy Directive to increase the share of renewable energy in gross inland energy consumption to 25% from 16.6% in 2005. Estonia is on track to meeting its overall renewable energy target. It should be commended for having reached 42.6% of renewable energy in the heating sector in 2010, well above the 2020 target of 38.4%.

Despite these significant achievements, Estonia's renewable energy policy could be further improved. The country has significant biomass and wind potential, as well as opportunities for SWH. A more ambitious, more forward-looking and more stable renewable energy policy would allow the country to go beyond EU-driven obligations and bring about significant environmental, energy security and societal benefits related to the use of renewable energy. Growth in renewable energy can also improve the balance of trade by freeing up other domestic energy resources for export. Other EU member states could also benefit from Estonia's abundant renewable energy resources through co-operation mechanisms, and the government should continue its efforts to encourage such co-operation.

The government rightly recognises that the development of renewable energy is interrelated with the development of the heating sector. DH systems are the key market for biomass; therefore, sustainability of the DH sector will have a direct impact on the Estonian biomass industry. And vice versa, stable and affordable supply of biomass makes DH more attractive compared with other heat options. At the same time, possible alternatives to DH can also be based on renewable resources. For example, SWH seems to be an economically viable option for the residential sector. Wider use of SWH is limited by the difficult access to financing and lack of awareness, but could be unlocked by effective government policies. This can improve energy efficiency, reduce pollution and provide economic solutions for households, but at the same time it could put DH companies in a difficult financial situation by reducing heat demand in the warm months. Encouragingly, the government is opening a public debate on the strategic development of the heating sector. This debate – and the ultimate heating strategy – should take into account the interdependence of the heating and renewable energy policies.

In the electricity sector, Estonia supports renewable energy by a premium added to the market price, and the amount of the subsidy does not depend on the actual market price of electricity. The recent proposal by the MEAC to modify the support scheme was under consideration in the parliament at the time of writing (February 2013). The proposal aims to cap the level of support as well as the amount of electricity that will receive support. The proposal rightly aims to eliminate the risk of overcompensating generators (and consequent excessive burden on end-users). Premiums with some kind of cap have worked well in several countries, including Switzerland, the Netherlands, Denmark and Spain.

However, the Estonian proposal envisages applying the modified scheme to both new and existing installations, which would undermine the fundamental objective of a renewable energy policy, *i.e.* providing revenue guarantees for investors. If the proposed changes apply retroactively to the existing plants, this would modify the business case of the investments that have already been made. Such changes can significantly undermine investors' confidence in policy stability, thus deterring possible future investments. Having said that, the costs of renewable energy technologies are decreasing over the years thanks to the learning curve; the government should therefore constantly monitor and adjust the renewable energy support measures applicable to future plants.

There is room for improvement in the permitting/licensing processes and grid access procedures. Space planning and land use are mainly in the hands of the local governments and so the procedures differ significantly from one municipality to another. Clear criteria or guidelines developed at the national level would facilitate the processes, which is especially important for small-scale installations with high transaction costs per energy unit.

Like everywhere else, growing wind generation with intermittent production patterns, underlines the need to look at renewable power from the perspective of the whole electricity system. The government should continue working with the system operator to address grid-related issues. It is also very important to co-ordinate with the neighbouring system operators to understand better if and how any new intermittent renewable energy capacity coming on line in different countries will influence the interconnected power grids.

The renewable energy generators have to pay for all the costs related to grid connection, including the cost of deep grid reinforcement. This provides an incentive for generators to find optimal locations for their renewable energy plants – with best resources and least connection costs. This is quite positive from the whole system's perspective. However, reportedly, some companies reserve connection capacity without using it, which impedes the use of best locations by other potential users. The government, together with the TSO, could consider measures to address this tendency, for example by requiring project developers to give back the reserved connection capacity if actual investments are not made after a certain period of time.

Another grid-related issue is the complex and frequently changing technical requirements for obtaining a connection agreement, especially for units below 1 MW connected to DSOs. The government is aware of these challenges and is discussing possible solutions with the market players.

The biggest challenge for Estonia is meeting its 10% target for the transport sector. The government's plan to introduce an obligation on oil companies to blend biofuels to oil products is in line with the policies already introduced in many other EU member states, and is considered by the Estonian oil industry as feasible.

There is less clarity on how the government plans to support electric vehicles and the use of biomethane in transport. The amount of the support – and therefore the possible impact of electric cars and biomethane on the transport sector – will depend on the availability of the EU funds.

Similarly, in the heating and cooling sector, specific measures to promote renewable energy are limited to investment support financed through EU Structural Funds. The government could consider supplementing such stand-alone start-and-stop measures by more stable, longer-term policies.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Maintain investor confidence by avoiding retroactive changes to the renewable energy support schemes.*
- ☐ *Streamline and simplify grid connection procedures as well as licensing and permitting at both national and regional levels.*
- ☐ *Develop a more ambitious and forward-looking renewable energy policy in the framework of the overall energy strategy, taking into consideration any new DH strategy. Use the co-operation mechanisms under EU Directive 2009/28.*

8. ELECTRICITY

Key data (2012 estimated)

Installed capacity (2011): 2.8 gigawatts (GW)

Electricity generation: 12 terawatt hours (TWh), +39% since 2002

Electricity generation mix: oil shale 85.3%, biofuels and waste 8.3%, wind 3.6%, natural gas 1%, peat 0.8%, oil 0.5%, hydro 0.4%

Peak demand (2011): 1.8 GW

Inland consumption per sector (2011): commercial and public services 39.1%, industry 30.9%, residential 29.2%, transport 0.8%

OVERVIEW

The Estonian electricity market is small and relies mainly on a single fuel source, oil shale, for most of its energy. This is due to historical reasons, but also because of the country's priority of ensuring its energy security, as oil shale is a domestic resource. Nevertheless, a considerable increase in the use of renewable energy sources for electricity production can be observed in the last decade, mainly by wind and biomass co-generation. Although the electricity market is still small and dominated by the state-owned energy group Eesti Energia, the state authorities are actively working towards the development of interconnections and market integration with the Nordic and Baltic regions and explore possibilities for more diversified domestic electricity generation mix.

SUPPLY AND DEMAND

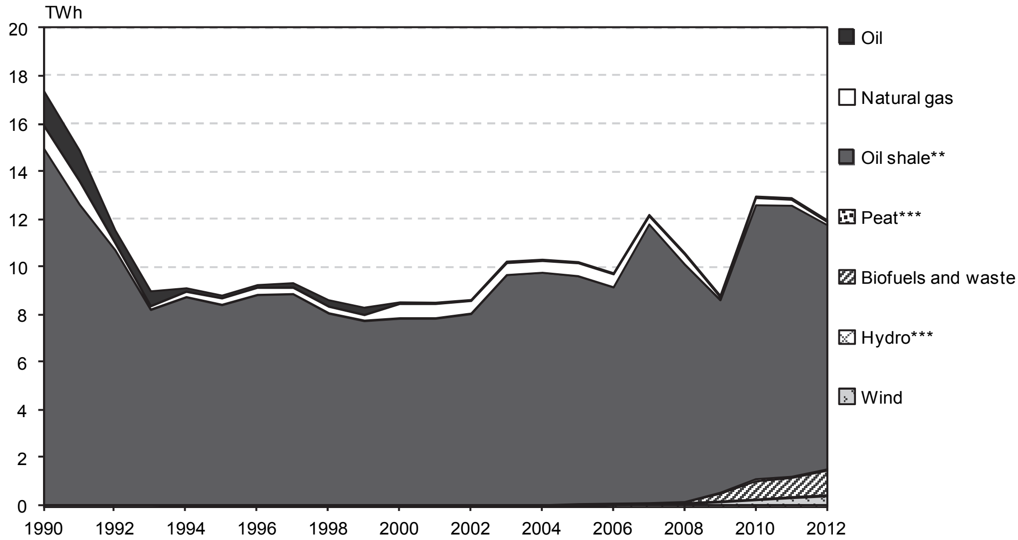
ELECTRICITY GENERATION

Electricity generation was 12 TWh in 2012, decreasing slightly from 12.9 TWh in 2011, yet 36.3% higher than a low of 8.8 TWh in 2009. Generation output declined for two consecutive years from 12.2 TWh in 2007, as recessionary conditions reduced demand for electricity in Estonia and the region. Since 2002, total electricity production has increased by 39%, owing to stronger economic activity before the recession and expanding electricity trade relationships with neighbouring countries.

Oil shale is the main source of electricity in Estonia, accounting for 85.3% of total generation in 2012.[37] Biofuels and waste accounted for a further 8.3%, followed by wind (3.6%) and natural gas (1%). Peat, oil and hydro represent less than 1% each of electricity generation. Over the past decade, the energy mix in Estonia has developed towards higher use of renewables. In 2002, biofuels and waste accounted for only 0.3% of total generation, but this doubling the output doubled every two years and reached 8.3% of total electricity in 2012.

37. Includes negligible amounts of gas works gas (see http://stats.oecd.org/glossary/detail.asp?ID=4597 for a definition of the term "gas works gas").

Figure 27. **Electricity generation by source, 1990-2012***



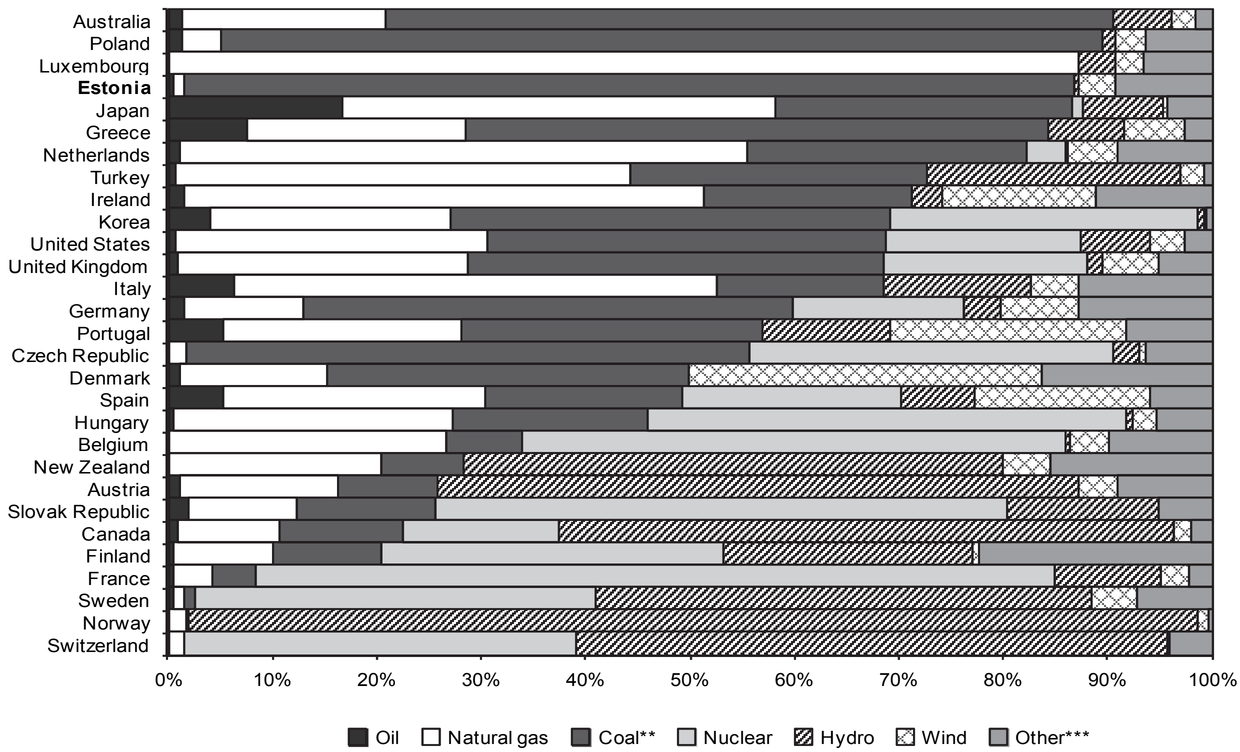
* Estimated for 2012.

** Includes negligible amounts of gas works gas.

*** Negligible.

Sources: *Energy Balances of OECD Countries*, IEA (International Energy Agency)/Organisation for Economic Co-operation and Development (OECD), Paris, 2012; and country submission.

Figure 28. **Electricity generation by source in Estonia and IEA member countries, 2012***



* Estimated.

** *Coal* includes oil shale for Estonia and negligible amounts of gas works gas.

*** *Other* includes geothermal, solar, wind, and ambient heat production.

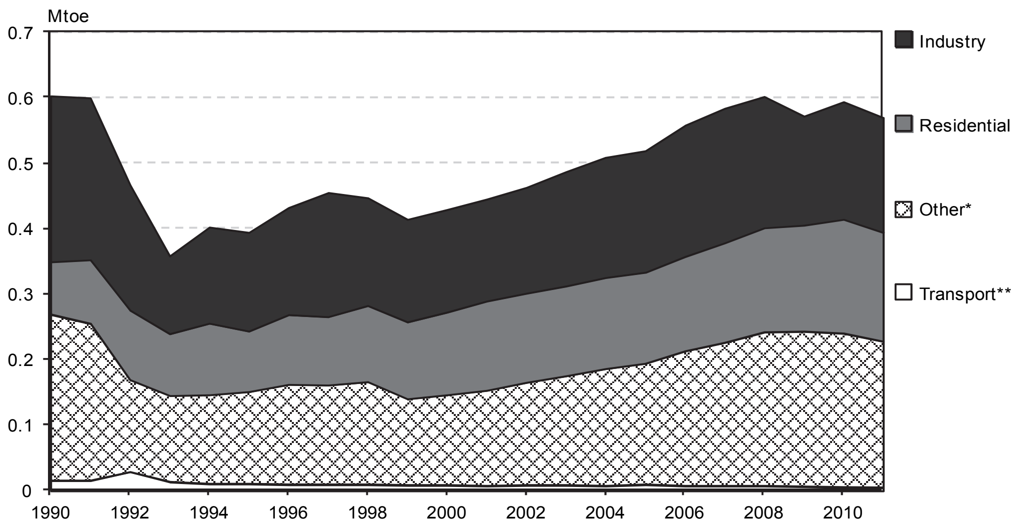
Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submissions.

Wind power generation began in 2003 and increased to nearly 4% of generation by 2012. While these renewable energy sources have expanded, the use of natural gas and shale oil has declined; since 2002, electricity output from natural gas has decreased by 76.4%. Oil shale usage has continued to grow in line with increasing generation, retracting only marginally from 91.9% of total generation in 2000.

ELECTRICITY CONSUMPTION

Electricity consumption has been on an upward trend over the past decade, increasing by 23.1% from 2002 to 2011. This is a slower rate of growth compared to generation, as electricity exports to neighbouring countries have grown. The commercial and public services sector consumes the highest proportion of electricity in Estonia, at 39.2% in 2011, increasing from 33.9% in 2002. This is followed by industry at 30.9% and the residential sector at 29.2%. The share of electricity consumption in the industry sector has fallen from 35% in 2002, while the share of residential consumption has remained relatively unchanged. Transport accounts for 0.8% of electricity usage, down from 1.7% in 2002.

Figure 29. **Electricity consumption by sector, 1990-2011**



* *Other* includes commercial and public service, and to a smaller extent agricultural, fishing and other non-specified sectors.

** Negligible.

Note: Mtoe = million tonnes of oil-equivalent.

Sources: *Energy Balances of OECD Countries*, IEA/OECD, Paris, 2012; and country submission.

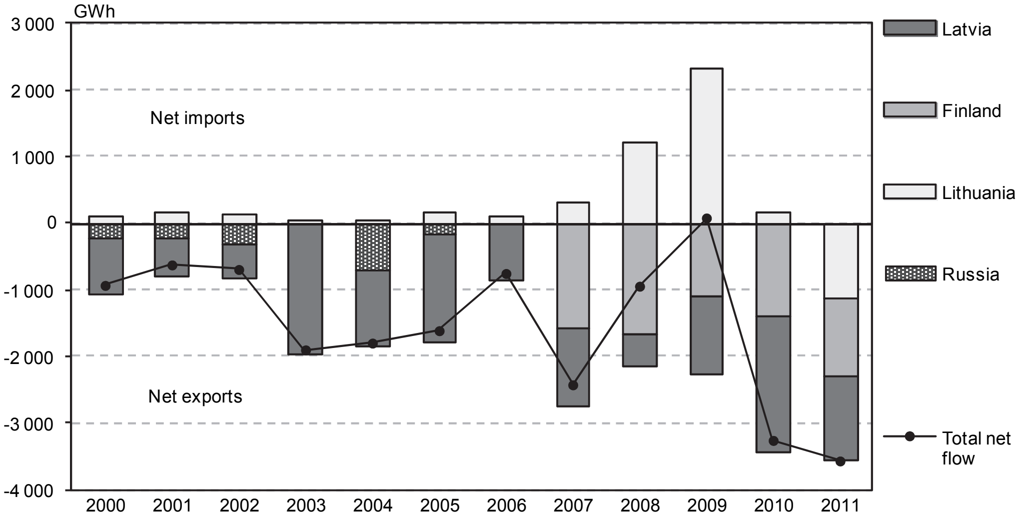
ELECTRICITY TRADE

Estonia is a net exporter of electricity, with net exports of 3.6 TWh in 2011 or 28% of total generation. Both imports and exports have grown considerably over the past decade, with net exports increasing from 0.9 TWh in 2000 when they represented 11% of generation. Regional trade has expanded thanks to a new interconnector with Finland and more open of electricity markets among neighbouring countries.

In 2011, Estonia had three main trading partners, Latvia, Finland and Lithuania, with similar net exports of 1.2 TWh to each country.

Trade with Finland started in 2007, when the EstLink 1 interconnector between Estonia and Finland became operational. As new trading partners, the magnitude of Estonia's electricity trade with Finland increased fivefold from 2006 to 2011.

Figure 30. **Electricity trade between Estonia and neighbouring countries, 2000-11**



Note: GWh = gigawatt hour.

Sources: *Electricity Information*, IEA/OECD, Paris, 2012; and country submission.

INSTITUTIONS AND POLICIES

The **Ministry of Economic Affairs and Communications (MEAC)** has overall responsibility for the development and implementation of energy policy. Within the ministry there is an Energy Department headed by the Deputy Secretary-General of Energy who oversees the Energy Markets Division and the Sustainable Energy Division.

The **Estonian Competition Authority** is a government agency, operating under the aegis of the MEAC, which regulates the electricity, natural gas and district heating (DH) markets. The **Energy and Water Regulatory Division** of the agency oversees competition in the energy sector and is responsible for the enforcement of the Electricity Market Act, the District Heating Act (DHA) and the Natural Gas Act.

DEVELOPMENT PLAN OF THE ESTONIAN ELECTRICITY SECTOR UNTIL 2018

In 2008, the Estonian government approved, by Order No. 13 of 10 January 2008, the preparation of the Development Plan of the Energy Sector and appointed the MEAC as lead agency in the development of the plan. The aim of this National Development Plan was to combine the specific development plans of the sector and to establish the general objectives of energy policy until 2020.

The aim of the development plan is to create an electricity system in Estonia that is "a system with varied and sustainable electricity production which is very well interconnected with the neighbouring countries and which ensures power supply to consumers at a justified electricity price at any moment in time".[38] The plan established three key objectives for the electricity sector, namely:

38. Development Plan of the Estonian Electricity Sector until 2018, Ministry of Economic Affairs and Communications, 2008.

- continuous supply of electricity is ensured for all Estonian consumers;
- more sustainable power supply and consumption is ensured for all Estonian consumers;
- power supply is available at a justified price for all Estonian consumers.

INDUSTRY STRUCTURE

GENERATION

The production of electricity in Estonia is highly concentrated and greatly reliant on a single fuel. As of September of 2012, Estonia's net installed generating capacity was 2 652 megawatts (MW), of which 2 275 MW of output were available to be used during peak consumption. Since September 2011, 152 MW of capacity was added to the electrical system.[39] The majority of installed generating capacity, approximately 2 000 MW, is oil shale-fired capacity followed by wind power with 247 MW.

Almost all electricity production is controlled by the biggest energy undertaking, Eesti Energia AS, that owns 87.7% of the installed capacity and that produced 95.3% of the total amount of electricity in 2011. In addition to 95% of the generation market, Elektrilevi OÜ, with a share of 86% of the distribution market, belongs to the Eesti Energia AS group.

COMBINED HEAT AND POWER

Feed-in tariffs are regulated by the Electricity Market Act of 2007 that sets out the conditions for subsidising electricity generated in combined heat and power (CHP) generation mode using biomass. Biomass is seen as one of the main sources of energy that could help to increase the amount of electricity generated from renewable energy sources, especially in the CHP mode in DH and power generation in general; it already dominates the renewable energy generation mix.

Pursuant to paragraph 7(2) of the DHA, a heating undertaking shall keep separate accounts for the production, distribution and sale of heat and for other areas of activity, including for the cost incurred in electricity co-generation. Paragraph 9(1) of the DHA stipulates that the price of heat produced in co-generation process is subject to approval by the Competition Authority according to Principles of Allocation of the Costs in Heat and Power Co-generation Plant.

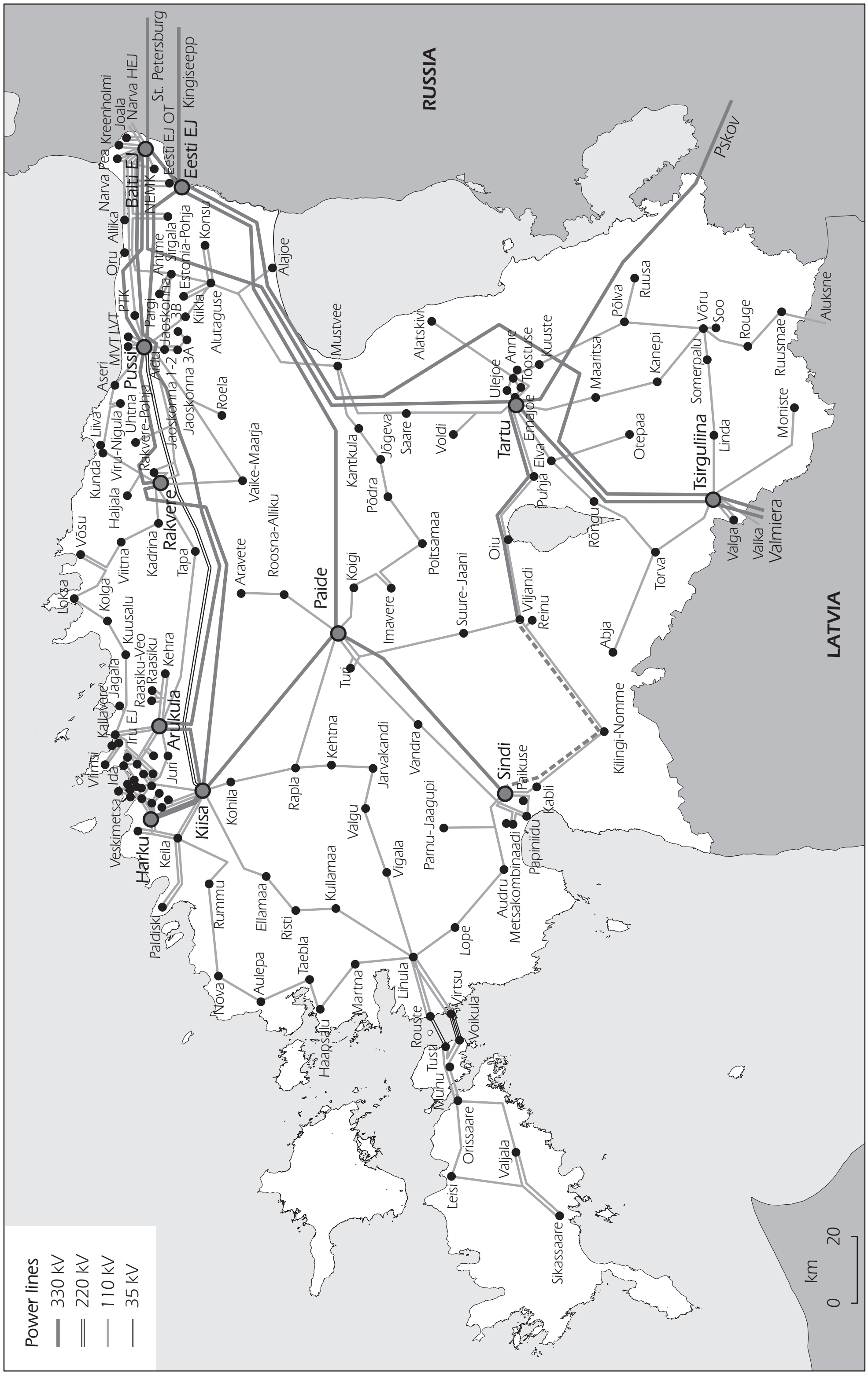
TRANSMISSION

The Estonian electricity transmission network, consisting of approximately 5 200 kilometres (km) of 110 kilovolt (kV) to 330 kV lines, operates within the larger Belorussian-Russian-Estonian-Latvian-Lithuanian (BRELL) transmission system.

It is connected by means of alternating current (AC) lines with Latvia and Russia, and in turn with nearby Lithuania and Belarus. Estonia is also connected with Finland by means of a direct current (DC) line (EstLink).

39. *Generation Capacity and Interconnections are Sufficient to Cover Estonia's Electricity Consumption*, Elering press release, Tallinn, November 2012.

Figure 31. **Electricity transmission system of Estonia**



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: country submission.

Since 1 July 2010, the Electricity Market Act sets out the requirement that the transmission system operator (TSO) cannot be at the same time also a distribution network operator, nor belong to the same group as a company that generates or sells electricity. Accordingly, Elering OÜ was unbundled from Eesti Energia in January 2010. The MEAC is the sole shareholder in Elering, which was restructured as a public limited company in April 2011. Elering is responsible for planning and managing the system and ensuring the safe and reliable operation of the network. It is also responsible for balancing the electricity system.

In addition to the 150 kV EstLink connecting Estonia with Finland, three 330 kV lines connect Estonia with Russia, two running from Narva to St Petersburg and Kingisepp, and one linking Tartu and Pskov. Estonia is also connected to the Latvian system by two 330 kV lines, one between Tartu and Valmiera, and one between Tsirguliina and Valmiera.

Transmission system development

Elering's work to keep the electricity system functioning and the investments needed to ensure security of supply are required directly by the Electricity Market Act, the Grid Code, the National Development Plan for the Energy Sector, and the government-approved development plan for the electricity industry. Elering's work plans are based on the general public interest, on ensuring the technical operation of the electricity system, the security of supply and the requirements of a functioning electricity market.

The investment policy followed. The investment budget states that investments must:

- be economically reasonable;
- consider increases in the system load and the new clients who may join the network;
- comply fully with all laws, especially the obligations and responsibilities in the Electricity Market Act and the Grid Code, and requirements for system reliability;
- take account of modern solutions from around the world.

A list of the technical and economic reasons for the investments and of the substations and lines that need reconstruction work is drawn up by the network owner to help in deciding the priorities for the investment budget. The size of the investment budget for 2012-16, approved by the Elering Supervisory Board, is EUR 450 million.

Major projects

EstLink 2

EstLink 2 is the second high-voltage direct-current (HVDC) interconnection between Estonia and Finland, which will triple the transmission capacity between the Baltic and Nordic regions. The connection will have a transmission capacity of 650 MW, which increases the total transmission capacity between the countries to 1 000 MW.

The investment will cost a total of around EUR 320 million, making it the largest ever single investment in the Estonian electricity system. The construction costs will be jointly financed by Elering and Fingrid Oyj, the Finnish TSO, with the European Union providing EUR 100 million. The total length of the link is approximately 170 km, 14 km of which is an overhead line in Finland, about 145 km submarine cable laid on the bottom of the Gulf of Finland, and about 12 km underground cable in Estonia.

Harku-Lihula-Sindi line

The planned EUR 45 million Harku-Lihula-Sindi 330/110 kV high-voltage line is one of Estonia's largest domestic infrastructure projects. Elering plans to construct a twin-circuit overhead line with both 330 kV and 110 kV circuits on the same corridor as the existing 110 kV overhead lines. The new infrastructure will benefit the whole of Estonia, notably with security of electricity supply in western Estonia and the Tallinn area.

Kiisa emergency reserve power plant

In order to ensure security of supply in the event of an emergency, Elering is building a EUR 135 million 250 MW emergency power station close to Tallinn. Its capacity is planned at around 250 MW with the first 110 MW unit expected to be ready for operation in 2013 and the 140 MW second unit in 2014.

Tartu-Viljandi-Sindi line

In August 2011, the first stage of construction of a new EUR 34 million high-voltage line connecting Tartu, in the east of Estonia, with Viljandi and Sindi in the south-west was completed. Construction of the new high-voltage line is taking place in two stages: the Tartu-Puhja-Oiu-Viljandi section in 2011-12 and the Viljandi-Kilingi-Nõmme-Sindi section in 2013-14. The purpose of the new line is to secure the flow of sufficient amounts of high-voltage electricity and significantly improve the supply of electricity in the region.

Table 7. **Existing and planned interconnection lines in Estonia (as of November 2012)**

Line	Border	Status	Voltage	Capacity
EstLink 1	Estonia-Finland	In operation	±150 kV DC	350 MW
EstLink 2	Estonia-Finland	Under construction, due in 2014	450 kV DC	650 MW
L358	Estonia-Russia	In operation	330 kV	790 A*
L373	Estonia-Russia	In operation	330 kV	800 A*
L374	Estonia-Russia	In operation	330 kV	1 200 A*
L301	Estonia-Latvia	In operation	330 kV	950 A*
L354	Estonia-Latvia	In operation	330 kV	950 A*
L677	Estonia-Latvia	In operation	110 kV	271 A*
L683	Estonia-Latvia	In operation	110 kV	225 A*
L502	Estonia-Latvia	Planned	330 kV	± 500 MW

* Estimated values for an outer temperature of +20 degrees Celsius.

Source: MEAC.

DISTRIBUTION

There are 37 distribution system operators (DSOs) in Estonia responsible for approximately 65 500 km of low- and medium-voltage lines. Elektrilevi OÜ is the largest of these, with the biggest market share (87.5%), followed by VKG Elektrivõrk OÜ (a subsidiary of Viru Keemia Grupp [VKG]) and Imatra Elekter, each with a 2.8% market share, and AS Energia OÜ with 1%.

In accordance with the Electricity Market Act, a DSO is required to form a separate business entity if the number of customers exceeds 100 000 and it shall not operate in any area of activity other than the provision of network services. In reality, the latter condition applies only to Elektrilevi OÜ (until 17 May 2012 Eesti Energia Jaotusvõrk OÜ), which belongs to the Eesti Energia AS group, as all other DSOs have fewer than 100 000 customers. DSOs with fewer than 100 000 customers are required to separate their accounts by provision of network service, sale of electricity and ancillary activity.

All DSOs, regardless of their size, are required to keep their accounts on the same principles as separate undertakings operating in the same area of activity. Therefore, a DSO that is not required to form a separate business entity is obliged to keep its accounts as a business entity would and shall submit in its accounts the balance sheet, profits and losses, the management report and other reports provided for in the Accounting Act separately for network services, electricity sales and ancillary activities. This information shall be submitted by each DSO in its annual report and made public, the separation of accounts shall be audited and the auditor's opinion attached.

The Estonian grid code "Võrgueeskiri" determines that all consumers must be provided with a "remote reading device" by 2017. The roll-out of smart meters is due to be dealt with in the next Development Plan of the Energy Sector until 2030.

INTEGRATION OF RENEWABLE ENERGY SOURCES

In Estonia, the deployment of wind power has been encouraged by a favourable incentive scheme, which has given rise to a large number of wind power projects. By the end of 2012, approximately 258 MW of wind power capacity was installed. The growing share of wind power on the relatively small power system is causing concern regarding both the technical and the economic feasibility of wind power integration and development.

Forecast errors are not likely to imply technical constraints on the level of wind power capacity in Estonia, but they create costs in ensuring sufficient reserves to cover a lesser wind power production than expected or costs to curtail wind power if wind power production is larger than expected and no other measures are available. With the present regulatory framework in Estonia, it would be difficult or even impossible for Elering to cover these additional costs by letting the wind power producer pay or by an increase in the system tariffs. If no extraordinary balancing costs are allowed, the maximum wind power capacity in the Estonian system would be around 600 MW with EstLink 1 in operation and 900 MW with both EstLink 1 and EstLink 2 in operation.[40]

RETAIL MARKET

Since April 2010, the Estonian electricity market has been 35% open for large eligible consumers. There were 213 eligible customers, those consuming more than 2 GWh of electricity per year at one point of consumption. Eligible consumers had the right and the obligation to select their electricity seller. This was done via bilateral contracts, or by buying from Nord Pool Spot (NPS), Estonia's power exchange, directly or via a broker.

Before January 2013, the approximately 700 000 household and commercial consumers could only buy electricity from their network (or from a seller nominated by such network

40. *Wind Power in Estonia: An analysis of the possibilities and limitations for wind power capacity in Estonia within the next ten years*, prepared by Ea Energy Analyses for Elering OÜ, 2010.

operator); each network operator had a selling obligation. The price of electricity sold under this selling obligation was fully regulated, subject to approval by the regulator.

The Electricity Market Act ended the sale of electricity at a regulated price as of 1 January 2013, and created the preconditions for the entry of new sellers into the market. Accordingly, since January 2013, household and commercial customers have been able to buy their electricity in one of the following ways:

- exchange-related package;
- fixed price package;
- universal service, if no seller is selected.

Consumers can switch supplier with a 21-day notice to their existing supplier. Furthermore, all consumers can choose to buy electricity at a fixed tariff or, alternatively, at a power exchange-dependent price. To facilitate the process, customers must provide the new seller with access to their detailed electricity consumption data and the retailer may then submit an access request for those consumers' data to a Data Warehouse created by Elering to that effect.[41]

At present, the largest retailer is Eesti Energia, which in 2013 enjoyed a market share of approximately 72.5%. A feature of Estonia's retail market is the "good faith agreement". Retailers that have committed to the good faith agreement on the opening of the electricity market have voluntarily pledged to avoid misleading consumers. Such sellers have the right to use the *Avatud 2013* logo.[42]

In the retail market, Eesti Energia AS has the biggest market share, 76.2% in 2011. In 2011, the maximum weighted average price limit for electricity sold to final consumers under the selling obligation of EUR 0.0307/kWh was applied for Eesti Energia AS. The Estonian Competition Authority approved this price in March 2010. The average final consumer price, including network service, excise tax and subsidy for renewable energy sources (without value-added tax) for household customers was EUR 0.0909/kWh and for businesses (all except households) EUR 0.0785/kWh.[43] In 2013, Eurostat reported that the lowest electricity prices in the European Union for households are found in Bulgaria, in Romania and in Estonia.

In 2012, an Estonian household consuming between 2 500 kWh and 5 000 kWh paid an average of EUR 0.11/kWh compared to a European Union (EU) average of EUR 0.186/kWh.[44]

WHOLESALE MARKET

The Nordic electricity exchange NPS covers Denmark, Finland, Sweden, Norway, Estonia and Lithuania. In April 2012, Elering and the Latvian and Lithuanian TSOs, Augstsprieguma Tīkls (AST) and Litgrid, respectively, signed a Memorandum of Understanding on the purchase of the shares of the NPS, Europe's largest power exchange. Before this event, Estonia was functioning as an NPS bidding area, with day-ahead market (Elspot) and intraday market (Elbas) established.

41. http://andmeladu.elering.ee/consumer/home (last accessed on 21 March 2013).

42. http://avatud2013.ee (last accessed on 21 March 2013).

43. *Estonian Electricity and Gas Market Report 2011*, Estonian Competition Authority, 2012.

44. *Electricity and natural gas price statistics*, Eurostat, 2013.

Commencing on 1 April 2010, NPS started operating in Estonia as transmission capacity allocator on Estonia-Finland, Estonia-Russia and Estonia-Latvia borders and the NPS Estonia price area was launched to provide a market where Estonian participants could trade in power.

At present, the system price is calculated on the basis of the supply and demand for electricity, disregarding the available transmission capacity between the bidding areas. The system price is the Nordic reference price for trading and clearing of most financial contracts. For each country, the local TSO decides which bidding areas the country is divided into. Finland, Estonia and Lithuania constitute one bidding area each. The different bidding areas help indicate constraints within the transmission systems, and ensure that regional market conditions are reflected in the price. In 2011, full price convergence between Estonian, Finnish, Swedish, Danish and Norwegian prices stood at 8%.

FORMATION OF THE COMMON BALTIC ENERGY MARKET

In April 2009, the Prime Ministers of the three Baltic states of Latvia, Estonia and Lithuania signed a Joint Declaration on the Principles for the Formation of the Common Baltic Energy Market and Actions for the Implementation of the Main Energy Projects. The declaration envisaged the creation of an open and transparent Baltic electricity market and its integration into the Nordic electricity market in line with the relevant EU legislation.

The signature of this declaration was followed in June 2009 by the signing of a Memorandum of Understanding on the Baltic Energy Market Interconnection Plan (BEMIP) by eight Baltic Sea member states.[45] The BEMIP is a European Commission initiative to examine measures on how to connect Lithuania, Latvia and Estonia better to wider EU energy networks. The main objective of the Memorandum is the creation of a fully functioning and integrated energy market supported by the necessary infrastructures in order to strengthen energy security in the Baltic Sea region. Effective interconnection of the Baltic region was identified as one of six priority energy infrastructure projects in the Second Strategic Energy Review adopted by the European Commission in November 2008.

Participation of the three Baltic states in the EU internal market requires, among other things, full implementation of market rules and strengthening of existing infrastructure. In this regard, the European Commission – through the European Energy Programme for Recovery (EEPR) – is providing funding for the construction of two electricity interconnections between the region and the Scandinavian Peninsula (EstLink2 between Finland and Estonia, NordBalt between Lithuania and Sweden). The total amount of the EEPR financial support is EUR 231 million. The most recent progress report published by the European Commission indicated that implementation of the BEMIP Action Plan seems to be on track and according to schedule. The European Commission also requested an agreement between Russia and Belarus on the legal framework to operate the electricity networks of the Baltic member states. Direct negotiations with both countries could lead to an agreement by the end of 2012.[46]

EUROPEAN TEN-YEAR NETWORK DEVELOPMENT PLAN 2012

The Third Legislative Package for the Internal Market of Electricity (Third Package), which entered into force on 3 March 2011, imposed a number of requirements on the

45. The Baltic Sea member states are Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and Germany.

46. *Baltic Energy Market Interconnection Plan*, Fourth progress report, June 2011 to May 2012, European Commission, 2012.

European electricity industry in terms of regional co-operation to promote the development of electricity infrastructure both within and between EU member states, while also looking at cross-border exchanges of electricity between the member states. The key element of the Third Package is the mandate to the European Network of Transmission System Operators for Electricity (ENTSO-E) to prepare and publish a biannual, non-binding, Ten-Year Network Development Plan (TYNDP), the main objectives of which are:

- to identify investment gaps, notably with respect to cross-border capacities;
- to contribute to a sufficient level of cross-border interconnection and to contribute to non-discriminating, effective competition and the efficient functioning of the market;
- to ensure greater transparency regarding the entire electricity transmission network in the Community.

In July 2012, ENTSO-E published its first TYNDP 2012 package and submitted it to the Agency for the Co-operation of Energy Regulators (ACER) for opinion. The TYNDP 2012 package comprises eight documents and identifies the need to invest EUR 104 billion in the refurbishment or construction of roughly 52 300 km of extra-high-voltage power lines clustered into 100 investment projects throughout Europe.

The TYNDP 2012 package consists of six detailed regional investment plans, including one for the TSOs of the Baltic Sea Regional Group, and the Scenario Outlook & Adequacy Forecast 2012-2030 as well as the pan-European TYNDP 2012 report.

The projects recognised in the BEMIP are part of this regional plan and include the EstLink 2 and NordBalt interconnectors, a planned 300 kV HVDC subsea cable between Lithuania and Sweden (440 km) with a capacity of 700 MW.

In 2011, the TSOs of the three Baltic states together with ENTSO-E started a feasibility study on the interconnection variants for the integration of the Baltic states (Lithuania, Latvia and Estonia) with the EU internal electricity market. One of the main objectives and outputs of the study will be the optimal variant and scenario identification with detailed analyses of the process and steps needed for full synchronous interconnection of the Baltic states' power system with the continental European power system. The study will be finalised and results will be available within the TYNDP 2014.

ELECTRICITY SECURITY

The Estonian Grid Code regulates the requirements applied to security of supply of power systems and the technical requirements for electrical installations arising from security of supply.

According to the report on the security of supply of the Estonian power system prepared by Elering OÜ, problems concerning coverage of peak demand may arise in Estonia from 2012 onwards. These problems are likely to become more severe in 2016 as a result of an obligation not to use the older units of the Narva power plants in their present mode.

ASSESSMENT

The Estonian electricity system was developed as an integrated part of the Soviet Union system and it still operates in a frequency-harmonised mode in the Unified Power System (UPS) with the Russian and Belorussian systems.

An AC connection exists with Latvia, a country similarly harmonised with Russia. EstLink 1, a 350 MW (around 20% of peak demand) DC cable with Finland has been built and links Estonia with the Nord Pool market and a second interconnection, EstLink 2 which is under construction, will triple interconnection capacity to 1 000 MW. As a proportion of peak demand, this will be one of the highest levels of interconnection in Europe and it is expected to fully integrate Estonia into the Finland price zone of Nord Pool.

Together with the other Baltic states, Estonia is making efforts to integrate the "Baltic Island" into the European transmission grid (the BEMIP). Nevertheless, synchronised operation and Union for the Co-ordination of Transmission of Electricity (UCTE) membership are not envisaged before 2025.

Power generation in Estonia is based on oil shale. While oil shale is a domestic resource providing energy security benefits, it is highly carbon-intensive. Recent and ongoing investments in oil shale power plants will preserve the technical, although not necessarily the economic, viability of oil shale power generation for decades. The government encourages the redirection of oil shale resources to liquid fuel production. Wind and biomass co-generation is playing an increasing role in Estonia, but it is not seen as a substitute for oil shale. Estonia does not have nuclear power and the prospects of nuclear in the Baltic states are highly uncertain following a recent referendum in Lithuania.

The Estonian electricity system has been unbundled in compliance with EU regulations. The transmission system operator, previously part of the Eesti Energia group, was unbundled into a separate, but state-owned public limited company, Elering. The state-owned incumbent, Eesti Energia, owns the oil shale-fired generation that provides the majority of generation and retains ownership of the vast majority of distribution networks. As the incumbent, it also maintains a dominant position in the recently liberalised electricity retail market. While retail market liberalisation is expected to lead to price increases following the elimination of implicit subsidies, the IEA notes that further unbundling measures, such as the separation of the distribution activities from the retail and generation activities of Eesti Energia, could help stimulate retail competition and force downward pressure on prices.

System adequacy is good with net exports and strong, improving interconnections. Conversely, the strategic future of oil shale-fired power generation is uncertain. Although much of the generation fleet is relatively new (a large part was built in the past decade and some is currently under construction), its operational economics remain uncertain despite the reasonably low marginal cost and domestic fuel availability. Following full integration into the Nord Pool market, prices and power plant operation are likely to follow the summer-winter cycle of the Nordic region, and it is unclear to what extent the high fixed costs of shale mining are suitable for this. Although carbon dioxide (CO_2) quota prices in the EU Emissions Trading Scheme are very low, reform discussions are under way. Nord Pool is regarded as a less carbon-intensive system, containing a high component of hydro and nuclear power; therefore it has a limited price response to the CO_2 price. It could be argued that oil shale-fired generation in Estonia may be vulnerable to carbon prices, EUR 20 or more per tonne, which is well within the range of possible outcomes. Should this happen, Estonia has the means to use locally available biomass instead of CO_2-intensive oil shale in power plants. This is more likely to be the case if liquid production from oil shale picks up, a more profitable use of shale resources. Consequently, Estonian energy policy needs to develop strategic options to address the possibility of a reduction of oil shale generation owing to economic or external policy pressures.

The present Estonian energy strategy calls for 110% of peak demand to be satisfied by domestic power generating capacity. Nevertheless, given its geographical location, it could prove difficult to achieve competitive diversification of gas supplies, with the result that gas prices are likely to remain high. Moreover, the market is small and any investor risks exposure to direct competition from Russian electricity imports. As a result, market signals may fail to deliver investment in new conventional generating capacity even if the share of oil shale power generation is reduced. This would mean a move towards greater electricity imports and increased reliance on interconnector flows from Finland. Given its large capacity, this will create difficulties in managing N-1 exposure. The TSO is building a limited amount of gas-fired capacity, which may contribute to managing this exposure, but this is not a market-based solution, and its possible operation could create market distortions. The Estonian government needs to assess carefully whether the Finnish, and potentially Russian, interconnectors would provide sufficient system adequacy and whether there is a need for policy measures to encourage investment in power generation.

Estonia has a sizeable wind generation fleet: wind capacity is equivalent to around 15% of peak demand. Although this is less than the leading countries Germany and Spain, there is potential for further growth. If so, it will have to be integrated into a much less diverse, and less flexible, system. Estonia has no priority dispatch for wind, the TSO controls wind scheduling on the basis of the bids of wind generators to the spot market. The day-ahead market splitting mechanism in operation within the Baltic states, as well as on the EstLink 1 interconnector, provides an efficient contribution to system flexibility on a day-ahead basis. An integrated balancing mechanism in the Baltic states is already functioning but developing a balancing market and integrating it with the Finland/Nord Pool balancing market remains a work in progress. Integration of wind will require a careful assessment of flexibility resources. Bringing interconnector capacity allocation closer to real time and effectively integrating balancing regimes could enhance flexibility, although Estonian wind production is likely to be correlated with wind around the Baltic region. In addition, it may be advisable to apply stress test scenarios on wind impact, should some of the interconnectors become unavailable.

Biomass electricity is much less likely to pose any special grid integration challenges, but the Estonian government will have to assess the extent of sustainable biomass resources and make strategic choices on their use. Biomass-based CHP is likely to play a significant role, although it is the lack of economically viable heat load which will soon prevent the further development of biomass-fired CHP capacity. CHP (either from biomass or natural gas) can be a system operation asset or liability, depending on the technical set-up and economic incentives. Estonian energy policy should ensure that CHP plants have adequate flexibility in heat storage so that they can provide ramping capability to the electricity system rather than having a rigid "must run" status. This will require a regulatory framework that exposes CHP plants to spot and balancing market signals.

From January 2013, price controls on the wholesale market were lifted without any structural measures to reduce Eesti Energia's dominant position such as capacity or contract release programmes. The government's reasoning was that, owing to the enhanced integration with Finland, pricing would be determined by Nord Pool and import interconnections would provide adequate competition. In effect, as interconnections improve to a larger and larger extent, the relevant market to assess competitive conditions will not be national market of Estonia but the integrated market of Nord Pool, where Eesti Energia is only a small market player. This is a very reasonable assumption on the wholesale market, but Eesti Energia is a vertically integrated utility and is very active in the retail market. Experience elsewhere suggests that the barriers to entry are considerable and effective retail competition will be difficult to develop. As a result, there is a risk that any wholesale competition would be swamped by retail margins without meaningful benefits to end-users. Estonia's energy and competition policy will need to pay special attention to reducing the barriers to market entry and facilitate consumers' switching supplier with adequate transparency and low transaction costs. The high broadband penetration and widespread use of e-business solutions in Estonia will help in this, and seven new marketers now offer online services to household clients.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Continue with interconnection development and market integration with the Nordic and Baltic regions and explore possibilities for integrated balancing with Nord Pool.*
- ☐ *Carefully assess capacity adequacy as well as possible measures to encourage generation investment consistent with its strategic choices over oil shale utilisation.*
- ☐ *Regularly assess the implications on system adequacy as oil shale generation capacity diminishes and further interconnections are developed; carefully assess whether the Finnish, and potentially Russian, interconnectors can provide sufficient system adequacy and whether there is a need for policy measures to encourage investment in power generation.*
- ☐ *Pursue present efforts to synchronise operation of the Estonian electricity system with the Central European electricity system.*
- ☐ *Make the necessary adjustments to the electricity market arrangements to expose CHP plants to spot and balancing market signals.*
- ☐ *Ensure that the Estonian Competition Authority has sufficient resources to carefully monitor the development of retail competition and the powers to introduce measures that ensure low barriers to entry and facilitate consumers' switching supplier with low transaction costs.*
- ☐ *Assess the need for further structural measures, such as further break-up of the Eesti Energia group, in order to reduce the competition impacts of vertical integration.*

PART III
ENERGY TECHNOLOGY

9. ENERGY TECHNOLOGY RESEARCH, DEVELOPMENT AND DEMONSTRATION

Key data (2011)

Government energy research, development and demonstration (RD&D) spending: EUR 9.4 million

Share of total government RD&D: 7.5%

RD&D per capita: USD 12.9 (International Energy Agency [IEA] median: USD 13.5)

GENERAL RD&D INSTITUTIONS AND STRATEGY

The structure and basis of operation of Estonia's research and development (R&D) system are established in the 1997 Research and Development Organisation Act and its amendments. The government prepares national R&D plans, submits them to the Riigikogu (the parliament), approves national R&D programmes and ensures the co-operation between the ministries.

In practice, the **Ministry of Education and Research** has the main responsibility for planning, co-ordinating, implementing and monitoring research and education policies. The **Research and Development Council**, a separate body, advises the government on matters related to R&D strategy, thereby directing the national research, development and innovation (RD&I) system.

The **Ministry of Economic Affairs and Communications (MEAC)** is responsible for planning, co-ordinating and implementing R&D activities and innovation policy related to the private sector. The **Innovation Policy Committee** acts as an advisory body for the Minister of Economic Affairs and Communications. National support measures for innovation policy are implemented by **Enterprise Estonia**, which provides financing products, advice, partnership opportunities and training for entrepreneurs, R&D institutions and the public.

Most R&D in Estonia is performed at the universities. In the case of energy, the main public research universities are the University of Tartu and the Tallinn University of Technology. Today, nearly all basic research is conducted in the public sector; the private sector focuses mainly on product development and innovation.

Estonia's policies and objectives regarding RD&I are laid out in the Estonian Research, Development and Innovation Strategy 2007-2013 "Knowledge-based Estonia". The main objectives are to increase the quality of public research and private-sector innovation and the potential for long-term economic growth. These objectives are to be achieved by developing human capital (increasing the attractiveness of researcher careers); increasing enterprises' innovation capacity; developing policies for long-term growth; and reorganising public-sector RD&I to increase efficiency (such as modernising R&D infrastructures).

In 2011, the Ministry of Education and Research and the MEAC launched the preparations for two new strategies: the RD&I Strategy and the Entrepreneurship Strategy for 2014-2020.

The 2007-2013 RD&I Strategy identifies key technology areas and areas that are important for the socio-economic and cultural development of the country. National R&D programmes are implemented in these areas. The programmes focus on areas where Estonia already has high-quality research and which are important to the Estonian economy to attract private-sector participation, including funding.

Energy technology is one of the six national R&D programmes included in the 2007-2013 strategy. The other five are information and communications technology (ICT), biotechnology, health, environment technology and materials technology.

THE ESTONIAN ENERGY TECHNOLOGY PROGRAMME

The Estonian Energy Technology Programme (ETP) is a national R&D programme in the energy sector. It is a co-operation programme involving research, business and the state to develop technology in three focus areas: oil shale, renewable energy, and other new energy technology. The focus areas are detailed below. They reflect domestic potential for energy sources and scientific know-how as well as the country's European Union (EU) commitments in the energy sector and the priorities set by the European Union's Strategic Energy Technology (SET) plan.

The ETP involves the Ministry of Education and Research, the MEAC, the Ministry of Agriculture and the Ministry of the Environment. Co-operation with the private sector and research institutions is based on their voluntary contribution.

International co-operation, at present, is based on *ad hoc*, direct contacts with various R&D institutions. International collaboration is mainly carried out in the EU context. Under the EU 7th Framework Programme for Research and Development (2007-2013), Estonia has participated in the ERA-NET Smart Grids. Estonian R&D institutions also have bilateral activities on energy, for example the Estonian Science Foundation with the United States Civilian Research & Development Foundation.

The ETP was launched in 2008 and by the end of 2011 it had organised two calls for proposals and committed all of its EUR 7.5 million in funding. It was the first of the six programmes under the 2007-2013 RD&I Strategy to do so. The ETP mid-term evaluation was carried out in 2011-12, with no major changes to the programme up to 2013.

The ETP projects are monitored by their individual expert groups at their regular meetings. Any bottlenecks or priorities defined at these meetings are, in turn, discussed by the ETP Advisory Body, comprising representatives of universities, enterprises and trade unions. As a result of those discussions, propositions are put forward to the Steering Committee, made up of representatives of the relevant ministries and the qualified representatives of final beneficiaries. Required amendments are executed as the Steering Committee Resolutions. The facilitator for these processes is the ETP management team, which consists of the one full-time ETP employee and representatives of implementing bodies.

ENERGY TECHNOLOGY AREAS

OIL SHALE

Oil shale has long dominated energy and electricity production in Estonia and it is also offering bright prospects for oil production. In the same vein, it has been the focus of energy R&D efforts. In the 2008 National Development Plan for the Utilisation of Oil Shale, these efforts were given the following objective: development of oil shale technologies, such as activities for the development and growth in efficiency of the entire oil shale production cycle, including the further increase in value of oil shale.

R&D on oil shale generally focuses, on the one hand, on developing oil production from oil shale, on the other hand, on reducing the carbon intensity of power generation from oil shale. More in detail, recent projects have covered the topics of oil shale mining without losses; oil from oil shale; motor fuels from oil shale oil; combined process for producing electricity and oil shale oil; carbon dioxide (CO_2)-free oil shale electricity; more efficient use of oil shale residues; and more efficient use of waste heat at oil shale power plants.

Basic research on oil shale is conducted by the Tallinn University of Technology. Applied research and demonstration is mostly done at company level, by the largest users of oil shale: Eesti Energia AS (mine owner, as well) and Viru Keemia Grupp AS. The major initiatives in the country's R&D history are the recent development of Eesti Energia's Enefit280 integrated oil production plant (see Box 5) and Petroter technology for oil production developed by Viru Keemia Grupp AS.

Box 5. **Enefit280**

Estonia is gearing the oil shale sector towards increased oil production. At the same time, power generation from oil shale will be reduced. All this should lead to gains for the economy and the environment.

Developing a new plant for oil production has been a crucial part of the restructuring of the oil shale sector. Over the past few years, the state-owned Eesti Energia, internationally known as Enefit, has invested more than EUR 200 million in the project. The result, Enefit280, is in many ways a pilot plant and investment in its development explains the large increases in RD&D spending in the oil sector in 2010-11.

Enefit280 has a modular design where each processing unit serves a special purpose, such as drying and pyrolysis of oil shale, combustion of semi-coke as well as the dedusting and cleaning of vapours and gases. The modular design allows for easy maintenance, process optimisation and streamlined adaptability to the individual characteristics of different oil shale deposits. The technology has been developed by Enefit Outotec Technology, a joint venture of Enefit and Outotec, a leading international metals and mining process technology company.

Enefit280 integrates oil, gas and power production with high efficiency and low emissions. According to Enefit, the new plant will consume 2.26 million tonnes of oil shale per year. Out of this, it will produce 1.9 million barrels of oil and 75 million cubic metres of hydrogen-rich retort gas. The plant also has an integrated 35 megawatt steam turbine, which uses waste heat to generate around 280 gigawatt hours of electricity. This is more than enough to run the plant, so Enefit280 is a net producer of electricity. In total, over 90% of the energy contained in oil shale is extracted as oil, gas and electricity. All organic matter is fully utilised, as the ash can be used in cement production and for road construction.

The first barrel of shale oil at Enefit280 was produced in December 2012. By 2016, Eesti Energia plans to launch two more Enefit280 units and shale oil upgrading facilities for making diesel fuel, shale gasoline and fuel oil from raw shale oil.

An example of electricity-related projects is the oil shale oxy-fuel combustion R&D project, started in 2012. It aims to reduce the decomposition of carbonate minerals and generate a highly concentrated CO_2 stream. Oil shale contains large amounts of carbonate minerals and their decomposition in the combustion process increases CO_2 emissions. On the other hand, oil shale can be co-fired with wood chips (for a wood chip share of up to between 50% and 60%) in a circulating fluidised boiler. This is much higher than in the case of coal, which can only tolerate a 10% to 20% share of wood chips in co-firing.

RENEWABLE AND OTHER NEW ENERGY TECHNOLOGIES

R&D on renewable and other new energy technologies includes wind power and biomass-based energy, but also a long list of other topics, such as fuel cells and electrolysers, solar energy, power storage and power grid development, plus ICT-based energy management technologies in buildings.

Estonia's Development Plan 2007-2013 for Enhancing the Use of Biomass and Bioenergy, issued in 2007, supports related R&D as part of efforts to reach its overall objective of reducing the country's dependence on imported resources and fossil fuels.

Bioenergy research is mainly carried out at the Estonian University of Life Sciences and at the Tallinn University of Technology. The former has a Centre of Renewable Energy where the suitability of various woody and herbaceous plants for producing bioenergy, including liquid biofuels, and their economic viability has been analysed.

At the Tallinn University of Technology, the biomass combustion characteristics as well as the construction of boilers have been studied. Research has also been done on theoretical and technical bioenergy resources, characteristics of new biofuels and possibilities of using them to produce heat and energy. Several thermo-technical tests of larger biofuel boilers and measurements of emissions have been carried out to determine specific emission characteristic of biofuels.

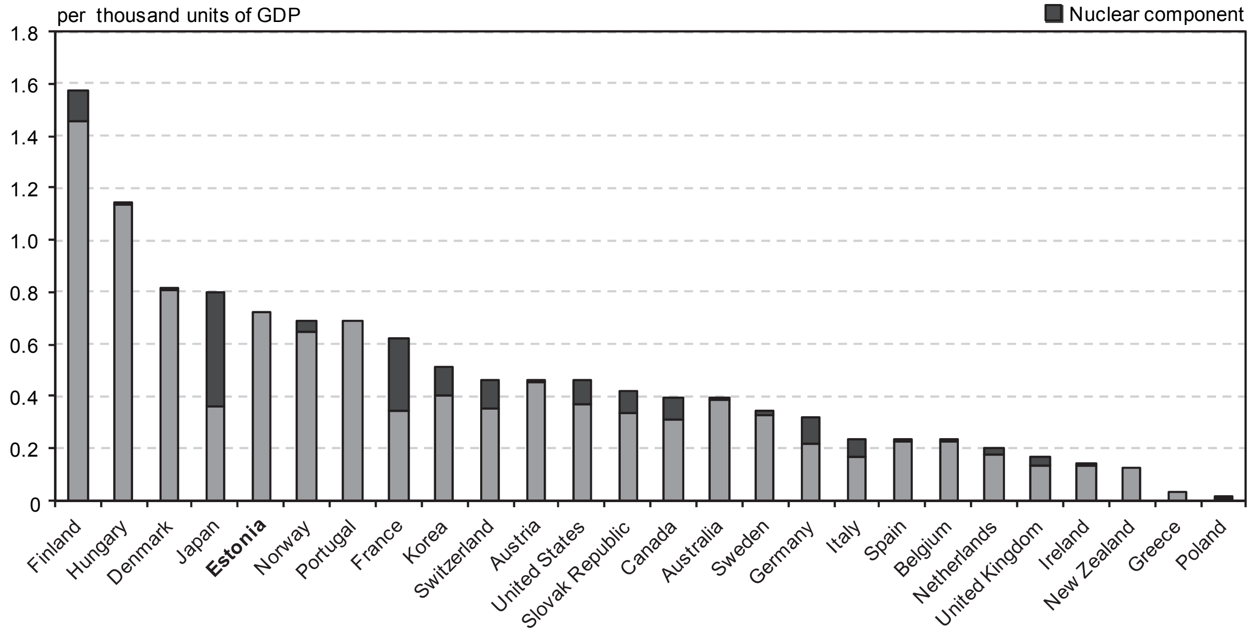
FUNDING

In 2011, public funding for energy RD&D amounted to EUR 9.9 million. Renewable energy projects, mostly wind power, accounted for 46% of the total, while oil shale was allocated 27%. Fuel cells and power systems accounted for around one-tenth each, and buildings energy management studies for the remaining 6% (see Table 8). The overall trend in RD&D spending has been up in recent years. By international comparison, government spending on energy RD&D is relatively high as a share of gross domestic product (GDP) (see Figure 32).

The largest publicly funded projects in 2011 concerned offshore wind technology, reducing CO_2 emissions from combustion by increasing the oxygen content in the boiler (oxy-fuel combustion), and loss-free and environment-friendly oil shale extraction techniques.

Public funding comes from the Ministry of Education and Research (for universities) and Enterprise Estonia (for applied research and demonstration). Within the ministry, the Estonian Research Council was created in 2011 to serve as a funding agency and to improve the functioning of the funding systems. The Estonian Research Council will be the main public funding organisation of R&D, consolidating different grants and types of funding and giving research more visibility in the society.

Figure 32. **Government RD&D budgets in Estonia and IEA member countries, 2011**



Note: data not available for the Czech Republic, Luxembourg and Turkey.

Sources: *OECD Economic Outlook*, Organisation for Economic Co-operation and Development (OECD), Paris, 2012; and country submissions.

Specific data for energy R&D funding from EU Structural Funds and from the EU 7th Framework Programme for Research and Development (2007-13) are not readily available but, in general, Estonian applications have been successful and the country has received more R&D funding per GDP than any other EU member state.

Table 8. **Government spending on energy RD&D, 2011**

Energy technology area	**Spending (EUR million)**	**Share in total spending (%)**
Fossil fuels (oil shale)	2.7	27
Renewable energy	4.6	46
Fuel cells	1.0	10
Electricity generation, transmission and distribution	1.1	11
Energy efficiency (smart grids/meters)	0.6	6
Total	**9.9**	**100**

Source: MEAC.

Regarding total public and private RD&D funding in Estonia, it is crucial to note the major impact of the state-owned Eesti Energia's project to develop the Enefit280 shale oil production plant (see Box 5). According to Statistics Estonia, RD&D spending on the oil industry rose from EUR 2 million in 2009 to EUR 25 million in 2010 and to EUR 125 million in 2011.

In 2010 and especially 2011, these investments significantly increased the overall RD&D level of the country. According to Statistics Estonia, in 2011, total spending on RD&D in the public and private sectors rose to 2.41% of GDP, or EUR 384.5 million and nearly two-thirds more than one year earlier (see Table 9). In 2011, the oil industry accounted for one-third of Estonian RD&D expenditure.

Table 9. **Total RD&D expenditure in Estonia, 2009-11 (EUR million)**

	2009	**2010**	**2011**
Non-profit sectors	109.2	116	141.6
Business enterprise sector	88.2	116.8	242.8
Total R&D expenditure	**197.4**	**232.8**	**384.5**
Non-profit sectors	86.6	89.8	109.4
Business enterprise sector	9.7	13	16.5
Government-financed R&D expenditure	**96.4**	**102.8**	**125.9**

Source: Statistics Estonia.

ASSESSMENT

RD&I is one of the government's economic priorities. As a small country, Estonia is rationally relying on trade and foreign investment for technology uptake, but there will always be a role for national RD&D, too. Over the past decade, the country has strengthened its RD&D and innovation system through market-oriented reform and, in recent years, it has enjoyed one of the highest growth rates in gross domestic expenditure on RD&D among the OECD member countries.

The objectives and technological priorities for RD&D are laid out in the Estonian RD&I Strategy 2007-2013 "Knowledge-based Estonia". Under the Strategy, six national programmes are outlined, energy technology being one of them. The Estonian ETP is a co-operation programme involving research, business and the state to develop oil shale technologies and new energy resources, mainly renewable energy.

Estonia has structured its RD&D policy framework in a clear manner. The national RD&I Strategy identifies technology areas for which specific sectoral programmes are adopted, and the programmes, in turn, identify focus areas for RD&D projects.

At the same time, the link between energy policy and energy RD&D is clear and coherent. Energy R&D priorities support the country's overall energy sector objectives in the main areas of oil shale and renewable and other new energy technologies. Wisely, the government has narrowed down the focus to just a few technology areas. This is a rational approach for a country with limited resources. An area where a stronger focus could be considered, however, is efficiency-related RD&D, for example in buildings where a large potential for improvements remains.

The government should maintain coherence between general energy strategy and the energy R&D strategy by focusing research priorities on areas with significant energy resource potential. This is particularly true for oil shale where major restructuring is needed, but has also been initiated. It is positive to note how this need for change is turned into an opportunity to profitably redirect the use of oil shale into oil production.

It is worth noting how the major efforts to respond to the modernising and restructuring challenges in the oil shale sector are founded on domestic RD&D efforts. The restructuring of the oil shale sector in general, and the development of the Enefit280 plant in particular, have heavily relied on domestic RD&D and demonstrated the vision and determination of the country for decarbonising its energy sector. The IEA acknowledges Estonia's concerted efforts in this respect.

In preparing the energy RD&D objectives beyond 2013, the government should seek balance in research by considering the drivers for energy demand, understanding the contribution from a changing energy sector to the economy, and identify opportunities to export Estonian energy expertise.

Developing technologies is becoming increasingly complex, so pooling resources in international activities makes sense, especially for small countries. International collaboration is essential in any R&D project. At present, however, international collaboration efforts in Estonia are fragmented. The country would benefit from a more coherent and strategic approach and should develop a comprehensive strategy for international energy R&D collaboration. It should also maximise its participation in IEA implementing agreements and EU programmes under the Horizon 2020. Bilateral co-operation with countries with similar profiles would be beneficial.

To succeed in the long term, energy research relies on the contributions of dedicated and talented individuals. A common challenge in many countries is the limited interest of students for natural sciences and engineering. Also in Estonia, the energy community should clearly bring this concern to the attention of national education policy makers.

The state-owned Eesti Energia's major focus on oil production from oil shale has, perhaps temporarily but in any case dramatically, boosted total RD&D spending. Estonia's public funding for energy RD&D as a share of GDP compares favourably with the IEA member countries, but as government budgets for RD&D will likely remain constrained, stronger incentives for more private funding, including venture capital, for energy technology development need to be considered. Another source for future funding will be the EU Framework Programme for Research and Innovation 2014-2020 (Horizon 2020). As far as possible, Estonia should work to ensure that energy-related activities receive a fair share of the programme's budget of around EUR 80 billion. Estonia should also try to maximise the use of EU Structural Funds for energy R&D beyond 2013.

RECOMMENDATIONS

The government of Estonia should:

- ☐ *Maintain coherence between general energy strategy and the energy RD&I Strategy by focusing research priorities on areas with significant energy resource potential.*
- ☐ *Seek balance in research by considering the drivers for energy demand, understanding the contribution from a changing energy sector to the economy, and identify opportunities to export Estonian energy expertise.*
- ☐ *Encourage further investment in R&D by the private sector by designing policy instruments to support both existing and emerging low-carbon shale oil technologies.*
- ☐ *Further develop a comprehensive strategy for international energy R&D collaboration.*

PART IV
ANNEXES

ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

Estonia has applied for membership of the IEA and this review is part of the accession process. The main objective of the review team is to present to the Estonian government an assessment of the country's energy policy and to provide relevant recommendations based on the IEA Shared Goals as a basis for developing energy policies that can contribute to sustainable economic development.

The Shared Goals, which were adopted by the IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews conducted by the IEA. The Shared Goals are presented in Annex C.

REVIEW TEAM

The in-depth review team visited Tallinn from 3 December to 7 December 2012. During the visit, the review team met with government officials, stakeholders in the public and private sectors, and other organisations and interest groups, addressing the key challenges of Estonia's energy policy. This report was drafted on the basis of the information obtained in these meetings; the government response to the IEA energy policy questionnaire; and information from other publically available sources. The team is grateful for the co-operation and hospitality of the many people it met during the visit. Thanks to their openness and candour, the review visit was highly productive.

The team wishes to express its gratitude to Mr. Ando Leppiman, Deputy Secretary-General for Energy, Mr. Timo Tatar, Vice-Director of the Energy Department and Mr. Jako Reinaste, Head of the Energy Market Division and his management team, notably Mr. Thor-Sten Vertmann, Ms Reesi-Reena Runnel and Ms Mari Koppel as well as Ms Helle Helena Puusepp, Counsellor at the Estonian Permanent Representation to the Organisation for Economic Co-operation and Development (OECD) for their input and support throughout the review. The IDR team also wishes to thank the Ministry of Environment, the Statistics Estonia and the Estonian Oil Stockpiling Agency for their participation in the review visit and their support throughout the process.

The author is particularly thankful to Ms Reesi-Reena Runnel for her ongoing support throughout the drafting process and to Ms Helle Helena Puusepp for co-ordinating the team visit and for her assistance and guidance throughout the process.

The members of the review team were:

IEA member countries

Mr. Patrick SPECHT, Germany (team leader)

Mr. Jean-Christophe FUEG, Switzerland

Mr. Milosz KARPINSKI, Poland

Mr. Ville NIEMI, Finland

European Commission

Mr. Zoltan DEAK

Consultant

Ms Elena MERLE-BERAL, international energy policy consultant

International Energy Agency

Mr. Robert TROMOP

Mr. Laszlo VARRO

Mr. Kieran MCNAMARA

Ms Thea KHITARISHVILI (desk officer)

Thea Khitarishvili prepared and managed the review and drafted Chapter 2 on General Energy Policy; the Energy Efficiency part of Chapter 4; Chapter 5 on Natural Gas; and the Oil Shale part of Chapter 6. Kieran McNamara drafted Chapter 1, the Executive Summary and Key Recommendations; the District Heating part of Chapter 4; and Chapter 8 on Electricity. Cuauhtemoc Lopez-Bassols drafted the Oil part of Chapter 6. Elena Merle-Beral drafted Chapter 7 on Renewable Energy, and Miika Tommila drafted Chapter 3 on Energy and Climate Change and Chapter 9 on Energy Technology Research, Development and Demonstration. Robert Tromop prepared the policy outline for Chapter 4 on Energy Efficiency and District Heating.

The draft has been reviewed and helpful comments provided by the review team members and IEA colleagues, including Ulrich Benterbusch, Stephen Gallogly, Rebecca Gaghen, Robert Tromop, Laszlo Varro, Doug Cook and Marc-Antoine Eyl-Mazzega.

Sonja Lekovic prepared the publication layout, figures and key energy data and Bertrand Sadin reproduced maps. Karen Treanton and Mieke Reece provided support on statistics. Muriel Custodio, Cheryl Haines, Astrid Dumond and Angela Gosmann managed the editing and production process. Editorial assistance was provided by Viviane Consoli and Anne-Marie Gray, and Sonja Lekovic helped in the final stages of preparation.

ORGANISATIONS VISITED

Ministry of Economic Affairs and Communications (MEAC)

Ministry of Environment

Statistics Estonia

Competition Board

Eesti Eneregia

Eesti Gaas

EG Võrguteenus

Elering (TSO)

Enterprise Estonia (EAS)

Estonian Power and Heat Association

Estonian Oil Association

Estonian Oil Stockpiling Agency (OSPA)

Estonian Renewable Energy Association

The KredEx Fund

Tallinn Power Plant

Tallinn University of Technology

Tartu City Government (transport)

Technical University

Viru Keemia Grupp (VKG)

ANNEX B: ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1990	2000	2008	2009	2010	2011	2012E
TOTAL PRODUCTION		**5.42**	**3.18**	**4.23**	**4.16**	**4.93**	**5.04**	**5.06**
Coal		4.83	2.59	3.41	3.21	3.86	3.98	4.00
Peat		0.39	0.08	0.06	0.08	0.09	0.08	0.04
Oil		-	-	-	-	-	-	-
Natural Gas		-	-	-	-	-	-	-
Biofuels & Waste[1]		0.19	0.51	0.74	0.85	0.96	0.94	0.98
Nuclear		-	-	-	-	-	-	-
Hydro		-	-	0.00	0.00	0.00	0.00	0.00
Wind		-	-	0.01	0.02	0.02	0.03	0.04
Geothermal		-	-	-	-	-	-	-
Solar/Other		-	-	-	-	-	-	-
TOTAL NET IMPORTS[2]		**4.37**	**1.51**	**1.22**	**0.95**	**0.60**	**0.56**	**0.70**
Coal	Exports	0.04	0.04	0.05	0.03	0.04	0.05	0.03
	Imports	0.73	0.33	0.09	0.02	0.05	0.04	0.05
	Net Imports	0.68	0.29	0.03	-0.00	0.01	-0.00	0.02
Oil	Exports	0.01	0.13	0.27	0.37	0.37	0.40	0.45
	Imports	3.29	0.92	1.16	1.18	1.10	1.13	1.06
	Int'l Marine and Aviation Bunkers	-0.21	-0.13	-0.28	-0.25	-0.25	-0.22	-0.14
	Net Imports	3.07	0.66	0.62	0.56	0.48	0.51	0.48
Natural Gas	Exports	-	-	-	-	-	-	-
	Imports	1.22	0.66	0.77	0.53	0.56	0.50	0.55
	Net Imports	1.22	0.66	0.77	0.53	0.56	0.50	0.55
Electricity	Exports	0.73	0.10	0.20	0.25	0.37	0.45	0.43
	Imports	0.13	0.02	0.12	0.26	0.10	0.15	0.23
	Net Imports	-0.60	-0.08	-0.08	0.01	-0.28	-0.31	-0.19
TOTAL STOCK CHANGES		**0.13**	**0.02**	**-0.01**	**-0.35**	**0.04**	**0.00**	**-0.04**
TOTAL SUPPLY (TPES)[3]		**9.91**	**4.72**	**5.44**	**4.75**	**5.57**	**5.60**	**5.72**
Coal		5.75	2.90	3.37	2.93	3.84	3.99	4.01
Peat		0.39	0.07	0.08	0.07	0.08	0.08	0.04
Oil		2.97	0.65	0.66	0.50	0.52	0.51	0.49
Natural Gas		1.22	0.66	0.77	0.53	0.56	0.50	0.55
Biofuels & Waste[1]		0.19	0.51	0.63	0.70	0.82	0.80	0.79
Nuclear		-	-	-	-	-	-	-
Hydro		-	-	0.00	0.00	0.00	0.00	0.00
Wind		-	-	0.01	0.02	0.02	0.03	0.04
Geothermal		-	-	-	-	-	-	-
Solar/Other		-	-	-	-	-	-	-
Electricity Trade[4]		-0.60	-0.08	-0.08	0.01	-0.28	-0.31	-0.19
Shares (%)								
Coal		*58.0*	*61.5*	*61.9*	*61.8*	*68.9*	*71.2*	*70.0*
Peat		*3.9*	*1.5*	*1.4*	*1.4*	*1.5*	*1.3*	*0.6*
Oil		*29.9*	*13.7*	*12.1*	*10.5*	*9.3*	*9.1*	*8.6*
Natural Gas		*12.3*	*14.0*	*14.2*	*11.1*	*10.1*	*9.0*	*9.5*
Biofuels & Waste		*1.9*	*10.9*	*11.6*	*14.7*	*14.7*	*14.2*	*13.9*
Nuclear		-	-	-	-	-	-	-
Hydro		-	-	-	*0.1*	-	*0.1*	*0.1*
Wind		-	-	*0.2*	*0.4*	*0.4*	*0.6*	*0.6*
Geothermal		-	-	-	-	-	-	-
Solar/Other		-	-	-	-	-	-	-
Electricity Trade		*-6.1*	*-1.7*	*-1.5*	*0.1*	*-5.0*	*-5.5*	*-3.4*

0 is negligible, - is nil, .. is not available

Unit: Mtoe

DEMAND							
FINAL CONSUMPTION	**1990**	**2000**	**2008**	**2009**	**2010**	**2011**	**2012E**
TFC	**6.00**	**2.58**	**3.18**	**2.78**	**2.91**	**2.85**	**..**
Coal	0.52	0.15	0.19	0.12	0.10	0.13	..
Peat	0.19	0.00	0.00	-	-	-	..
Oil	1.98	0.79	1.00	0.89	0.93	0.98	..
Natural Gas	0.44	0.28	0.35	0.20	0.21	0.20	..
Biofuels & Waste[1]	0.19	0.43	0.53	0.52	0.55	0.50	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	0.60	0.43	0.60	0.57	0.59	0.57	..
Heat	2.09	0.51	0.51	0.49	0.53	0.48	..
Shares (%)							
Coal	*8.6*	*5.7*	*5.9*	*4.1*	*3.4*	*4.4*	..
Peat	*3.1*	*0.1*	*0.1*	-	-	-	..
Oil	*33.0*	*30.5*	*31.4*	*31.9*	*32.0*	*34.3*	..
Natural Gas	*7.3*	*10.7*	*11.0*	*7.1*	*7.1*	*7.1*	..
Biofuels & Waste	*3.1*	*16.5*	*16.7*	*18.6*	*18.9*	*17.4*	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	*10.0*	*16.6*	*18.9*	*20.6*	*20.4*	*20.0*	..
Heat	*34.7*	*19.8*	*16.0*	*17.8*	*18.2*	*16.7*	..
TOTAL INDUSTRY[5]	**2.80**	**0.75**	**0.92**	**0.59**	**0.61**	**0.65**	**..**
Coal	0.37	0.11	0.17	0.10	0.09	0.11	..
Peat	0.01	0.00	0.00	-	-	-	..
Oil	0.78	0.14	0.11	0.07	0.08	0.10	..
Natural Gas	0.37	0.22	0.26	0.11	0.11	0.11	..
Biofuels & Waste[1]	0.01	0.08	0.12	0.09	0.10	0.11	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	0.25	0.16	0.20	0.17	0.18	0.18	..
Heat	1.02	0.04	0.05	0.04	0.04	0.04	..
Shares (%)							
Coal	*13.1*	*14.9*	*18.8*	*17.8*	*14.1*	*17.4*	..
Peat	*0.2*	*0.3*	*0.3*	-	-	-	..
Oil	*27.7*	*18.0*	*11.5*	*12.5*	*13.6*	*15.4*	..
Natural Gas	*13.3*	*29.4*	*28.3*	*19.0*	*18.6*	*17.5*	..
Biofuels & Waste	*0.2*	*10.5*	*12.9*	*14.7*	*17.0*	*16.8*	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	*9.1*	*20.9*	*22.0*	*28.5*	*29.4*	*27.1*	..
Heat	*36.5*	*5.9*	*5.9*	*7.4*	*7.2*	*5.7*	..
TRANSPORT[3]	**0.81**	**0.56**	**0.79**	**0.71**	**0.75**	**0.75**	**..**
OTHER[6]	**2.39**	**1.27**	**1.48**	**1.48**	**1.55**	**1.45**	**..**
Coal	0.15	0.04	0.02	0.01	0.01	0.01	..
Peat	0.18	0.00	-	-	-	-	..
Oil	0.42	0.10	0.11	0.11	0.10	0.13	..
Natural Gas	0.07	0.06	0.09	0.09	0.09	0.09	..
Biofuels & Waste[1]	0.18	0.35	0.41	0.43	0.45	0.39	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	0.33	0.26	0.40	0.40	0.41	0.39	..
Heat	1.07	0.47	0.46	0.45	0.49	0.44	..
Shares (%)							
Coal	*6.2*	*2.8*	*1.0*	*0.7*	*0.7*	*0.8*	..
Peat	*7.6*	*0.1*	-	-	-	-	..
Oil	*17.4*	*8.1*	*7.6*	*7.2*	*6.6*	*9.1*	..
Natural Gas	*2.8*	*4.3*	*6.0*	*5.8*	*6.0*	*6.2*	..
Biofuels & Waste	*7.6*	*27.2*	*28.0*	*29.0*	*28.8*	*26.8*	..
Geothermal	-	-	-	-	-	-	..
Solar/Other	-	-	-	-	-	-	..
Electricity	*14.0*	*20.8*	*26.7*	*26.9*	*26.4*	*26.9*	..
Heat	*44.5*	*36.8*	*30.7*	*30.4*	*31.5*	*30.2*	..

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1990**	**2000**	**2008**	**2009**	**2010**	**2011**	**2012E**
ELECTRICITY GENERATION[7]							
INPUT (Mtoe)	**6.63**	**2.86**	**3.38**	**2.94**	**3.91**	**4.04**	**..**
OUTPUT (Mtoe)	**1.50**	**0.73**	**0.91**	**0.75**	**1.11**	**1.11**	**1.03**
(TWh gross)	17.39	8.51	10.58	8.78	12.96	12.89	11.97
Output Shares (%)							
Coal	*86.2*	*91.9*	*93.6*	*91.4*	*88.4*	*87.9*	*85.3*
Peat	*-*	*0.2*	*0.1*	*0.7*	*0.9*	*0.7*	*0.8*
Oil	*8.3*	*0.7*	*0.3*	*0.5*	*0.3*	*0.3*	*0.5*
Natural Gas	*5.5*	*7.0*	*4.0*	*1.2*	*2.3*	*1.9*	*1.0*
Biofuels & Waste	*-*	*0.2*	*0.3*	*3.6*	*5.7*	*6.1*	*8.3*
Nuclear	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Hydro	*-*	*0.1*	*0.3*	*0.4*	*0.2*	*0.2*	*0.4*
Wind	*-*	*-*	*1.3*	*2.2*	*2.1*	*2.9*	*3.6*
Geothermal	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Solar/Other	*-*	*-*	*-*	*-*	*-*	*-*	*-*
TOTAL LOSSES	**3.36**	**2.09**	**2.48**	**2.28**	**2.96**	**3.08**	**..**
of w hich:							
Electricity and Heat Generation[8]	2.65	1.48	1.87	1.59	2.18	2.38	..
Other Transformation	0.20	0.22	0.25	0.36	0.42	0.34	..
Ow n Use and Losses	0.51	0.39	0.37	0.33	0.36	0.37	..
Statistical Differences	**0.55**	**0.04**	**-0.23**	**-0.32**	**-0.30**	**-0.33**	**..**
INDICATORS	**1990**	**2000**	**2008**	**2009**	**2010**	**2011**	**2012E**
GDP (billion 2005 USD)	10.13	9.84	15.77	13.55	14.00	15.16	15.65
Population (millions)	1.59	1.37	1.34	1.34	1.34	1.34	1.34
TPES/GDP[9]	0.98	0.48	0.35	0.35	0.40	0.37	0.37
Energy Production/TPES	0.55	0.68	0.78	0.88	0.89	0.90	0.88
Per Capita TPES[10]	6.24	3.44	4.06	3.54	4.16	4.18	4.27
Oil Supply/GDP[9]	0.29	0.07	0.04	0.04	0.04	0.03	0.03
TFC/GDP[9]	0.59	0.26	0.20	0.21	0.21	0.19	..
Per Capita TFC[10]	3.78	1.88	2.37	2.08	2.17	2.13	..
Energy-related CO_2 Emissions (Mt CO_2)[11]	36.1	14.6	17.7	14.7	18.5	19.3	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.7	0.4	0.9	0.8	0.8	0.7	..
GROWTH RATES (% per year)	**90-00**	**00-08**	**08-09**	**09-10**	**10-11**	**11-12**	**90-12**
TPES	-7.2	1.8	-12.7	17.2	0.6	2.1	-2.5
Coal	-6.6	1.9	-13.0	30.9	3.9	0.4	-1.6
Peat	-15.4	0.5	-13.2	24.2	-8.5	-52.0	-10.2
Oil	-14.1	0.2	-24.1	3.2	-1.2	-3.7	-7.8
Natural Gas	-5.9	1.9	-31.8	7.0	-10.5	8.4	-3.6
Biofuels & Waste	10.5	2.7	10.4	17.5	-2.8	-0.4	6.8
Nuclear	-	-	-	-	-	-	-
Hydro	-	-	50.0	-33.3	50.0	33.3	-
Wind	-	-	54.5	41.2	33.3	15.6	-
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	-	-	-
TFC	-8.1	2.7	-12.7	4.6	-2.1	..	..
Electricity Consumption	-3.3	4.3	-5.0	3.8	-4.0	..	..
Energy Production	-5.2	3.6	-1.6	18.6	2.2	0.4	-0.3
Net Oil Imports	-14.2	-0.9	-9.6	-13.1	6.4	-6.0	-8.1
GDP	-0.3	6.1	-14.1	3.3	8.3	3.2	2.0
Grow th in the TPES/GDP Ratio	-6.9	-4.0	1.4	13.7	-7.0	-1.1	-4.4
Grow th in the TFC/GDP Ratio	-7.8	-3.2	1.5	1.5	-9.6	..	..

Footnotes to energy balances and key statistical data

1. Biofuels and waste comprises solid biofuels and biogases. Data are often based on partial surveys and may not be comparable between countries.
2. In addition to coal, oil, natural gas and electricity, total net imports also include peat, biofuels and waste.
3. Excludes international marine bunkers and international aviation bunkers.
4. Total supply of electricity represents net trade. A negative number in the share of total primary energy supply indicates that exports are greater than imports.
5. Industry includes non-energy use.
6. Other includes residential, commercial, public services, agriculture, forestry, fishing and other non-specified.
7. Inputs to electricity generation include inputs to electricity, combined heat and power, and heat plants. Output refers only to electricity generation.
8. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 100% for hydro and wind.
9. Tonnes of oil-equivalent (toe) per thousand US dollars at 2005 prices and exchange rates.
10. Toe per person.
11. "Energy-related CO_2 emissions" have been estimated using the Intergovernmental Panel of Climate Change (IPCC) Tier I Sectoral Approach from the Revised 1996 IPCC Guidelines. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2010 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/ Organisation for Economic Co-operation and Development (OECD) emission factors and methodology.

ANNEX C: INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The member countries* of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants. In order to secure their objectives, member countries therefore aim to create a policy framework consistent with the following goals:

1. **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. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the agency in responding jointly to oil supply emergencies.

3. The environmentally sustainable provision and use of energy are central to the achievement of these Shared Goals. Decision makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should respect the Polluter Pays Principle where practicable.

4. More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. Improved energy efficiency can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. Undistorted energy prices enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. Free and open trade and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. Co-operation among all energy market participants helps to improve information and understanding, and encourages the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at the meeting of 4 June 1993 Paris, France.)

*Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

ANNEX D: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations and acronyms are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention, this glossary provides a quick and central reference for many of the abbreviations used.

AAU	assigned amount unit
AC	alternating current
ACER	Agency for the Co-operation of Energy Regulators
AST	Augstsprieguma Tīkls
b/d	barrels per day
bcm	billion cubic metres
bcm/yr	billion cubic metres per year
BEMIP	Baltic Energy Market Interconnection Plan
CFBC	circulating fluidised-bed combustion
CH_4	methane
CHP	combined heat and power
CO_2	carbon dioxide
CO_2-eq	carbon dioxide-equivalent
DC	direct current
DH	district heating
DHA	District Heating Act
DSO	distribution system operator
EEPR	European Energy Programme for Recovery
ENTSO-E	European Network of Transmission System Operators for Electricity
ERDF	European Regional Development Fund
ETP	Energy Technology Programme
ETS	Emissions Trading Scheme
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
EUR/kWh	euros per kilowatt hour
EUR/MWh	euros per megawatt hour

g CO_2	gram of carbon dioxide
g CO_2/km	gram of carbon dioxide per kilometre
g CO_2/kWh	gram of carbon dioxide per kilowatt hour
GDP	gross domestic product
GHG	greenhouse gas
GIPL	gas interconnector Poland-Lithuania
GIS	Green Investment Scheme
GMS	gas metering station
GW	gigawatt, or 1 watt x 10^9
GWh	gigawatt hour, or 1 gigawatt x 1 hour
GWh/d	gigawatt hours per day
GWh/yr	gigawatt hours per year
HVDC	high-voltage direct current
ICT	information and communications technology
IEA	International Energy Agency
IET	International Emissions Trading
IPCC	Intergovernmental Panel on Climate Change
IRL	Pro Patria - Res Publica Union
JI	joint implementation (projects under the Kyoto Protocol)
kb/d	thousand barrels per day
KIK	Environmental Investment Centre
kJ	kilojoule
km	kilometre
km^2	square kilometre
KredEx Fund	Credit and Export Guarantee Fund
kt	kilotonne, or 1 000 tonnes
kV	kilovolt
kWh	kilowatt hour, or 1 kilowatt (1 watt x 10^3) x 1 hour
kWh/m^2/yr	kilowatt hours per square metre per year
kWh_{heat}/m^2/yr	kilowatt hours of heat per square metre per year
L	litre
LNG	liquefied natural gas
LULUCF	land use, land-use change and forestry
mb	million barrels

mcm	million cubic metres
mcm/d	million cubic metres per day
MEAC	(Estonian) Ministry of Economic Affairs and Communications
MEPS	minimum energy performance standards
MJ/kg	megajoules per kilogram
MOP	maximum operating pressure
Mt	million tonnes
Mt CO_2-eq	million tonnes of carbon dioxide-equivalent
Mt/yr	million tonnes per year
Mtoe	million tonnes of oil-equivalent
MW	megawatt, or 1 watt x 10^6
MWh	megawatt hour, or 1 megawatt x 1 hour
NAP	National Allocation Plan
NEEAP	National Energy Efficiency Action Plan
NEFCO	Nordic Environment Finance Corporation
NESO	National Emergency Strategy Organisation
N_2O	nitrous oxide
NO_X	nitrogen oxides
NPS	Nord Pool Spot
NREAP	National Renewable Energy Action Plan
OECD	Organisation for Economic Co-operation and Development
OSPA	(Estonian) Oil Stockpiling Agency
PJ	petajoule
PPP	purchasing power parity: the rate of currency conversion that equates the purchasing power of different currencies, *i.e.* PPP estimates the differences in price levels between countries
Q	installed capacity
R&D	research and development
RD&D	research, development and demonstration
RD&I	research, development and innovation
SET	Strategic Energy Technology (European Union)
SME	small and medium-sized enterprise
SO_2	sulphur dioxide
SWH	solar water heating

t	tonne
toe	tonne of oil-equivalent
TFC	total final consumption of energy
TPES	total primary energy supply
TSO	transmission system operator
TWh	terawatt hour, or 1 terawatt (1 watt x 10^{12}) x 1 hour
TYNDP	Ten-Year Network Development Plan
UCTE	Union for the Co-ordination of Transmission of Electricity
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value-added tax
VKG	Viru Keemia Grupp
yr	year

IEA Publications
9, rue de la Fédération, 75739 Paris cedex 15

Printed in France by Sorégraph, September 2013
Cover design: IEA.

(612013041P1) ISBN: 9789264190795; ISSN: 2307-0897