INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

Austria 2002 Review

OECD

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

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

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

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

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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

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

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

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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The two most important developments in the Austrian energy sector since the last IEA in-depth review are the liberalisation of the electricity and natural gas markets, and the current and planned measures to meet emissions reduction targets under the Kyoto Protocol. Austria's commendable liberalisation in advance of European Union deadlines has lowered prices for larger customers but has had less of an impact for residences. Austria should extend liberalisation's benefits to all customer classes, particularly through lowering network tariffs and monitoring excessive market concentration.Austria's commitment under the Kyoto Protocol (13% reduction below 1990 levels) poses challenges, although the completion in 2002 of a comprehensive climate strategy is a clear step in the right direction. Immediate implementation of the measures included therein will help minimise the expense of emissions reduction. Emissions forecasts and their related macroeconomic projections should be revisited, especially as experience is gained in this area. In addition, international flexible mechanisms should be more fully incorporated into the core climate change strategy. The country continues to operate without significant energy supply security concerns, aided substantially in this by its extensive international energy trade.

Austria lies at the geographical heart of Europe. It is entirely landlocked with 2 562 km of borders shared with eight other countries. The Austrian government is a federal system with nine different Länder (or states), with responsibilities on energy policy shared between the federal and the Länder governments. The country has substantial hydropower resources which it has tapped to provide approximately 70% of its electricity needs. Austria also has domestic oil and natural gas resources, providing 9% and 23% of the country's demand for these fuels respectively. Oil and gas production from these domestic fields has declined over the last 20 years and is expected to decrease further as the fields become depleted.

Austria engages in substantial international energy trade. While it has energy exports, it is a net importer, importing approximately 65% of its total primary energy supply (TPES) in 2000. The country imports over 90% of its crude oil needs, nearly 60% of its diesel fuel and close to 80% of its natural gas needs. Austria is a net exporter of electricity but trade balances vary seasonally as Austria's hydropower capability fluctuates throughout the year. This international trade offers the lowest-cost solution to meeting the country's energy needs as well as a viable means of enhancing energy security and revenue opportunities for the Austrian economy. Such trade will continue and should be encouraged as liberalisation in the region spreads and the EU enlarges by accepting neighbouring countries.

Austria faces no significant energy supply security problems. While its large import shares of oil, gas and (seasonally) electricity warrant continued monitoring of this issue, a number of factors combine to protect the country against energy shortfalls. These factors include a long history of uninterrupted imports from producing countries and the significant transmission/transportation capabilities between Austria and these producing countries. Austria has also taken steps domestically to ensure supply security, including the development of large gas storage capabilities, comprehensive emergency response measures for oil and a sizeable reserve margin capacity for electricity. The electricity regulator has the mandate to monitor electricity supply security, and forecasts sufficient capacity to meet demand for the next five to seven years.

Over the last several years, Austria has worked to liberalise its electricity and natural gas sectors. On 1 October 2001, all electricity customers were given the right to choose their supplier and on 1 October 2002, all natural gas customers were extended the same right. These market openings are well in advance of EU directives on the subject, making Austria the fifth EU country to offer supplier choice to all electricity customers and the third EU country to offer supplier choice to all natural gas customers.

Austria completed the liberalisation of its electricity sector through an amendment to the Electricity Industry and Organisation Act (EIWOG 2000). This law gave all customers the right to choose their supplier, created regulated TPA (third-party access) to the networks, established an independent electricity regulator (the E-Control Commission), and required utilities to separate their accounts into generation, transmission, distribution and retailing activities. The results of this liberalisation have been mixed and vary by customer class. While larger consumers have enjoyed reduced power prices, smaller customers have seen little or no change to their overall bills[1]. Less than 1% of residential customers have switched suppliers while 20% of larger consumers have done so. One impediment to residential supplier switching is the high distribution charges found in Austria. Access charges to the Austrian system, which account for approximately 35% of the average residential bill, are between 60% and 70% higher than the average of other European countries. High access charges can imply cross-subsidisation, in which companies overcharge for their regulated activities and use the excess revenues to subsidise competitive activities. While system access charges have already begun to fall since the market liberalisation, the regulator would like to realise further reduction of between 20% and 30% in coming years. This initiative is commendable and, if such efforts do not succeed in lowering access charges, Austria should consider more complete unbundling than the account unbundling currently in place.

The Austrian Gas Act opened 50% of the natural gas market (by volume) in August 2000, the date at which all gas generators and consumers with an annual consumption of over 25 million cubic metres (mcm) were given the right to choose suppliers. From October 2002, all consumers were given supplier choice. While negotiated TPA was initially used, this was switched to regulated TPA from October 2002. Austria will also establish an independent regulator by expanding the authority of the E-Control Commission. Although these commendable developments

1. The approximately 10% reduction in residential bills has been offset by a tax increase of roughly the same amount that was prompted by budgetary reasons.

establish a solid framework for a successful liberalised gas sector, certain aspects of the market still threaten to undermine the success of this process. A study commissioned by the EU Directorate-General for Transport and Energy provides some insight into the market functioning thus far. While the study lauded the transparent TPA access conditions and the unbundling of the main incumbents, it also found that only one non-incumbent gas company is competing effectively in Austria and that customer switch rates were quite low. Difficulties in accessing network pipelines and long-term take-or-pay contracts were cited as factors for the limited activity in the liberalised market. The regulator should address disputes related to network access and the government should act to increase the liquidity of natural gas in the market by examining the effects that long-term gas contracts have on supply diversity and competition.

The role of Austrian utilities in the liberalised Central European energy electricity and gas market is evolving. While significant ownership stakes in these companies have been privatised in recent years, Austrian law still requires that government (at either the federal or the Land level) maintain majority ownership of the major energy utilities. In response to competition brought about by liberalisation, a number of incumbent Austrian utilities are forming alliances with one another. Such alliances can bring internal cost savings and help defer hostile take-overs by foreign firms, but they also reduce the number of competing companies. Austria introduced new regulations addressing market power which the Cartel Court will use to assess the market dominance of these allied Austrian companies. This is a positive step towards inhibiting any potential market power concerns that could stifle true competition.

Austria's most important energy-related environmental issue is its commitment to the Kyoto Protocol, which was ratified by the Parliament in March 2002. Under the EU's burden-sharing system, Austria has agreed to reduce its greenhouse gas (GHG) emissions by 13% below 1990 levels by the time of the first commitment period, 2008-2012. In order to help formulate a policy to reach this target, the federal government has commissioned a study which projects GHG emissions forecasts running through the year 2020. This study, Energy Scenarios up to 2020 (*Energieszenarien bis 2020*), was conducted by the Austrian Institute for Economic Research (WIFO) on behalf of the Federal Ministry of Economic Affairs and Labour, and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The forecast reached the surprising conclusion that greater emissions reductions would result in improved macroeconomic conditions. As Austria gains experience in reducing emissions, it should revisit its forecasts in order to assess the validity of this conclusion and, if necessary, adapt its climate change strategy accordingly in order to reduce costs across the economy.

Austria has recently finalised the *Klimastrategie*, a comprehensive plan which outlines measures to reduce GHG emissions so as to reach its Kyoto target. The plan was passed by the government on 18 June 2002. The climate change strategy included therein was developed with the participation of the federal and Länder governments, as well as in consultation with the private sector. Emissions reduction measures were placed into six different categories, with space heating and transport measures accounting for more than one-half of the total projected emissions cuts. Kyoto flexible mechanisms (Joint Implementation, Clean Development Mechanisms and international emissions trading) have been incorporated into selected areas of the *Klimastrategie* and are expected to yield emissions reductions of 3 Mt of CO_2-equivalent by the time of the first Kyoto commitment period, 2008-2012. Many of the plans for flexible mechanisms involve new initiatives which will help establish the proper frameworks for such activities. As experience is gained with flexible mechanisms, Austria could look more closely at the costs and benefits those options offer, and refine its plans accordingly. In the meantime, Austria should proceed as quickly as possible to implement the most cost-effective measures included in the *Klimastrategie*.

Austrian energy intensity (as measured by TPES over the country's GDP) is below the average for IEA European countries. This is due in part to low energy intensity in the transport sector (resulting largely from a high share of diesel-fuelled vehicles in the Austrian fleet), an economy dominated by services rather than large energy-intensive industry, and efforts to reduce public energy use such as street lighting[2]. In April 2002, the government published the Austrian Strategy for Sustainable Development (*Die Österreichische Strategie zur Nachhaltigen Entwicklung*) which establishes the goal of reducing national energy intensity at a rate of 1% per year beyond the average energy intensity improvements seen in the EU from 1990 to 1997. This is a commendable but challenging goal to achieve. Ensuring co-ordination between the many diverse energy efficiency measures and institutions already in place would allow Austria to most effectively make progress towards this target. Effective monitoring of policy performance is also essential.

Austria makes substantial use of district heating (DH) and combined heat and power (CHP) plants. Such facilities provide 12% of the country's heating and 27% of its electricity. These plants are supported by regulations requiring local utilities to pay above-market rates for electricity coming from such plants. While CHP does have impressive energy efficiency qualities, many of the Austrian CHP systems operate at relatively high costs. Faced with termination of the current subsidy system at the end of 2004, Austria needs now to debate the possibilities for other forms of support. These should include a gradual lowering of support levels and use of a benchmarking system involving minimum efficiency standards as ways of maximising CHP contributions to meeting environmental goals in a cost-effective way.

Austria makes substantial use of renewable resources in the form of large hydropower and biomass which in 2000 provided 12.6% and 10.9% of the country's TPES, respectively. Small hydropower facilities (<10 MW) provided 1.3% of the country's TPES while other renewable energy technologies (solar, wind, geothermal, biomass electricity generation and landfill gas generation) accounted for less than 0.5% combined. Small renewable energy technologies (i.e., excluding large hydropower and biomass) benefit from two separate support schemes. One scheme requires that electricity suppliers source a minimum percentage of their electricity from renewable energy technologies. Suppliers must get 8% of their

2. The low energy intensity is also due to the statistical treatment of Austria's substantial hydropower.

power from small hydro facilities (<10 MW) and 1% (increasing to 4% by 2007) from other renewable energy technologies. The second support scheme is the feed-in tariff system. Utilities are obliged to purchase power from selected renewable energy technologies at above-market tariffs which are determined by the government. These tariffs were originally set by each individual Land, but legislation passed in July 2002 transferred this responsibility to the federal government so that now the feed-in tariffs can be made consistent across the country. This move will allow renewable resources to be used more efficiently around the country, providing the same level of renewable generation at lower overall cost. Austria could further lower costs by introducing a degression scheme into the feed-in tariffs whereby prices are gradually lowered to provide an incentive for producers to improve efficiency. The renewables policy should be regularly revisited.

RECOMMENDATIONS

The Government of Austria should:

Energy Market and Energy Policy

- ☐ Continue with the liberalisation of the electricity and natural gas sectors.

- ☐ Further clarify energy policy objectives in the context of market liberalisation, ensuring that policy tools fit the new policy environment.

- ☐ Continue the national debate between the desire for large Austrian utilities able to fend off hostile take-overs by foreign companies and the market concentration issues that such utilities raise.

- ☐ Review energy tax policies to prevent possible market distortion and send the right signals to consumers, taking into account the tax harmonisation efforts at the EU level.

Energy and the Environment

- ☐ Conduct regular monitoring of the implementation and actual emissions reductions of the proposed *Klimastrategie* measures under close co-ordination between relevant ministries and between the public and private sectors.

- ☐ Review the GHG emissions forecasts used as the basis for the development of climate change policy.

- ☐ Revisit the cost-effectiveness of various *Klimastrategie* policies as cost experience is gained through their implementation.

- Examine the transport sector to ensure its optimal contribution to overall GHG emissions reduction strategy.

- Ensure an appropriate mix of domestic policies and flexible mechanisms with a view towards minimising the economic cost of climate change mitigation policies for the whole economy.

Energy Efficiency

- Further improve co-ordination among the many bodies and programmes which address energy efficiency in the country.

- Institute an effective monitoring scheme for government-sponsored energy efficiency programmes to measure their efficacy in order to both improve them and ascertain their cost-effectiveness.

- Review the support scheme for CHP plants, including its continuation after 2004. Maximise CHP's cost-effective contribution to meeting environmental goals through such measures as a gradual lowering of the support levels in accordance with a benchmarking system which includes minimum efficiency standards.

Renewable Energy

- Explore the most cost-effective measures to achieve the country's targets for contributions from renewable resources.

- Explore the introduction of a degression scheme for the feed-in tariffs which lowers prices to consumers, encourages producers to reduce costs and provides investors with a measure of predictability for their revenue streams.

- Create a procedure by which renewable energy policies can be regularly revisited. This can be done as the costs of the minimum renewables percentage requirements become clearer.

- Weigh the current costs of renewable energy technologies against their respective long-term potentials when deciding the level of support each will receive.

- Ensure that electricity source labelling requirements provide customers with reliable information on the sources and costs of electricity generation options offered by different suppliers.

Oil

- Monitor OMV's (the largest domestic oil company) self-imposed price limitation on retail sales to ensure that it in no way impedes the current high level of retail competition by either distorting market prices or discouraging new entrants.

Natural Gas

- Ensure that non-discriminatory TPA is provided to the entire pipeline system and, if necessary, consider requiring the legal unbundling of all pipeline owners or the divestiture of assets to achieve this goal.

- Assess whether the development of large supply groups overly concentrates market power and, if necessary, consider laws for the Cartel Court to address such market concentration.

- Assess the impact of distribution tariffs on effective competition in the gas market and review which costs should be recovered through clear, transparent access charges which accurately reflect costs.

- Facilitate access to different sources of supply by promoting liquidity in the market; consider the role a gas-trading hub at Baumgarten could play in increasing supply liquidity.

Electricity

- Monitor and evaluate the performance of the full liberalisation, particularly the way in which price reductions are spread across customer classes.

- Continue to lower system access charges.

- Maintain the independence of the electricity regulator.

- Consider the option of further unbundling, if account unbundling has not ensured transparency, as well as the accurate reflection of costs in the pricing of the network services.

- Investigate the consolidation of the numerous distribution operators.

- Pay special attention to the issue of market power, particularly the definition of the relevant market in making any assessments.

Energy Research and Development

- Further clarify the objectives the R&D programmes are designed to meet in order to accomplish particular energy and environmental policy objectives and allocate resources appropriately, based on the national goal of expanded R&D expenditures.

- Enhance monitoring of progress in reaching the energy-related R&D goals Austria has established.

- Review energy R&D priorities in order to maximise the cost-effectiveness of finite government R&D expenditures in relation to mid- to long-term objectives in the energy sector.

ORGANISATION OF THE REVIEW

REVIEW TEAM

The 2002 IEA in-depth review of the energy policies of Austria was undertaken by a team of energy specialists drawn from the Member countries of the IEA. The team visited Austria from 15 to 19 April 2002 to meet with government officials, energy suppliers, and energy consumers. This report was drafted on the basis of those meetings and the government's official response to the IEA's 2001 policy questionnaire. The team greatly appreciated the openness and co-operation shown by everyone it met.

The members of the team were:

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Jonathan Coony managed the review and drafted the report. Monica Petit and Bertrand Sadin prepared the figures.

The team held discussions with the following:

- Federal Ministry of Economic Affairs and Labour
- Federal Ministry of Agriculture, Forestry, Environment and Water Management
- Federal Ministry of Transport, Innovation and Technology
- Federal Ministry of Finance
- Federal Chancellery
- Liaison Office of the Länder
- Austrian Institute for Economic Research
- Federal Chamber of Labour
- Federation of Trade Unions
- Association of Austrian Petroleum Industries
- Association of Gas and District Heating Utilities
- Austrian Ferngas
- Association of Austrian Electricity Utilities
- Verbundgesellschaft
- Austrian Energy Consumers Association
- Austrian Energy Agency
- OMV AG
- E-Control Ltd
- E-Control Commission
- Fernwärme Wien
- Federal Chamber of Commerce
- Federation of Austrian Industrialists
- Standing Committee of the Presidents of the Austrian Chambers of Agriculture

The assistance and co-operation of all participants in the review are gratefully acknowledged.

REVIEW CRITERIA

The *Shared Goals* of the IEA, which were adopted by the IEA Ministers at their 4 June 1993 meeting, held in Paris, provide the evaluation criteria for the in-depth reviews conducted by the Agency. The *Shared Goals* are set out in Annex B.

3

ENERGY MARKET AND ENERGY POLICY

COUNTRY OVERVIEW

The Republic of Austria is a federal country comprising nine Länder (states). It has a total area of 83 850 km^2 with a population of 8.15 million (June 2001 estimate). The GDP per capita in the year 2000 was approximately $25 000 (based on purchasing power parity).

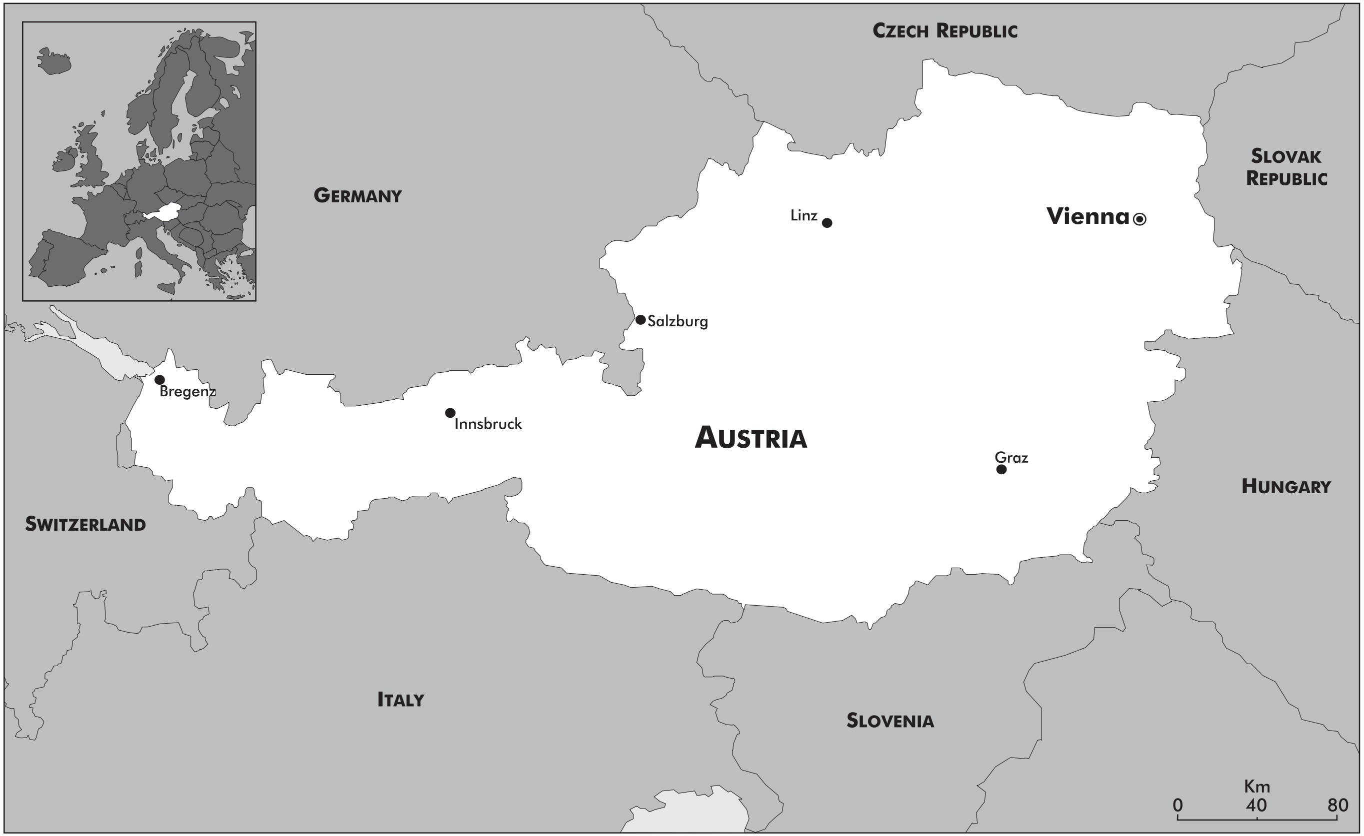
Austria is located at the crossroads of Central Europe. It is entirely landlocked and shares 2 562 km of boundaries with eight different countries. The energy situations of these bordering countries vary considerably. Some, such as Germany, have proceeded with liberalisation of their gas and electricity markets, while others, such as Slovenia, still operate under more traditionally regulated systems. Austria makes use of its extensive border with such diverse neighbours to engage in substantial energy trading, both in fossil fuels and electricity. The ongoing energy policy developments in some of the larger bordering countries such as Germany and Italy can influence the energy sector within Austria itself.

Austria is a tremendously diverse country. For one thing, its geography varies widely across the country. Almost two-thirds of Austria's territory are alpine regions, mostly concentrated in the west and the south. These areas see substantial annual rainfall of more than 1 000 mm per year. These mountainous regions have a relatively low population density. The eastern and northern sections, by contrast, are mostly flat or gently sloping plains. These areas include the nation's largest cities and the majority of its industry. This diversity of terrain means Austria's substantial hydropower is disproportionately spread, with the majority located in the mountains. Lower population densities there make customer grid access (for natural gas or electricity) more costly. By contrast, industry and urban clusters concentrate energy use in the east. As a result of these variations across the country, the Länder sometimes have different priorities when pursuing energy policy objectives.

Forests cover approximately 45% of the country, providing a sizeable store of the biomass resources on which the country relies. The River Danube flows from Germany, through Austria and into Slovakia before ending in the Black Sea. It plays an important role in both the Austrian transport industry and as a source for hydroelectricity. Austria has both cold winters and warm summers, providing seasonal variations in both the energy demand and the power supply from the large share of hydroelectric plants in the country.

Austria has a well-developed market economy and a standard of living in line with EU norms. Since the mid-1990s, economic growth in the country has been roughly in line with the EU average. The GDP is driven primarily by services (67.4%) and industry (30.4%), with the remaining contribution coming from agriculture (2.2%). Agriculture's decline as a contributor to the economy has resulted in a decrease in its overall energy use.

Figure 1
Map of Austria



Source: IEA.

Austria joined the EU in 1995. In 1999, it adopted the euro (€) replacing the previous currency at a fixed exchange rate of 13.7603 Austrian Schillings per euro (In 2001, US$ 1 = Sch 15.37 or € 1.117). The Austrian economy is operating in line with international business cycles. Economic activity improved in 1999 from previous years and further strengthened in 2000 with growth of 3.0% for the year. Following international trends, economic growth declined in 2001.

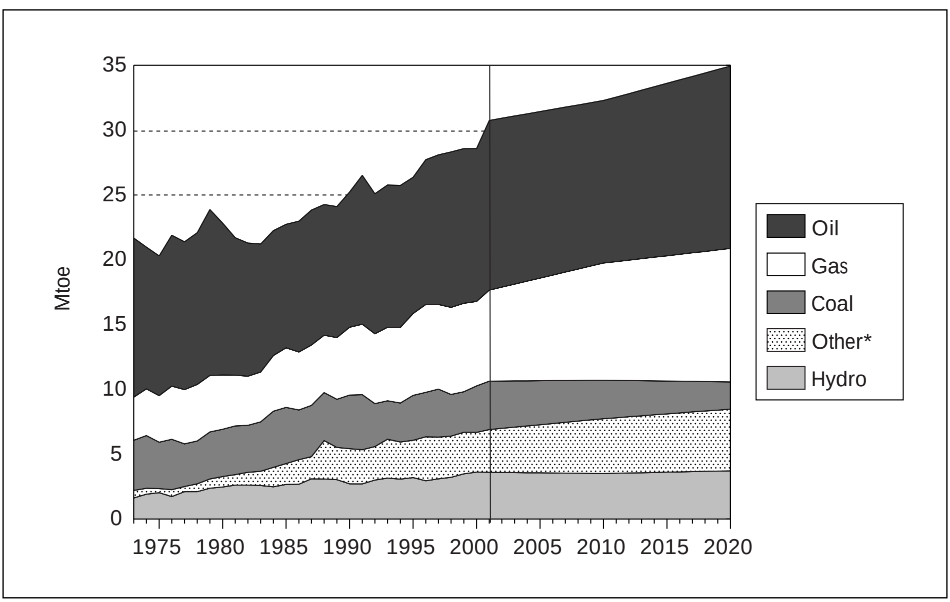
ENERGY MARKET

Primary Energy Supply

In 2000, total primary energy supply (TPES) in Austria was 28.6 Mtoe. This indicates a total increase of just 3.1% from four years earlier, or 0.8% annually. This rate of TPES growth since the last IEA in-depth review is lower than the long-term rate of TPES growth seen from 1973 to 2000, which averaged 1.1% per annum. At the same time that the recent TPES growth rate has slowed, national GDP growth has slightly accelerated. From 1997 to 2000, GDP rose at an average annual rate of 2.6% which is above the long-term annual GDP growth rate of 2.4% seen from 1974 to 2000. This growth of GDP with moderate TPES growth has accelerated the decrease in Austrian energy intensity.

Figure 2

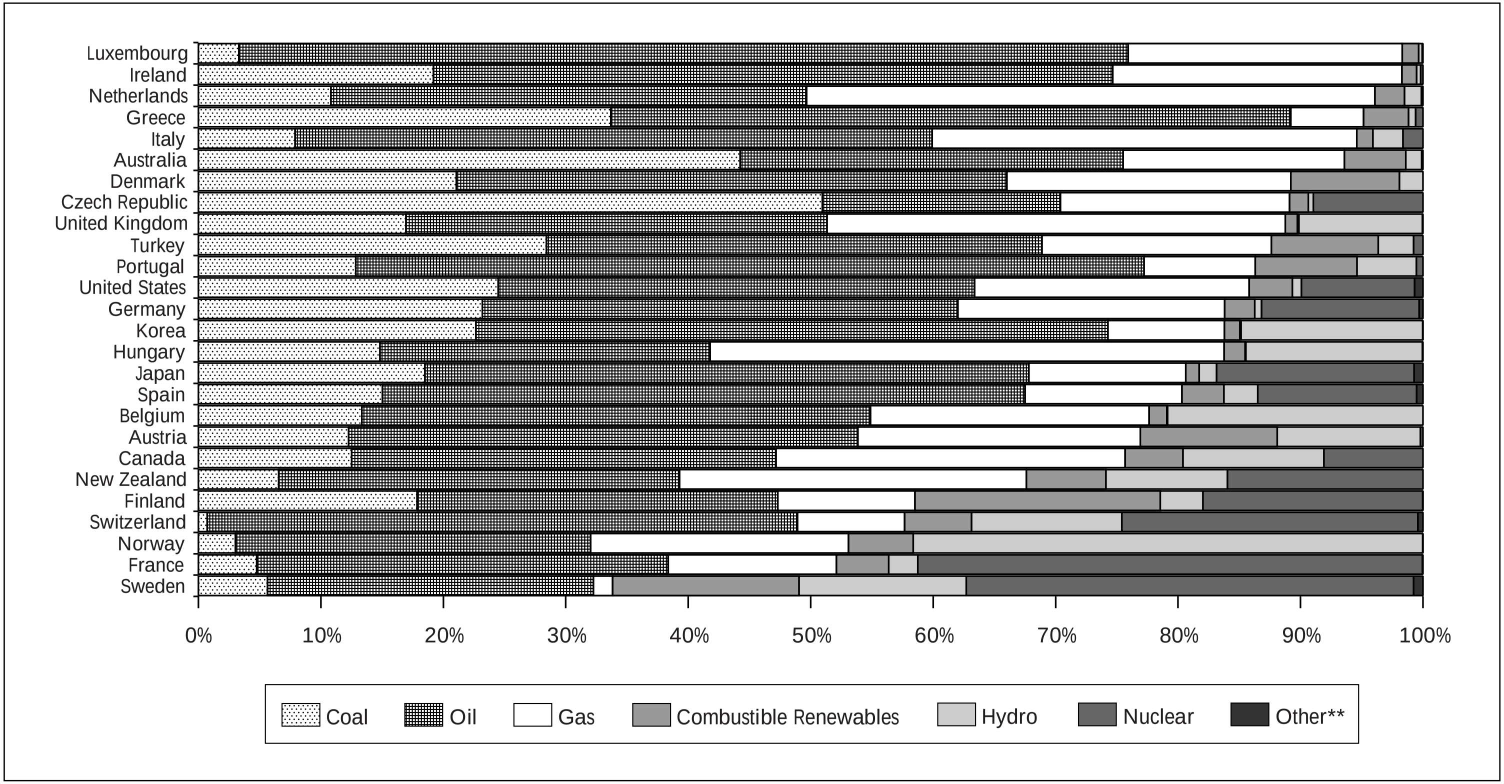
Total Primary Energy Supply, 1973 to 2020



* includes geothermal, solar, wind, combustible renewables and waste, and electricity trade.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

Figure 3
Total Primary Energy Supply in IEA Countries, 2001*



* preliminary data.
** includes solar, wind and ambient heat production.

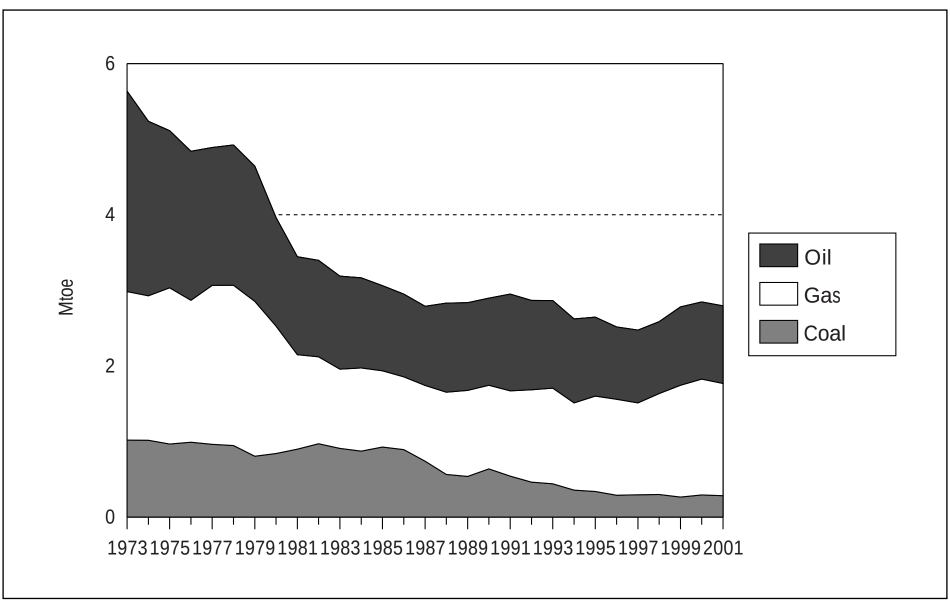
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Oil has been the predominant energy source in Austria for a number of years, accounting for 41.3% of the country's TPES in 2000. While oil's share of TPES has decreased significantly from 1973 when it was 56.7% of the total, it has shown essentially no change since 1997 when it was 41.1%. Hydroelectric power has increased its share of TPES from 11.0% in 1997 to 12.6% in 2000. This came at the expense of coal, natural gas and biomass whose contributions fell over the same period. This increase in hydropower's share of TPES does not represent the addition of hydropower capacity but, rather, increased generation from existing plants as a result of above-average snow and rainfall over that period. Changes in the percentage shares of TPES by source on the order of those seen over the last several years can occur because of meteorological conditions, even in the absence of explicit changes in energy policy.

The share of natural gas in TPES has fallen slightly in recent years, from 23.3% in 1997 to 22.8% in 2000. This decrease is inconsistent with the long-term increase in gas use, which in 1973 accounted for only 15.3% of national TPES. Much of this long-term increase has come at the expense of oil and coal which, combined, have lost nearly 20% of their share of TPES. These changes have largely come as a result of the greater availability and lower price of imported natural gas. Gas is expected to continue increasing its share of TPES in the coming years.

Figure 4

Indigenous Fossil Fuel Production, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Indigenous resources are dominated by hydropower and biomass, which in 2000 contributed 3.6 Mtoe and 3.2 Mtoe to the TPES, respectively. Hydropower production has increased substantially since 1973 rising by 3.3% annually. This trend has accelerated in recent years with annual growth of 5.3% from 1997 to 2000[3]. Biomass production has also increased dramatically, growing by 6.5% annually since 1973, even though production levels have fallen slightly from 1997 to 2000.

Austria also has indigenous fossil fuel resources. In 2000 the country produced 1.0 Mtoe of oil, the same level as in 1997. As part of a long-term trend, however, domestic oil production has fallen from 1973 when 2.7 Mtoe were extracted from Austrian oil fields. Domestic natural gas production in 2000 was 1.5 Mtoe, a 26% increase from 1997 when the production level was 1.2 Mtoe. As part of the long-term trend, natural gas production has fallen although not as significantly as oil production. The all-time high domestic production of gas occurred in 1978 when the country produced 2.1 Mtoe. The domestic production of both natural gas and oil is expected to decline in the future as the country's fields become further depleted.

Final Energy Consumption

In 2000, Austria's total final consumption (TFC) was 24.8 Mtoe. The growth rate of TFC over the last four years has been consistent with the growth rate over the last thirty years at roughly 1.5% per annum. This trend is below the GDP growth rates of the last four years (approximately 2.6% annually) but above the rate of growth in TPES of 0.8%. TFC's growth at a rate nearly twice that of TPES is consistent with the country's decrease in overall energy intensity.

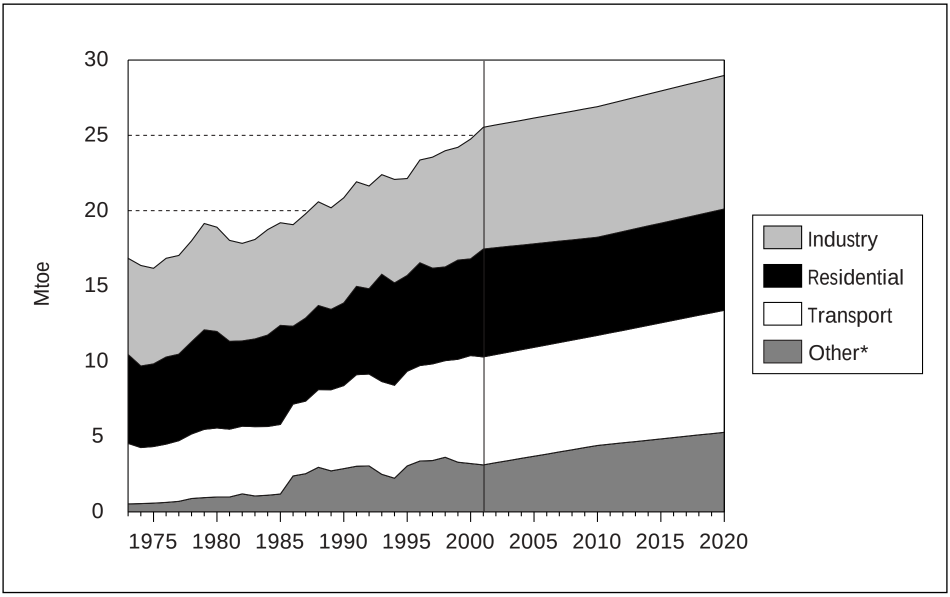
In the year 2000, industry consumed 32.1% of Austria's final energy consumption. This is down from a high of 40.8% in 1974. Transport has seen a slight rise in the share of TFC over the last four years, going from 27.3% in 1997 to 29.0% in 2000.

Energy Trade

Austria imported 18.7 Mtoe of energy in 2000, accounting for 65.3% of its TPES. This import percentage has remained nearly the same since 1973 when it was 64.5%. In the last four years, however, the percentage of TPES met via imports has fallen: in 1997 it was 67.2% while in 1998 it was 69.2%. The fall in the import share to 65.3% in 2000 is attributable to both greater hydropower production as a result of above-average rainfall and increased domestic production of natural gas.

3. As mentioned previously, much of this recent increase is a result of meteorological conditions.

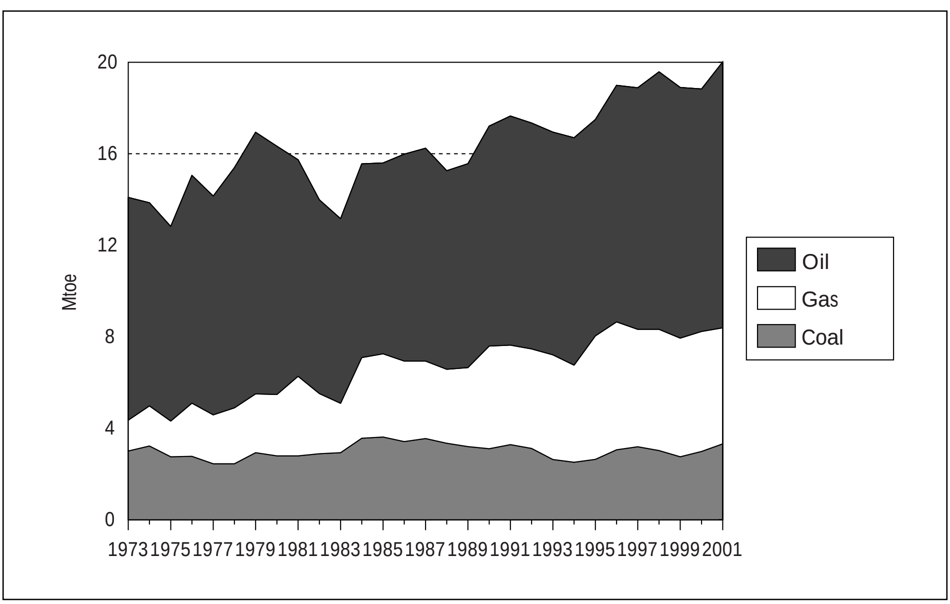
Figure 5
Total Final Consumption by Sector, 1973 to 2020



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

Figure 6
Fossil Fuel Imports, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

The majority of Austria's net energy imports come in the form of oil and natural gas. The import shares of these two fuels have both risen considerably since 1973. In 1973 Austria imported 79% of the oil it consumed and in 2000, it imported 90%. The rise in import share was even more pronounced with natural gas. In 1973, Austria imported only 41% of its gas demand, while in 2000, that figure was 81%. While these import shares have fallen since the last IEA in-depth review in 1997, the long-term trend of increased reliance on imports is expected to continue as domestic fossil fuel resources become depleted.

While Austria is a net exporter of electricity on an annual basis, the country also imports significant amounts of electricity, especially during the winter months when the hydroelectric stations do not operate at full capacity. In 2000, Austria imported 26.4% of the total electricity consumed, up from 12.9% in 1973 and a low of 8.2% in 1977.

Energy-related Emissions

According to the "Burden Sharing Agreement" among EU countries, Austria is committed to reducing GHG emissions by 13% below 1990 levels by the first Kyoto Protocol commitment period, 2008-2012. In Austria, CO_2 accounts for 83% of the country's total GHG gases and the majority of these CO_2 emissions are energy-related. In 2000, Austria emitted 60.3 Mt[4] of CO_2, up 9% from 1990 levels. In order to meet its Kyoto target, Austria must reduce annual CO_2 emissions by approximately 12 Mt (20%) from 2000 levels.

The country recently commissioned a study which forecast CO_2 emissions under three different scenarios. This study, entitled *Energieszenarien bis 2020* – "Energy Scenarios up to 2020" – was conducted by the Austrian Institute for Economic Research (WIFO) and completed in the fall of 2001.

The first scenario is the Baseline Scenario which forecasts CO_2 emissions assuming the continuation of all climate change-related policies in place as of the fourth quarter of 2001. No new measures are assumed to be added. Results from the Baseline Scenario show a continual increase in Austrian energy use with a resultant increase in CO_2 emissions[5]. By 2010, CO_2 emissions will have increased by 5.9 Mt annually for a total rise of 9.8% from 2000 levels. The major contributors to this increase will be motor fuels, natural gas and electricity, while coal and fuel oil are forecast to contribute fewer emissions by 2010. Energy-related CO_2 emissions will remain constant in the industrial sector, decline in the household sector, and increase in both the services and the transport sectors.

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4. This figure and all Kyoto-related emissions are taken from *Energieszenarien bis 2020* ("Energy Scenarios up to 2020"). IEA statistics have slightly higher figures due to data collection methodology.
5. Emissions from electricity end use come indirectly from its generation in fossil-fuel-driven power plants.

The second forecast case is the Kyoto Scenario. This scenario intends to project GHG emissions resulting from the adoption of measures which would allow Austria to meet its Kyoto targets by the 2008-2012 commitment period. These measures include the deployment of more efficient end use and transformation technologies and a shift in energy sources from high-carbon to low- or no-carbon fuels. However, the forecast shows that the measures adopted as part of this scenario are insufficient to reduce CO_2 to the required Kyoto level. Instead, emissions are reduced by only 6.8 Mt from 2000 levels, an amount 5.2 Mt short of the Kyoto targets. No attempt was made to revisit the adopted measures in this scenario so that the Kyoto targets could be met.

The final scenario is the Sustainability Scenario. This forecast case assumed adoption of all the measures of the Kyoto Scenario plus additional measures aimed at the enhanced diffusion of new energy technologies. These additional measures were specifically intended to reduce emissions following the first Kyoto commitment period. Emissions for this scenario are projected to be 51.5 Mt in 2010 and 38.3 Mt in 2020.

Macroeconomic conditions were forecast to improve as greater emissions reductions were achieved. For example, Austrian GDP grows at a higher rate in the Kyoto Scenario than in the Baseline Scenario and at an even higher rate in the Sustainability Scenario. Job growth is highest in the Sustainability Scenario and lowest in the Baseline Scenario. Energy costs are forecast to be lowest in the Sustainability Scenario and highest in the Baseline Scenario.

Greater details of these three scenarios, their implications for climate change policy, and a critique of their assumptions and results are discussed in Chapter 4 on the environment.

ENERGY POLICY

Energy Policy Objectives

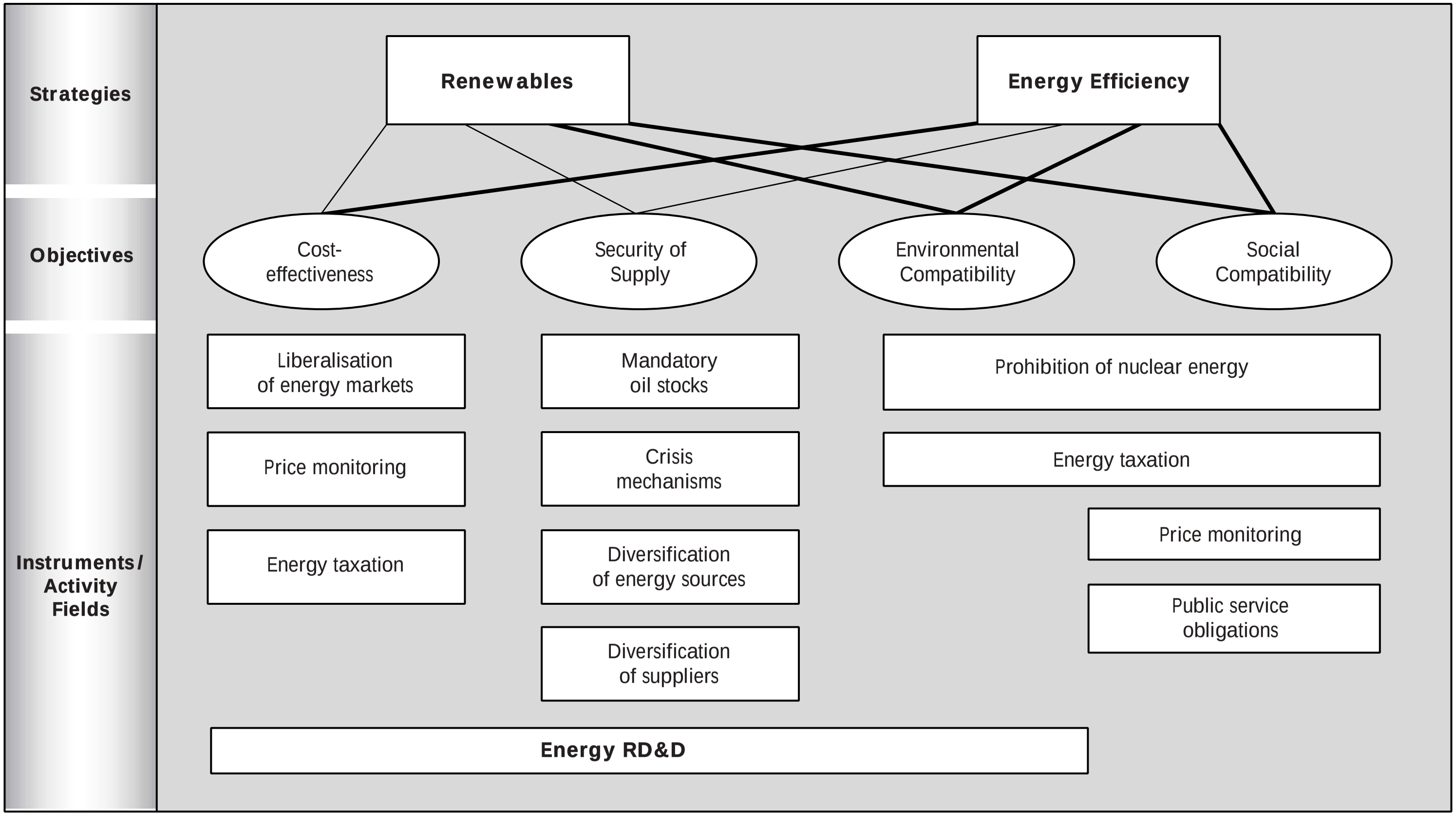
Austria's energy policy is committed to the following four objectives:

- **Security of Supply:** Austrian energy policy seeks security of supply for both the provision of primary fuels to the country as a whole and the delivery of end-use fuels to final consumers. The two primary fossil fuels in the market, natural gas and oil, derive a measure of energy security from *i)* storage capabilities within the country, and *ii)* extensive international pipeline capacities. Policy governing security for energy use by the consumer relates primarily to electricity, where the regulator for that field is responsible for monitoring adequacy of supply in both the short and the long term.

- **Cost-effectiveness:** The Austrian government seeks cost-effectiveness in assessing all policy decisions. This can be seen in the liberalisation of the natural

Figure 7

Energy Policy Goals, Strategies and Activity Fields



Source: Federal Ministry of Economic Affairs and Labour.

gas and electricity sectors, where the introduction of competition and supplier choice is intended to improve efficiency in the energy supply industry and subsequently lower costs to final consumers. Government R&D and energy efficiency initiatives are also intended to reduce energy costs to Austrian consumers by developing more efficient equipment and technology.

- **Environmental Compatibility:** Austria has traditionally placed great emphasis on the environmental impacts of energy production and use. In March 2002, Austria ratified the Kyoto Protocol, which obliges the country to reduce greenhouse gas emissions by 13% below 1990 levels by the first commitment period 2008-2012. The country has developed a *Klimastrategie* which includes a blueprint of actions that can be taken to meet this goal. In addition, electricity liberalisation law includes ambitious targets for the inclusion of renewable energies in the electricity mix. Lastly, Austria's ban on the production of nuclear power is based on environmental concerns.

- **Social Compatibility:** Austrians have long worked within the "Social Partnership", in which business, labour and agriculture discuss national policy. This forum allows all three to express their views and influence the direction of energy policy, ensuring that decisions are acceptable to the different segments of society.

These objectives are pursued throughout the energy supply system, in accordance with the framework displayed in Figure 7.

These objectives are pursued in the energy sector through various policy activities. Such activities include:

- Liberalisation of the energy markets.
- Diversification of energy sources.
- Diversification of suppliers.
- IEA strategies to cope with energy supply disruptions (crisis mechanisms).
- Energy taxation.
- Price monitoring.
- Public service obligations.
- Mandatory oil stocks.
- Energy R&D.

Austrian energy policy works within the framework of the country's membership in the following international organisations:

- **European Union (EU):** Austrian energy policy is influenced by the European Union in a number of ways. Primary among them are the EU directives supporting liberalisation in the internal markets of both gas and electricity, both of which Austria is implementing, well in advance of EU requirements. Other EU influences on Austrian energy policy include energy efficiency standards on appliances, rules on international energy trade and the adoption of the euro currency as one means of facilitating trade.

- **International Energy Agency (IEA):** Austria was a founding member of the IEA in 1974. The country fully complies with all IEA requirements on oil security.

- **Energy Charter Treaty (ECT):** Austria signed the Energy Charter Treaty in 1994 which entered into force in 1998. The ECT mission of striving towards open markets to promote a climate conducive to energy interdependence is consistent with Austrian national and international energy policy goals.

The two major energy policy initiatives pursued since the last in-depth review are both consistent with the country's stated energy objectives. They are *i)* the liberalisation of the electricity and natural gas sectors, and *ii)* the development of a comprehensive strategy to meet Kyoto Protocol commitments on GHG reductions.

The liberalisation process has proceeded in two stages. First, all customers were given the right to choose their electricity supplier on 1 October 2001, and subsequently, all customers were given the right to choose their natural gas suppliers on 1 October 2002. Austria's liberalisation places it well in advance of the timing of the respective EU directives on such liberalisation and market opening, making Austria one of the leading countries within the EU, especially in the natural gas sector. Results in the electricity sector thus far show mixed results. There have been some substantial price reductions although they have been spread unevenly between customer classes; in general, larger customers have seen greater price drops than smaller customers.

The liberalisation process has prompted two changes in the structure of Austrian energy policy-making. The first is the creation of two regulatory bodies which will monitor and supervise the liberalised markets for electricity and gas. These are the Electricity Control Commission (*Elektrizitäts-Control Kommission*) and the Electricity Control Private Limited Company (*Elektrizitäts-Control GmbH*), discussed more below[6]. The second change is a reappraisal of the Federal Cartel Office's mandate regarding market power in the energy sector. Changes in the law were enacted on 1 July 2002 to address the unique circumstances pertaining to the markets of electricity and natural gas. These new cartel laws are expected to be tested on the incumbent utilities which hold sizeable market share and

6. The amendment to the Austrian Gas Act, passed by the government on 24 August 2002, expands the mandate of these agencies to include independent regulation of the liberalised gas sector. The agencies' names are now the Energy Control Commission and the Energy Control Ltd (*Energie-Control Kommission* and *Energie-Control GmbH*).

whose recent alliance activities have further concentrated market power. Such alliances have been encouraged by the Austrian government on the federal ministerial level.

In response to climate change challenges, Austria has recently developed the *Klimastrategie*, a comprehensive strategy which lays out a series of measures intended to curb the country's GHG emissions by 13% below 1990 levels by 2008-2012, as stipulated in the EU burden-sharing corollary agreement to the Kyoto Protocol. The *Klimastrategie* was released in early 2002 and co-ordinated by the Federal Ministry of Agriculture, Forestry, Environment and Water Management which has responsibility for the overall energy policy with respect to climate change. The plan was developed through a consultative process among the relevant ministries at the federal level as well as with representatives of all nine Länder and calls for a variety of measures at the federal, Länder and municipal levels. Flexible mechanisms which allow the country to reduce the expense of emissions reduction through international activities are being examined but do not, as yet, constitute an integral part of the overall climate change strategy. Responsibility for the implementation of the *Klimastrategie* is shared by various federal and Länder government institutions.

Energy Policy Institutions

Austria is a federal republic with nine states ("Bundesländer", or Länder). The Federal Constitution allocates responsibilities either exclusively to the federal level, or to both the federal level and the state level. Federal level responsibilities cover issues that require co-ordination between Länder, such as energy security, while the Länder responsibilities involve issues endemic to each state, such as building code efficiency regulations and subsidies for renewable energy, where diverse local conditions require different types of approaches. Table 1 summarises the division of responsibilities.

Table 1

Division of Responsibilities for Energy Policy between the Federal Government and the Länder

Federal Responsibility	*Shared Federal and Länder Responsibility*
♦ Energy taxation	♦ Electricity
♦ Energy statistics	♦ Gas
♦ Metering of energy flows in the country	♦ District heating
♦ Energy supply emergency regulations	♦ Energy conservation
♦ Prohibition of nuclear power	♦ Subsidies

The Federal Ministry of Economic Affairs and Labour (*Bundesministerium für Wirtschaft und Arbeit*, or BMWA) is the main body responsible for energy policy on the federal level. Other ministries involved in energy matters include: *i)* the Federal Ministry of Agriculture, Forestry, Environment and Water Management, *ii)* the Federal Ministry of Transport, Innovation and Technology, and *iii)* the Federal Ministry of Finance. Government involvement in the energy sector also includes state ownership of energy companies. The federal government owns 35% of OMV, Austria's dominant gas and oil company, and the law requires that electric utilities be at least 51% owned by either the federal or the Länder governments.

As mentioned above, the government is currently liberalising the electricity and natural gas markets, and two related institutions have been created to monitor this process. They are the Electricity Control Commission (referred to hereafter as the E-Commission as it is known in Austria) and the Electricity Control Private Limited Company (referred to hereafter as the E-Control as it is known in Austria). The E-Commission is a three-member body that rules on issues relating to the regulation of the electricity sector. Its three members are appointed by the federal government but are not bound by ministerial instructions in the exercise of their office. The commission rules on system access charges and disputes between market participants. The E-Control acts as the secretariat for the commission. It monitors compliance with competition rules, provides information to the public on liberalisation, supervises electricity balancing and oversees the unbundling of electricity utilities.

While both the E-Commission and the E-Control are free to execute their mandate for the liberalised energy sector, other political institutions also play a role in shaping the new market. For example, the Ministry of Economic Affairs and Labour acted as an agent to facilitate an announced partnership between existing Austrian electricity utilities. The Federal Cartel Office also plays a role in the liberalised market through its ability to thwart potentially anti-competitive activity.

The Austrian Social Partnership

The institutional arrangements that frame the social partnership are unique to the Austrian economy. On both sides of the labour market, there exists a parallel set of voluntary organisations (trade unions, industrial associations and others) and self-governing bodies called chambers (Kammern). Membership in the chambers is compulsory. The two central chambers are for workers and employers. In addition, farmers have a separate chamber.

The institutional centrepiece of the social partnership is the so-called Parity Commission for wage and price issues in which the government and central trade unions are represented along with the central chambers. One of the four sub-committees, responsible for price developments, is the place where energy prices are discussed.

Within this arrangement, the chambers represent their members' interests. They have the opportunity to present comments on government draft bills. As a result, the social partners can influence many aspects of public policy.

The general idea of the system is that the basic aims of economic and social policy are recognised by all partners and can be better realised through co-operation and co-ordinated action rather than through confrontational means such as strikes or lockouts. The Social Partnership is not a means of denying conflicts between societal interests, but a model which aims at mutual problem-solving.

Energy policy – as well as other public policy – is formulated and implemented within the framework of the Social Partnership (see box for further description). The Social Partnership was formed after World War II to provide a forum for debate among workers, commerce and agricultural interests.

On both the federal and the state levels, the responsible public bodies make use of the expertise of organisations usually referred to as "energy agencies". These are normally non-profit organisations dealing with energy efficiency and renewable energies. Academic institutions also play a role within the country's energy policy debate and implementation.

Security of Energy Supply

In 2000, Austria imported 78% of its total supply of natural gas. This figure is expected to increase as domestic fields are depleted and demand continues to grow. The large majority of the imported gas comes from Russia, although supply sources have been diversified in recent years and at present nearly 20% of imports come from other countries, notably Germany and Norway. Austria has never experienced unexpected import cuts during its more than 40 years of purchasing gas from Russia (and previously the Soviet Union). Natural gas security is enhanced by the large volumes of Austrian gas storage facilities, representing approximately 140 days of gas consumption, one of the highest levels in Europe.

As with natural gas, the majority of Austria's demand for oil is also met via imports. The percentage share of imports is expected to climb as domestic fields are depleted and demand continues to rise. Countries importing to Austria are spread across a number of different oil-producing regions of the world, including the Middle East, Central Asia, and North and sub-Saharan Africa. Austria has never experienced any unexpected cuts to its oil imports. Demand for all oil products with the exception of diesel fuel is almost entirely met by the country's own refining capabilities. Imports of diesel fuel come primarily from other European countries. Austria's oil supply security is enhanced by its emergency preparedness measures which are comprehensive and fully equipped to address short-term supply cuts.

Austria has a substantial reserve margin of electricity-generating capacity in excess of its peak demand for power. The majority of this capacity (64%) is hydroelectric power, which normally accounts for about 70% of the country's total generation. The hydroelectric generation is highly seasonal with significantly greater production capability in the summer than in the winter. Austria imports significant amounts of electricity in the winter because of this seasonal generation pattern. Austria's combined heat and power (CHP) production facilities operate more in the winter when heat is required and their electricity generation is also used to offset diminished hydroelectric production. Austria has substantial international transmission capacities which allow for imports or exports of power roughly equal to the country's peak power demand. The newly created regulatory body which oversees the liberalised electricity market is responsible for monitoring electricity security and reports that it anticipates no problems with the issue in the next five to seven years.

ENERGY TAXATION

All energy taxation (i.e., excise duties and value-added tax) is set at the federal level. Taxes vary by energy source. While Austria has a general policy of no energy tax differentiation by customer class, a partial tax reimbursement scheme for energy-intensive enterprises results in a reduction in net energy taxes for certain businesses. The VAT is generally 20% of the price including excise tax. Table 2 summarises the array of Austrian taxes on energy products.

Table 2

Austrian Energy Taxation, Fourth Quarter 2001

Fuel / User	*Excise Tax € / unit*	*VAT %*
Automotive Diesel	0.29/litre	20
Automotive Diesel (haulers, taxis, etc.)	0.29/litre	0
Regular Unleaded Gasoline	0.415/litre	20
Regular Unleaded Gasoline (haulers, taxis, etc.)	0.415/litre	0
Light Fuel Oil / Households	0.076/litre	20
Electricity / Households[1]	0.0150/kWh	20
Electricity / Industry	0.0150/kWh[4]	0
Natural Gas / Households	43.60/kcm	20
Natural Gas / Industry[2]	43.60/kcm[4]	0
Steam Coal / Households	0	20
Steam Coal / Industry[3]	0	0

kcm: 1 000 cubic metres.

1. Data for 2000.
2. Data for 1999.
3. Data for 1998.
4. While businesses pay the same excise tax as households on electricity and natural gas, almost all commercial enterprises are entitled to a reimbursement of such taxes paid in excess of a certain level. The government estimates that with this reimbursement, eligible companies pay slightly less than 50% of the electricity and natural gas tax they would pay without the reimbursement.

Sources: *Energy Prices and Taxes*, IEA/OECD Paris, 2002; "The Implementation of the EU Directive for Electricity in Austria: A New Era!", Reinhard Haas, Hans Auer, Wolgang Orasch; Vienna Institute of Technology.

The electricity tax on households was nearly doubled on 1 June 2000 from 0.73 € cents/kWh to 1.5 € cents/kWh. This increase is roughly equivalent to the average price reduction households have realised from market liberalisation.

Austria takes a general policy of no energy tax differentiation among customer classes. However, partial reimbursements to energy-intensive companies reduce the net energy tax burden on businesses compared to that of residences. While businesses pay the same excise tax as households on electricity and natural gas, almost all commercial enterprises are entitled to a reimbursement of such taxes paid in excess of a certain level[7]. The government estimates that, with this reimbursement, eligible companies pay slightly less than half of the electricity and natural gas excise tax they would pay without the reimbursement. Such a differential between residential and industrial energy taxation is not uncommon in EU member countries.

As a result of a change in tax policy in the early 1990s, taxation for automotive fuel now favours diesel over unleaded gasoline. In 2001, total taxes for regular unleaded gasoline were 36% higher than the taxes on diesel for non-commercial use. This tax differential in favour of diesel fuel is not inconsistent with the individual policies of other IEA European countries which, on average, give roughly the same tax preference to diesel fuel.

A range of fuel taxes per MBtu of useful energy is shown in Table 3. While coal has the highest CO_2 emissions per unit of energy, it has the lowest tax. Both oil and natural gas have lower CO_2 emissions and higher tax rates.

Table 3

Energy Taxes on a per MBtu Basis, 2001

Energy Source	*Total Tax (€/MBtu)*
Steam Coal	2.04
Natural Gas	2.80
Light Fuel Oil	3.91
Electricity	10.79

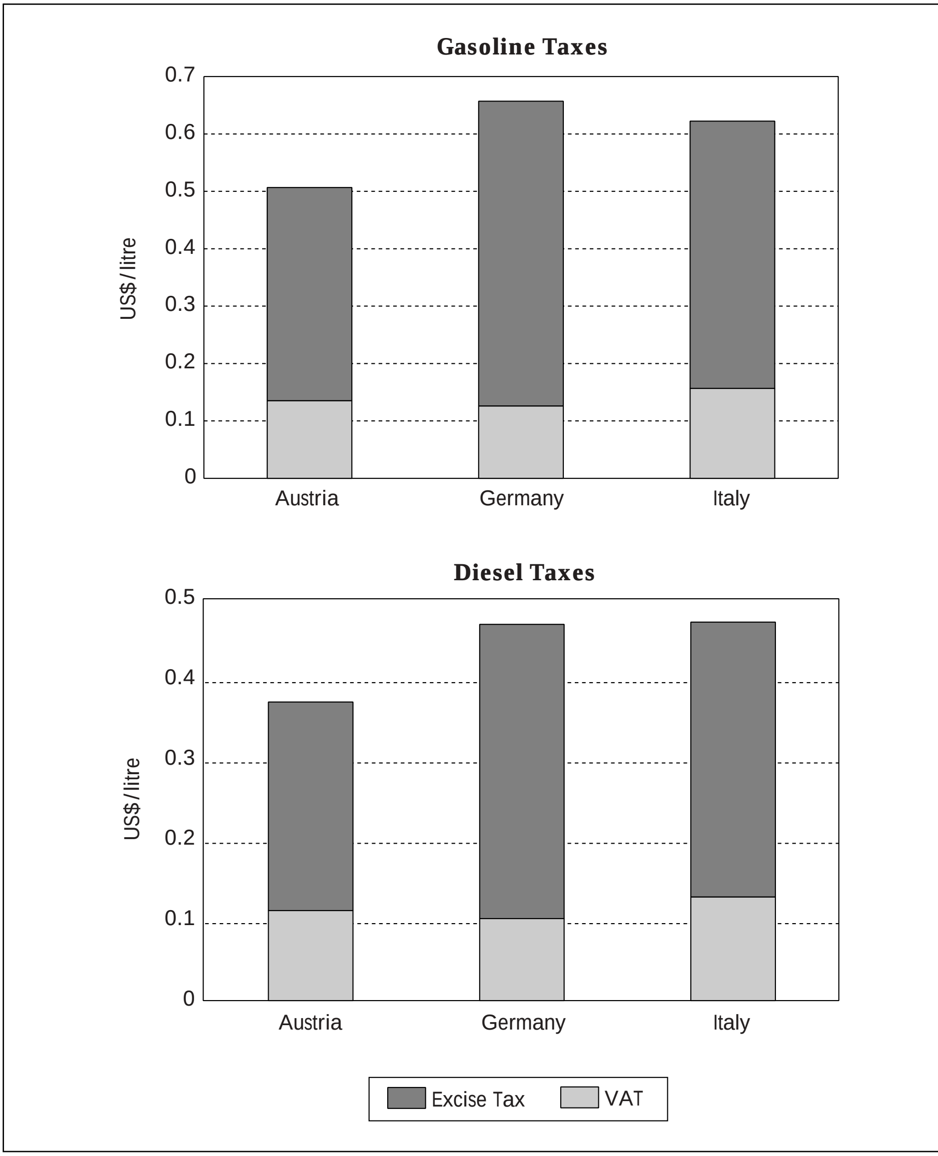
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

As shown in Figure 8, Austrian taxation of motor fuels is lower than its neighbours to the West (e.g. Germany and Italy) and higher than its neighbours to the East (e.g. the Czech Republic and Slovakia).

7. This level is calculated as a function of the actual energy taxes paid and the company's valued added.

Figure 8

Motor Fuel Taxation in Austria and in Neighbouring Countries, 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Austria has considerable international road traffic. A great number of (largely commercial) drivers pass through the Austrian "corridor" connecting Germany and Italy. In addition, Austria's lengthy border along population-dense areas encourages international traffic. Differences in taxes on motor vehicle fuels between Austria and neighbouring countries can influence drivers' decisions on where to purchase fuel. While no reliable statistics are kept to track the extent of this cross-border fuelling phenomenon, government officials suggest that foreigners seeking to take advantage of Austria's lower taxes could account for one-fourth of the 40% rise in motor fuel use from 1990 to 2000.

CRITIQUE

The Austrian energy sector is shaped by three major factors: *i)* the internal political and economic climate, *ii)* international obligations and commitments such as those with the EU and co-operation with international organisations and treaties, and *iii)* the country's unique geographical and geological characteristics.

Regarding internal factors shaping the energy sector, the Austrian government is now proceeding with liberalisation of both the electricity and natural gas sectors in advance of the EU relevant directives. Further internal developments influencing domestic energy are the divestiture of government holdings in energy utilities and the creation of new cartel laws which will determine the size and scope of the country's electricity and natural gas utilities.

The Kyoto Protocol has had and will continue to have a great effect on the Austrian energy policy. Released in 2002, the *Klimastrategie* includes a blueprint of measures that will allow the country to meet its GHG emissions reduction targets under the Kyoto Protocol. The plan will influence every sector of energy policy from production sources and transformation efficiency to technology use and agricultural energy use.

The liberalisation of Austria's electricity and natural gas sectors is motivated by the EU directives which mandate such market opening. Austria is acting in advance of the EU deadlines for market opening as a result of the pro-market philosophy of the last government. Liberalisation in other EU countries which follow the EU directives will create more willing trading partners, particularly for electricity and natural gas. In addition, the introduction of the euro and the dismantling of trade barriers lower transaction costs for international trade with other EU countries. The enlargement of the EU to the East, particularly with the inclusion of the Czech Republic, will create further opportunities for additional energy trading. Such expanded trading can bring lower costs to Austrian consumers, high-revenue export markets for Austrian producers and enhanced energy security from shared capacities and resources.

Austria has developed an energy policy that takes advantages of its unique geographic and geological characteristics. The lack of substantial indigenous fossil fuels could have represented problems in terms of energy security and cost. However, the country has developed substantial trade and transit capabilities in natural gas, oil and electricity which take advantage of its unique location between energy-producing and energy-consuming regions The seasonal nature of its substantial hydroelectric resources favours both the import and export of electricity and the country has developed significant international electricity transmission to take advantage of these opportunities.

Austria's liberalisation of the electricity and natural gas sectors in advance of the EU directives is commendable. This liberalisation process must be viewed in the light of greater liberalisation in all EU countries. This not only involves cross-border trade of energy commodities (as mentioned above), but also investment of foreign companies in the native energy infrastructure. As a result of EU liberalisation, many large European electricity companies have made substantial international investments within Europe although, to date, such activity has been very limited in Austria. Foreign investment in Austrian energy infrastructure is firmly opposed by popular and political will. For example, certain politicians have supported an alliance between existing electricity utilities in order to create an entity that is sufficiently large to retard any substantial foreign investment in the sector.

Such growth of local utilities may succeed in keeping the energy infrastructure in Austrian ownership, but could have a deleterious effect on the potential benefits of liberalisation by introducing market power that deters true competition. This could occur as a result of horizontal integration (the ability to profitably raise prices in the absence of competitors who would capture market shares as a result) or vertical integration (favouring your own company at different points along the value chain, despite the presence of well-intentioned open access regulations). Decisions on this matter will be made by the Austrian Cartel Office which operates under a new set of laws instituted on 1 July 2002. These new laws give more strength to the office should it choose to oppose alliance on the grounds of market dominance. In addition, the E-Control will play a role in this decision as it can effectively raise concerns about any such alliance within the electricity and the gas industries. This debate will pit the desire to maintain Austrian ownership of energy infrastructure against the market power concerns that could arise with the development of an oligopoly of Austrian companies.

Austria faces no significant security of supply issues. While its large import shares of oil, gas and (seasonally) electricity warrant continued monitoring of this issue, a number of factors combine to protect the country against energy shortfalls. These factors include a long history of uninterrupted imports from producing countries and the significant transmission/transportation capabilities between Austria and these producing countries. Austria has also taken steps domestically to ensure supply security. These steps include the development of large gas storage capabilities, comprehensive emergency response measures for oil and a sizeable reserve margin capacity for electricity.

The taxation of competing energy sources (e.g., gas, oil, electricity, coal) does not reflect their GHG emissions and could therefore work in opposition to the country's climate change strategy. Coal has the lowest tax level of any energy source on a per MBtu basis, and yet it emits the greatest amount of CO_2 per unit of energy when burned. Both natural gas and oil products have lower CO_2 contents and yet higher taxation. Electricity has the highest tax, over five times that of coal on a per unit of energy basis (i.e. €/MBtu), and its emissions can vary depending on the source of the electricity[8]. While taxation inversely proportional to GHG emissions is not uncommon

8. If the electricity comes from hydropower stations (as approximately 70% of Austrian electricity does), there are no emissions. However, tax rates generally affect generation from the economically marginal plants which, in the case of Austria, are usually natural gas facilities. In that case, emissions per useful unit of energy for electricity would be approximately 50% higher than coal, 90% higher than oil, and 150% higher than gas.

within IEA countries, the impact of such taxation could be studied to determine to what extent such taxation precipitates a significant shift in fuel consumption patterns, and how that might affect the country's GHG emissions reduction strategy.

The international aspect of much of Austria's energy sector must be accounted for when reviewing tax policy. For example, motor fuel tax differentials between Austria and neighbouring countries, and the consequent transborder purchase of fuel affect environmental energy policy, public tax revenues and energy security. Determining the real extent of Germany-Italy "corridor" traffic and of "fuel tourism" by foreign residents living or working close to the Austrian border and seeking to take advantage of Austria's lower fuel taxes perhaps should be the first step of any tax policy review.

RECOMMENDATIONS

The Government of Austria should:

- ☐ Continue with the liberalisation of the electricity and natural gas sectors.
- ☐ Further clarify energy policy objectives in the context of market liberalisation, ensuring that policy tools fit the new policy environment.
- ☐ Continue the national debate between the desire for large Austrian utilities able to fend off hostile take-overs by foreign companies and the market concentration issues that such utilities raise.
- ☐ Review energy tax policies to prevent possible market distortion and send the right signals to consumers, taking into account the tax harmonisation efforts at the EU level.

4

ENERGY AND THE ENVIRONMENT

CLIMATE CHANGE

Greenhouse Gas Emissions

According to the "Burden Sharing Agreement" among EU countries, Austria is committed to reducing greenhouse gas (GHG) emissions by 13% below 1990 levels by the time of the first commitment period, 2008-2012. Total Austrian GHG emissions have risen by 2.7% from 1990 to 1999, so the country must now reduce emissions by slightly more than 15% from 1999 levels in order to meet its Kyoto Protocol commitments. The Austrian Parliament ratified this agreement in March 2002 and the EU as a whole ratified it in May 2002, making the country's commitment to GHG emissions targets legally binding.

Carbon dioxide is the most important GHG emitted in Austria. In 1999, it accounted for approximately 83% of the country's total contribution to climate change, followed by methane (CH_4) with a 12% share, and then by the combined impact of N_2O, HFCs, PFCs and SF_6, which constitute the remaining 5%. These percentage shares of GHG emissions are similar to those of other developed countries. While the majority of CO_2 emissions are energy-related, the other emissions are much more likely to come from non-energy activities. The Austrian Research Centre Seibersdorf has calculated scenarios for non-energy GHG emissions. Data show a 20% decrease of CH_4 emissions in the baseline case, whereas N_2O emissions are expected to stabilise. According to a forecast by the Austrian Environment Agency, emissions of industrial F-gases (HFC, PFC and SF_6) will increase by nearly 50% between 1995 and 2010 .

Austria's CO_2 emissions increased to 60.3 Mt[9] in 2000, up 5.8 Mt (or 9%) from 1990 levels. The main contributor to the increase in CO_2 since 1990 has been the transport sector. Over that time emissions from this sector have risen by 26.5%. Road transport makes up 95% of the emissions. The manufacturing sector increased emissions by 10.9%, largely as a result of an increase in the sector's overall energy use and despite a trend towards replacing oil with natural gas. The emissions from the residential sector have stayed constant since 1990. This stability masks two contrary trends in the sector. One, an

9. This and all Kyoto-related emissions taken from *Energieszenarien bis 2020* (Energy Scenarios up to 2020) which was conducted by the Austrian Institute for Economic Research (WIFO) and completed in the fall of 2001.

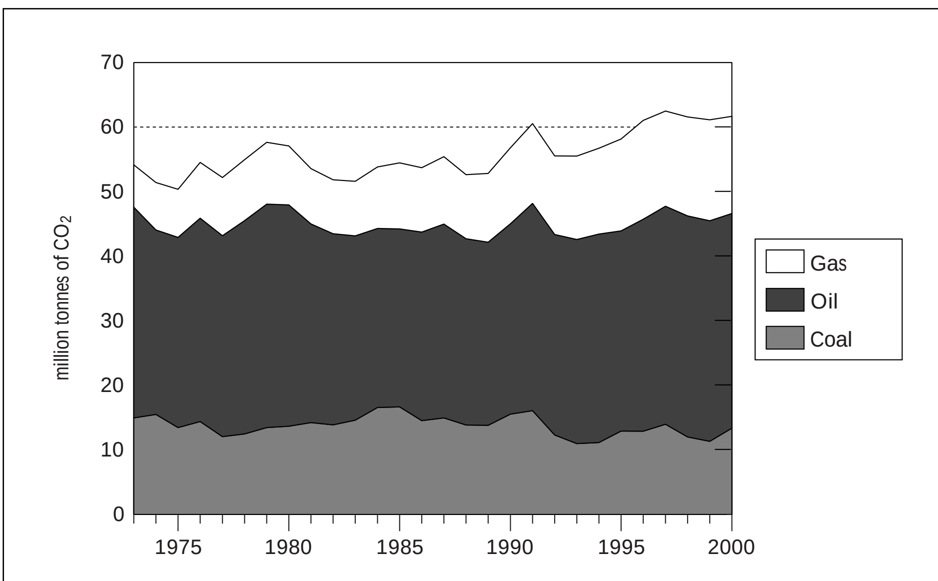
increase in overall energy consumption and two, a switch from coal to oil and natural gas. The only sector to substantially reduce emissions was the electricity and heat generation sector. From 1990 to 2000, this sector reduced emissions by just over 8%, primarily as a result of decreased coal usage and increased production from hydroelectric facilities. This decrease in emissions from the electricity and heat generation sector is heavily influenced by annual variations in hydroelectric production which, in turn, are affected by meteorological conditions.

Regarding CO_2 emissions by fuel, petroleum products have contributed the greatest increase in emissions since 1990. Over that time, emissions from oil and oil products increased by 13%. Natural gas, however, saw the biggest percent increase in CO_2 emission contribution, rising by 28% from 1990 to 2000. Emissions from coal use dropped by 14% over the same time. These percentage changes in emissions from fuels are consistent with the percentage changes in each fuel's contribution to Austria's TPES.

Figure 9 shows the progression of CO_2 emissions by fuel from 1973 to 2000, while Figure 10 shows the CO_2 emissions by sector over the same time period. Figure 11 displays international comparisons on CO_2 emissions per unit of GDP for Austria, selected countries and the IEA Europe average.

Figure 9

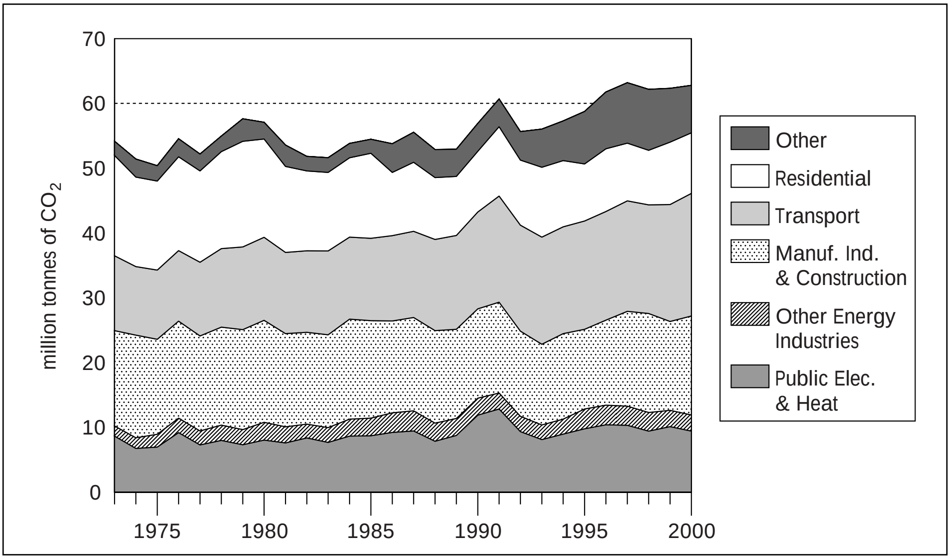
CO_2 Emissions by Fuel*, 1973 to 2000



* estimated using the IPPC Sectoral Approach.

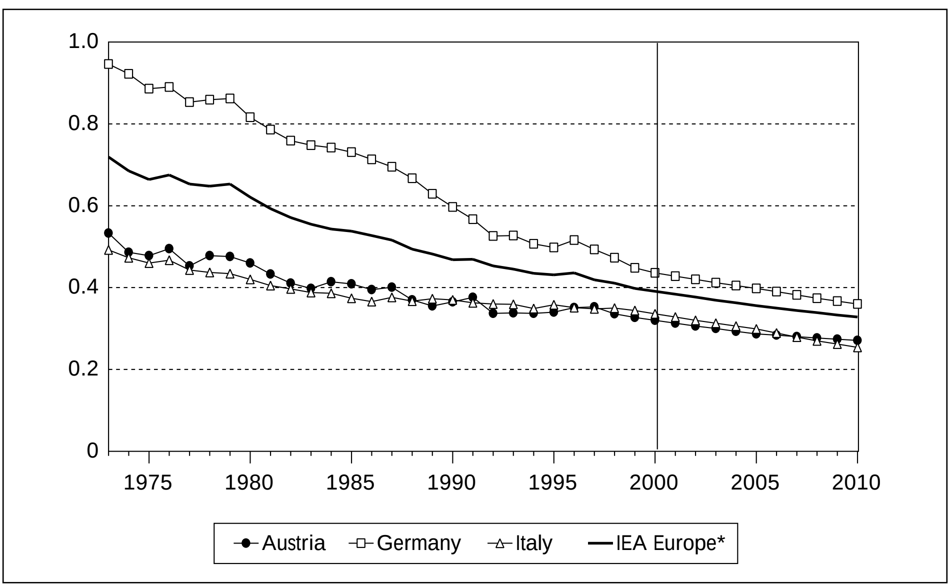
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2002.

Figure 10
CO_2 Emissions by Sector*, 1973 to 2000



* estimated using the IPPC Sectoral Approach.
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2002.

Figure 11
Energy-related CO_2 Emissions per GDP in Austria and in Other Selected IEA Countries, 1973 to 2010



* excluding Norway from 2001 to 2010.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002; *National Accounts of OECD Countries*, OECD Paris, 2002; and country submissions.

A study which forecasts Austrian CO_2 emissions under different scenarios was jointly commissioned by the Federal Ministry of Economic Affairs and Labour and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Both of these agencies are playing an important role in the formulation of the country's climate change strategy and used this forecast as a basis for developing that strategy.

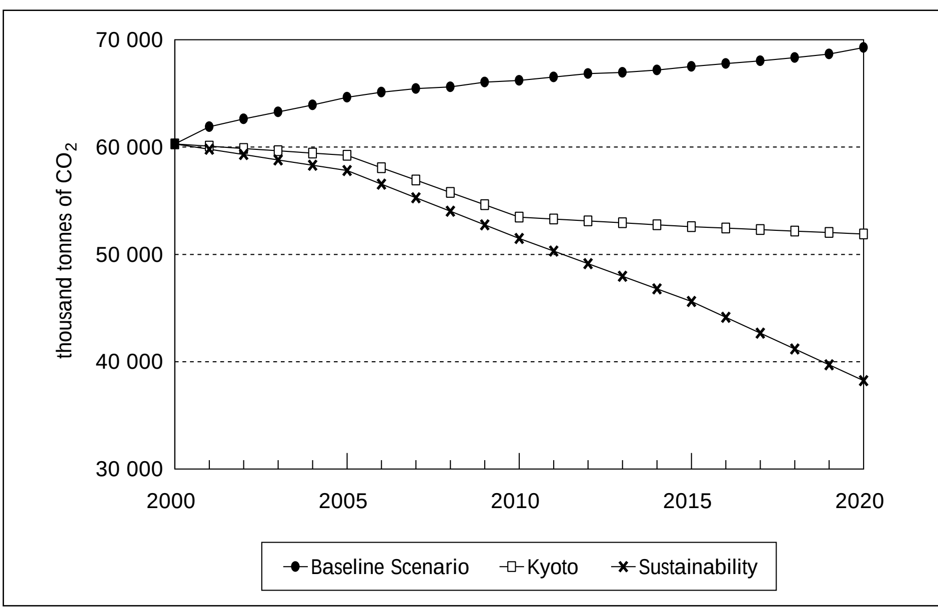
This study, *Energieszenarien bis 2020* – "Energy Scenarios up to 2020" – was conducted by the Austrian Institute for Economic Research (WIFO). It included three different forecast scenarios, each of which projected energy-related CO_2 emissions using a different set of assumptions about the implementation of CO_2 emissions reduction strategies in the energy sector. These forecasts are:

- Baseline Scenario – This "business-as-usual" case assumes continuation of all climate change-related policies (as of Q4 2001) with no additional measures enacted.
- Kyoto Scenario – This forecast includes the implementation of all measures to be introduced as part of Austria's GHG emissions reduction strategy.
- Sustainability Scenario – This scenario reflects implementation of various sustainable development strategies posited at the international level, including those of the EU, UNDP, IPCC and the World Energy Council.

Figure 12 shows the forecast results of all three scenarios.

Figure 12

CO_2 Emissions Forecasts for Three Scenarios, 2000 to 2020



Source: *Energieszenarien bis 2020*, Austrian Institute for Economic Research (WIFO), 2001.

The Baseline Scenario is designed to provide a forecast of the expected growth of Austrian GHG emissions if the country were to continue its existing policies relating to climate change without adding any new measures. Three important assumptions are the price of crude oil, the overall development of the Austrian economy and the impact of national energy market liberalisation. The crude oil price assumptions are taken from the *World Energy Outlook 2000* of the IEA, which forecasts that the price of crude oil will drop to €16.50/barrel in real terms (1990) and subsequently rise to €22.50/barrel in real terms (1990) by 2020. National GDP assumptions are derived from a medium-term WIFO forecast based on the MULTIMAC III model. According to this forecast, the medium-term growth rate of the real GDP in Austria will be about 2% per year.

The liberalisation of the energy market was assumed to result in a price drop of 9.0% for electricity consumers in 2001, 2.5% for residential natural gas consumers in 2002, and 5.0% for industrial natural gas consumers, also in 2002. The forecasts assume that these initial price drops will be followed by a second stage in the liberalised market during which a concentration of market power among individual suppliers will result in selective price increases across customer classes. These secondary price increases will erase half of the initial price reduction seen by households but will have no effect on the reduced rates of the industrial customers. The forecast further assumes that liberalisation will change Austria from a net exporter of electricity (2.6% of domestic consumption) to a net importer of electricity (up to 3.0% of domestic consumption). This transition will be accompanied by a slight increase in power generation from hydroelectric sources and wind power, but these production increases will not be sufficient to meet added demand growth for electricity. As a result, increased generation from thermal power plants will be needed to meet this shortfall and CO_2 emissions will rise accordingly.

Results from the Baseline Scenario predict an increase in energy-related CO_2 emissions of 5.9 Mt from 2000 to 2010. Much of this increase will come from greater direct end use of energy, resulting in a 2.7 Mt rise in CO_2 emissions from 2000 to 2010. The major contributors to this end use increase are motor fuels, natural gas and electricity[10] while coal and fuel oil are the only energy sources whose GHG emissions from end use decrease over the forecast period (2000 to 2020). Overall emissions caused by energy end use will remain constant in the industrial sector, will decline in the household sector, and will increase in the services and transport sectors. Forecast results also predict that the conversion of energy into electricity and useful heat will increase CO_2 emissions by 3.2 Mt, with 1.5 Mt coming from electricity utilities and 1.7 Mt coming from industrial facilities.

10. Emissions from electricity end use come indirectly from its generation in fossil-fuel-driven thermal power plants.

The Kyoto Scenario forecast is based on a set of strategies intended to allow Austria to meet its Kyoto commitments on GHG reduction (i.e., 13% reduction from 1990 levels by 2008-2012 commitment period). The strategies employed to reach this target can be classified according to their effect on the energy sector:

- Reduction of redundant energy services (e.g., transportation services, room temperature controls).

- Use of more efficient end-use technologies (e.g., vehicle engines, thermal insulation of buildings).

- Use of more efficient technologies for energy transformation (e.g., through co-generation, improvement in the energy efficiency of plants and equipment).

- Shift in the mix of energy sources (e.g., greater reliance on low-carbon and carbon-free energy).

The effect of these four sets of policies was measured individually. However, forecasters expect that, if these four sets of measures were implemented together, certain of their activities would overlap, resulting in combined emissions reductions that would be less than the sum of reductions from the four individual sets of measures. This overlap effect would decrease the extent of emissions reductions by 25%. As a result, the combined effect of the measures employed in the Kyoto Scenario would produce CO_2 emissions of 53.3 million tonnes in 2010. This emission level is 12.8 Mt below the Baseline Scenario in 2010. Of this difference, 9.6 Mt (or 75%) will come from energy end use, and 3.2 Mt (or 25%) from conversion of energy. The reduction in emissions from conversion is the same in the Kyoto Scenario as in the Baseline Scenario, indicating that all of the additional emissions reducing measures in this scenario take place at the point of energy end use rather than during energy conversion.

The overall macroeconomic results of the Kyoto Scenario are forecast to be superior to those of the Baseline Scenario. The country will incur costs in order to stimulate investments in the required energy-saving technologies that would not be made without additional incentives. The government-borne portion of these costs include incentive (i.e., low-cost) financing, promotion programmes, information campaigns and the refund of network charges for electricity generated from renewable sources of energy. In order to meet government deficit goals, these expenditures must be recovered either through additional taxes or the reduction of public spending in other areas. The scenario forecasts that these costs will be €1.2 billion annually (in constant 2000 euros) to be gathered in taxes or through other measures reducing the public's disposable income.

The investments in energy-saving technologies will stimulate the economy and counteract the negative impact of reducing the public's disposable income through increased taxation. This scenario projects that these investments will equal €1.9 billion annually (in constant 2000 euros). The net effect of €1.9 billion in investments less €1.2 billion in costs will provide a net stimulus to the economy of €700 million. This scenario also forecasts that, compared to the Baseline Scenario, the costs of energy consumption will be substantially reduced, resulting in a further stimulus to the economy of approximately €70 million on average between 2000 and 2010.

In comparison to the Baseline Scenario, the Kyoto Scenario forecasts accelerated GDP growth, reduced unemployment and greater public sector revenues. However, such positive impacts are not forecast to be spread evenly across the economy. Predictably, the fossil fuel supply sectors will experience a steep decline in output and employment while the higher level of capital expenditure will have a favourable impact on the metal goods, office machinery and electrical equipment sectors. Comparative details of the macroeconomic effects of all three scenarios are shown in Table 4.

The Sustainability Scenario is based on the implementation of measures that will allow for greater GHG emissions reductions than envisaged in the Kyoto Scenario. It incorporates the effect of three current developments at the international level.

- The sustainability strategy of the European Union.

- The global energy scenarios of the United Nations Development Program and the World Energy Council.

- The "Third Assessment Report" of the Intergovernmental Panel on Climate Change (IPCC).

This scenario considers the technological options available to change both the volume and the type of energy flows. Accelerating the diffusion of these technologies is the basis for the scenario. This diffusion is achieved through similar yet expanded government programmes utilised in the Kyoto Scenario.

The results of this scenario are similar to those of the Kyoto Scenario through the year 2010. Total CO_2 emissions in 2010 are projected to be 51.5 million tonnes compared to the 53.3 Mt projected for the Kyoto Scenario. It is only after 2010 that the Sustainability Scenario realises significantly greater GHG emissions reductions. By 2020, the Sustainability Scenario projects CO_2 emissions of 38.2 Mt, a full 37% below the year 2000 emissions level.

The Sustainability Scenario forecasts improved economic conditions, in comparison with the other two scenarios. The average annual costs to the economy to diffuse these technologies are €1.8 billion while the investment is €2.8 billion, resulting in a net stimulus to the economy of €1.0 billion annually (with all figures in constant 2000 euros). In addition, energy costs are also forecast to be considerably lower than in the Kyoto Scenario, which will further benefit the overall national economy.

Table 4 provides a summary of the three different GHG emissions scenarios, including the level of emissions they project and the macroeconomic effects they are expected to produce.

Table 4
Comparison of GHG Emissions Scenarios

Parameter Result	*Baseline*	*Forecast Scenarios* *Kyoto*	*Sustainability*
CO_2 Emissions (2010)	66 215 kt	53 467 kt	51 491 kt
CO_2 Emissions (2020)	69 263 kt	51 895 kt	38 242 kt
Energy Consumption (2010)	1 049,161 Tj	925 504 Tj	884 474 Tj
Energy Consumption (2020)	1 121,451 Tj	931 608 Tj	755 764 Tj
GDP Growth	Approx. 2% growth per annum	1% higher than baseline in 2010; 0.6% higher than baseline in 2020	1.4% higher than baseline in 2010; 1% higher than baseline in 2020
Net Public Sector Revenues	..	€1.4 billion greater than baseline through 2020	€1.5 to 2.2 billion greater than baseline through 2020
Employment	..	20 000 to 25 000 more jobs than baseline	30 000 to 40 000 more jobs than baseline
Energy Costs	Slight increase from present	€1.4 billion decrease from baseline through 2020	"Considerably lower" than in baseline

kt: 1 000 tonnes.

Tj: terajoule.

Source: *Energieszenarien bis 2020* – "Energy Scenarios up to 2020", Austrian Institute for Economic Research (WIFO), 2001.

Climate Change Abatement Programmes and Institutions

Relevant ministries at the federal and Länder level have finalised a national climate strategy ("Strategie Österreichs zur Erreichung des Kyoto-Zieles – Klimastrategie 2000–2008/2012"). This report builds on the ideas and structures outlined in the "Third National Climate Report of the Austrian Federal Government" submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2001. The strategy therein draws upon earlier work, including the study "Kyoto-Optionen-Analyse" by the "Österreichische Kommunalkredit" which itself built upon work of the Austrian Council on Climate Change (ACCC), as well as related studies from the business and industry sector which took into account the views of different stakeholders on costs and effects.

Policies and measures intended to mitigate GHG emissions are conducted on three different levels of Austrian government: *i)* the federal level, *ii)* the Land level, and *iii)* the municipal level. In general, policy benefiting from consistency across the entire country is shaped at the federal level, while policies that can reasonably differ from state to state are performed at the Land or municipal levels. For example, the federal government addresses all international aspects of energy (e.g., trade and treaties) as well as taxation and crisis management, while the Länder governments address public transportation, construction and regional planning. Table 5 below shows the jurisdictions of each level with regard to climate change. As can be seen, there is some overlap of responsibilities on certain issues.

Table 5
Jurisdiction of Climate Change Issues by Government Level

Federal Level	*Land Level*	*Municipal Level*
♦ International Trade	♦ Building Construction	♦ Land-use Planning
♦ Industry and Mining	♦ Space Heating	♦ Public Transportation
♦ Taxation	♦ Road Construction	♦ Road Construction
♦ Price Regulation	♦ Public Transportation	♦ Public Buildings
♦ Crisis Management	♦ Regional Planning	♦ Procurement
♦ Energy Supply, Transport and Shipping	♦ Energy Supply	
♦ Motor Vehicles		
♦ Railway Infrastructure		

The Federal Ministry of Agriculture, Forestry, Environment and Water Management (*Bundesministerium für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft, BMLFUW*) co-ordinates the overall Austrian policy with respect to climate change. However, as noted above, jurisdiction for measures to reduce GHG emissions is distributed among several levels of government. In order to support efficient co-ordination of related activities among these levels and in different fields, several committees have been established.

■ *The Interministerial Committee to Co-ordinate Measures to Protect Global Climate Change (IMC Climate Change)*
This committee advises the Minister of the BMLFUW on climate change issues. It was founded in 1991 during preparations for the UNFCCC and consists of representatives of the federal ministries concerned with climate change issues, representatives of the Social Partnership, and a common representative of the Länder.

■ *Austrian Committee on Climate Change (ACCC)*
The ACCC advises the Minister of the BMLFUW with respect to the scientific issues relating to climate change. This committee is made up of Austrian experts on climate change drawn from universities, research institutions and private companies.

■ *Kyoto Forum*
This new organisation represents an initiative to combine the efforts of the different levels of government on climate change issues. It was established at the BMLFUW in 1999. The Forum comprises high-level representatives of the Federation, the Länder and the municipalities. For the development of detailed policy programmes, subgroups have been established for several topics such as energy supply, space heating, financial co-ordination and economic instruments.

Austrian policies and measures designed to achieve the GHG emissions reductions required by the Kyoto Protocol are broken down into seven different categories. These are clearly laid out in the *Klimastrategie* and the country's third communication to the UNFCCC. The categories of measures are listed below along with the country's expectation on how much emissions reduction each set of policies will achieve. The sum of annual emissions reduction from the combined measures listed below would be 13.85 Mt of CO_2-equivalent, that is, approximately 1.65 Mt more than Austria's required reduction from 2000 levels in order to meet the Kyoto commitment.

Space Heating and Small Consumption

This category involves the following activity types:

- Thermal improvement of existing building stock.
- Enhanced technical standards for new buildings.
- Increasing share of renewable energy sources and district heating.
- Increasing boiler efficiency.
- Switching to fuels with lower (fossil) carbon content.
- Demand-side measures to reduce electricity demand.

Measures in this category are expected to reduce CO_2 emissions by 4.0 Mt per annum once fully implemented[11].

Energy Supply

This category deals with all measures related to energy supply with activities falling under one of the following rubrics:

- The role of renewable energy sources and efficient district heating systems.
- Electricity production and various means of supporting non-polluting electricity generating systems that are not currently commercially competitive in a liberalised market.
- Heat production in forms that maximise benefits of indigenous biomass resources.
- Cross-cutting measures which would include energy-related taxes and earmarking for climate change-related measures, and intra-national GHG emissions trading schemes.

Measures in this category are expected to reduce CO_2–equivalent emissions by 2.1 Mt per annum once fully implemented.

Transport

This category includes measures to curb emissions from all modes of Austrian transport. Activities include:

- Financial instruments for motor vehicles (i.e., fuel consumption-based registration taxes and road tolls).
- Regional and urban rail transport investments.
- Improvement of fuel quality and promotion of biodiesel.

11. The emissions reduction effects from demand-side measures have been included in the Energy Supply category in order to avoid double counting.

- “Car-free” tourism projects (e.g., building public transportation at heavily-frequented tourism locations).
- Technology innovation.
- Traffic management, reducing speed limits and improvement of spatial planning.

Measures in this category are expected to reduce emissions by 3.7 Mt of CO_2-equivalent per annum once fully implemented.

Industry

Austria has experienced a degree of uncoupling between its production output and its energy demand over the last 20 years. Overall GHG emissions from industry accounted for 22 Mt in 1980, have been flat throughout much of the early 1990s and have shown a slight increase since 1997. Policies and measures for the manufacturing industry, therefore, aim at supporting a continuation of efforts undertaken by companies. Such policies encourage the use of renewable energies, greater energy efficiency and the implementation of an emissions trading regime. They are expected to produce GHG emissions reductions of 1.25 Mt of CO_2-equivalent per annum once fully implemented.

Agriculture and Forestry

Methane (CH_4) and nitrogen oxide (N_2O) are the two main GHGs produced by the agriculture and forestry industry. CO_2 is generated only as a result of the sector’s energy demand. Efforts will be made to extend ecological farming, cultivate oil-seed crops and extend the country’s vital forests. These measures are expected to reduce emissions by 0.4 Mt of CO_2-equivalent per annum once fully implemented, but maybe more depending on the development of future wood markets.

Waste Management

This category of GHG mitigation measures concerns itself primarily with waste incineration and only affects energy-related issues insofar as such facilities are equipped with CHP equipment. Estimated GHG emissions from this sector are 1.1 Mt of CO_2-equivalent per annum once the prescribed measures are fully implemented.

Fluorinated Gases

This sector emits hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). It is not directly related to energy policy areas. Austria hopes to reduce emissions in this sector by 1.2 Mt of CO_2-equivalent per annum once the prescribed measures are fully implemented.

International Initiatives / Kyoto Mechanisms

In order to assess to what extent Kyoto flexible mechanisms could contribute to the abatement of GHG emissions, the Austrian government is investigating both the use of Joint Implementation/Clean Development Mechanism (JI/CDM) activities and international emissions trading.

The country is currently developing the proper framework to take best advantage of the benefits JI/CDM projects can bring. Such a framework includes bilateral agreements ("Memoranda of Understanding" or MoU) between Austria and partner countries. The programme will begin with Central and Eastern European countries and then expand, as appropriate, to include other countries in Europe and the world. In 2002, the Ministry of Agriculture, Forestry, Environment and Water Management signed bilateral Memoranda of Understanding with the Czech Republic, Slovakia and Bulgaria for co-operation in the field of Joint Implementation. A similar MoU is being finalised with Romania.

The *Klimastrategie* recognises that the proper organisational structure for the support, identification, development and implementation of such projects needs to be developed. Plans to implement these projects include a standardised monitoring system and criteria for environmental and social integrity for projects carried out in developing countries. Furthermore, the *Klimastrategie* envisages agreements with Austrian industry (and other large groups of energy consumers) establishing how emissions reductions of JI/CDM projects could be most effectively credited to sector-specific emissions reduction targets.

Draft legislation for the Austrian JI/CSM programme has been prepared and was scheduled to enter into force on 1 January 2003. However, unpredicted elections in November 2002 have postponed the law's approval, currently expected in March or April 2003. Under the new legislation, project developers will be able to make project proposals. Selected projects would be subsidised in the preparation phase and, at the same time, it is envisaged that the Austrian government would buy the emissions reduction units that these projects would produce. The decisions regarding the JI/CDM projects would be governed by a secretariat to be chaired by the Ministry of Agriculture, Forestry, Environment and Water Management, and also including the Ministry of Foreign Affairs, the Ministry of Finance, the Ministry of Economic Affairs and Labour, and the Ministry of Transport, Innovation and Technology. The approval process would be in accord with international requirements (Marrakech Accords) and in close co-operation with the host country.

An Austrian Emissions Trading System is also under discussion. It is envisaged that the development of such a system would involve three distinct steps. First, emissions trading would take place exclusively within Austria and act as a pilot programme that would give valuable practical experience to both the relevant government agencies and the participating companies. Second, the emissions trading would become international, with trades taking place with other EU countries. Third, the system would be opened completely to include trades between Austria and any other country in the world as allowed under Kyoto regulations governing such activities. It is hoped that implementation of this system will encourage early adoption of and investment in clean energy technologies that could later benefit financially from the existence of such an international emissions trading scheme.

It is expected that four of the categories of the *Klimastrategie* emissions reduction measures would benefit most from the use of flexible mechanisms. Emissions reductions realised through these mechanisms would supplement and partly replace national measures. They are:

- **Space Heating and Small Consumption:** Projects for building refurbishment on the basis of JI might be attractive for the Austrian building trade.

- **Energy Supply:** Projects with Central and Eastern European countries could enhance Austria's position as a technology exporting country. These projects would aim to build up a sustainable energy provision system in the partner countries and to reduce energy service demand by demand-side management (DSM) activities (e.g. modernisation of appliances).

- **Waste Treatment:** JI/CDM could play a role in international projects that aim to reduce methane emissions from waste. Central and Eastern European countries may be the most attractive partners for such schemes.

- **Industry and Goods Producing Businesses:** The Kyoto mechanisms offer a wide range of possibilities for investments made by Austrian industry. This would include not only investments in the industrial facilities themselves, but also in the exportation of energy, waste treatment and transportation technologies.

The crediting of emission certificates from the JI/CDM projects would follow the corresponding UNFCCC rules. The Austrian government expects JI/CDM projects to yield GHG emissions reductions of 3 Mt of CO_2-equivalent by the time of the first Kyoto commitment window.

CRITIQUE

The greatest environmental challenge now facing Austria is the reduction of GHG emissions. The country has committed itself to lowering its GHG emissions by 13% below 1990 levels by the first Kyoto Protocol commitment period of 2008-2012. Since Austrian emissions have already increased by 2.7% from 1990 to 2000, the country now needs to enact an overall emissions reduction of 15.3% in less than ten years. This provides a very challenging goal for Austria. In order to meet this goal, the government has recently finalised the *Klimastrategie 2000-2008/2012*, a plan intended as a blueprint of measures to achieve the required reductions. This plan was adopted by the government on 18 June 2002.

The Austrian government should be commended for the comprehensive nature of the policy approaches included in the *Klimastrategie*. Measures suggested as emissions-reducing means cut across numerous disciplines, combining activities in energy supply with those in agriculture and waste management, among others. This top-down approach enabled the country to avoid a fragmentary climate change strategy whereby each industry and emission source develops separate approaches without effective co-ordination. The government should be further commended for the consultative process used in developing the report. Throughout the plan's development process, federal ministries, Länder governments, and industry and labour representatives were continually consulted. This not only improves the report by incorporating the expertise of these various groups, but also facilitates its acceptance by the relevant public and private parties since they have all had a stake in its development.

Austria must now take steps to implement the proposals included therein. In many cases, the *Klimastrategie* proposes measures which cut across the traditional lines of Austrian political institutions, for example involving both the Federal Ministry of Economic Affairs and Labour and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The Ministry of Transport, Innovation and Technology and the Ministry of Finance will also play important roles in many of the suggested measures. In addition, nearly all of these measures require the involvement of both the Austrian government and the private companies. Developing effective communication and co-ordination among government agencies and between the public and private sectors will be essential to realise the gains envisaged in the *Klimastrategie*.

Effective monitoring of progress made with the *Klimastrategie* will also be necessary to improve its chances of success. Such monitoring would entail both ensuring that suggested measures are implemented and reviewing their results once they have been put into practice. In many instances, implementation of measures will require legislative action and this must be pursued as soon as possible within the context of domestic political cycles. Implementation of other measures will require action by government agencies within the framework of existing regulations. These agencies should be mobilised quickly. Follow-up monitoring of programme results will allow Austria to adjust and improve climate change strategies and continually measure the progress the country makes in reaching its GHG emissions targets.

The favourable macroeconomic conditions projected to result from climate change policies call into question the utility of the forecast[12] used by the *Klimastrategie*. In short, the forecast predicts that the more emissions are reduced, the better the macroeconomic conditions would be, while the consensus of international analyses in this field concludes the opposite. A review of the emissions forecasts which looks at this issue could improve the accuracy of the projections and, hence, the viability of the *Klimastrategie*.

The cost-effectiveness of the *Klimastrategie* measures should be revisited as experience with the actual costs of policy implementation is gained. While cost-effectiveness was one of many factors considered in developing the *Klimastrategie*, its use as an important parameter was limited by the innovative nature of the measures and technologies and the resulting lack of reliable cost data. As a result,

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12. Described at length in the study: *Energieszenarien bis 2020* – "Energy Scenarios up to 2020" – commissioned by the Federal Ministry of Economic Affairs and Labour and the Federal Ministry of Agriculture, Forestry, Environment and Water Management, and conducted by the Austrian Institute for Economic Research (WIFO).

the *Klimastrategie* may have unwittingly included some measures that are more costly than some others it has omitted. Nevertheless, as experience is gained through actual implementation, cost-related data will become available. The Austrian government should therefore periodically revisit the mix of strategies and adjust it on the basis of these new cost data. In order to do so, it will be necessary for the government to establish an effective communication channel with the private sector in order to assess the financial impact that its climate change strategies are having on Austrian companies and citizens.

The transport sector has seen the greatest growth (in percentage terms) in CO_2 emissions since 1990. Such growth has come despite the introduction of substantial numbers of diesel-fired vehicles into the fleet over the same time. Addressing ways to mitigate emissions growth from this sector will be crucial in meeting the country's Kyoto targets.

RECOMMENDATIONS

The Government of Austria should:

- ☐ Conduct regular monitoring of the implementation and actual emissions reductions of the proposed *Klimastrategie* measures under close co-ordination between relevant ministries and between the public and private sectors.

- ☐ Review the GHG emissions forecasts used as the basis for the development of climate change policy.

- ☐ Revisit the cost-effectiveness of various *Klimastrategie* policies as cost experience is gained through their implementation.

- ☐ Examine the transport sector to ensure its optimal contribution to overall GHG emissions reduction strategy.

- ☐ Ensure an appropriate mix of domestic policies and flexible mechanisms with a view towards minimising the economic cost of climate change mitigation policies for the whole economy.

5

ENERGY EFFICIENCY

END-USE EFFICIENCY TRENDS AND OBJECTIVES

In 2000, Austrian energy intensity, as measured by a ratio of the country's TPES (in Mtoe) over its national GDP (in thousand US$ PPP), was 0.15 Mtoe/ 1 000 US$. This was 20% below the average of all OECD European countries which had an average energy intensity of 0.18 Mtoe/1 000 US$. Figure 13 compares Austrian energy efficiency with that of comparable countries and regions.

Austria's relatively low energy intensity compared to the IEA European average is due in part to different statistical counting of the country's extensive hydroelectric power[13]. More substantial causes include low energy intensity in the transport sector (resulting from the large share of diesel engines in the Austrian fleet), predominance of service industries in the country's economy and efforts to reduce public electricity use such as for street lighting. Figure 14 shows energy intensity by sector for Austria, other relevant countries, and the IEA European average.

Austria has followed international trends over the last thirty years by steadily decreasing its energy intensity. Figure 15 shows the reduction of energy intensity in Austria and selected countries.

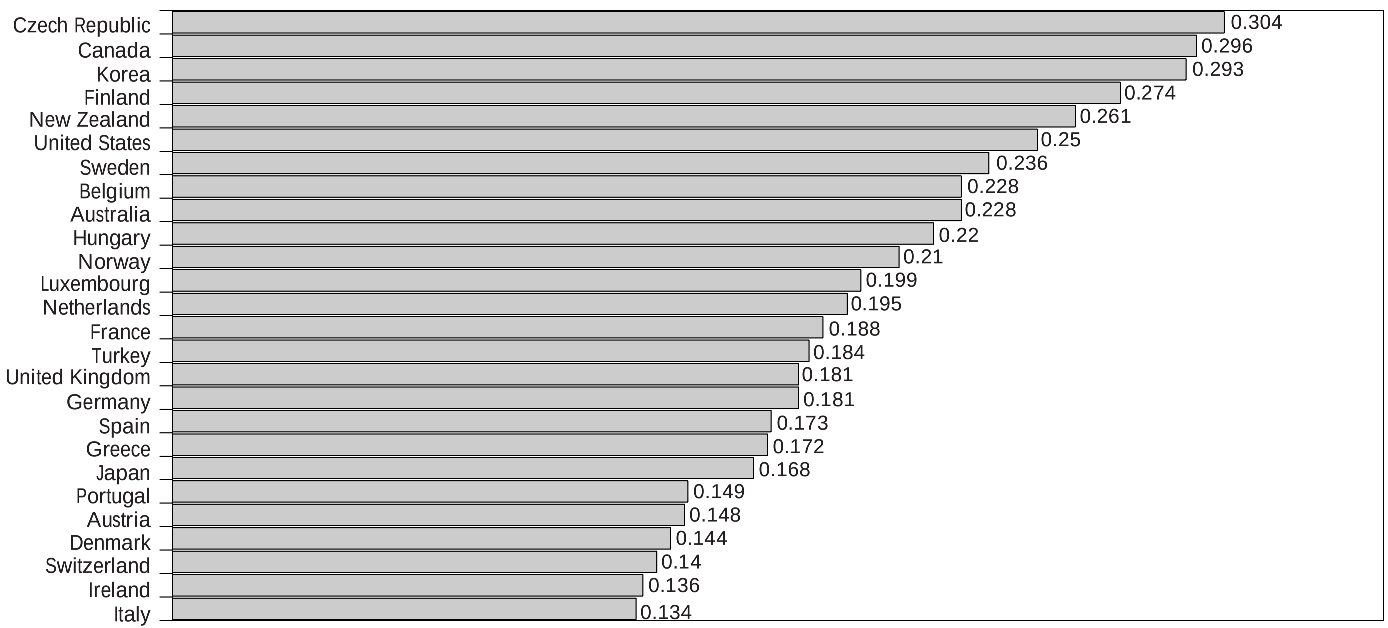
The government has recently announced plans to accelerate the reduction in its national energy intensity. In April 2002, the government published the Austrian Strategy for Sustainable Development (*Die Österreichische Strategie zur Nachhaltigen Entwicklung*) which establishes goals for the further reduction of the country's energy intensity (defined as national TPES per unit of GDP). The country is aiming for an average improvement of energy intensity of 1% per year beyond the normal improvements in this area that can be expected in the absence of any explicit policy initiatives. The report defines these normal energy intensity improvements to be the average EU decrease of energy intensity in the time period 1990-1997, which it estimates as 0.6% annually. Therefore, the total energy intensity improvement target is 1.6% annually. Such a target is identical to that put forth by the European Council for all EU countries in their resolution on energy efficiency issued on 7 December 1998. The main goal is to increase resource productivity in conjunction with increased economic growth in such a way as to

13. Hydropower is assumed to be 100% efficient for statistical purposes. So, 1 Mtoe used as electricity counts as 1 Mtoe towards the county's TPES. If that electricity had been generated by a thermal plant(fossil fuel or nuclear), the same 1 Mtoe of electricity consumed would require 1 / (0.40) = 2.5 Mtoe, assuming 40% efficiency for the thermal power plant. So hydroelectric plants are counted less in TPES statistics than thermal plants are for the same useful energy (i.e., electricity) consumed.

Figure 13

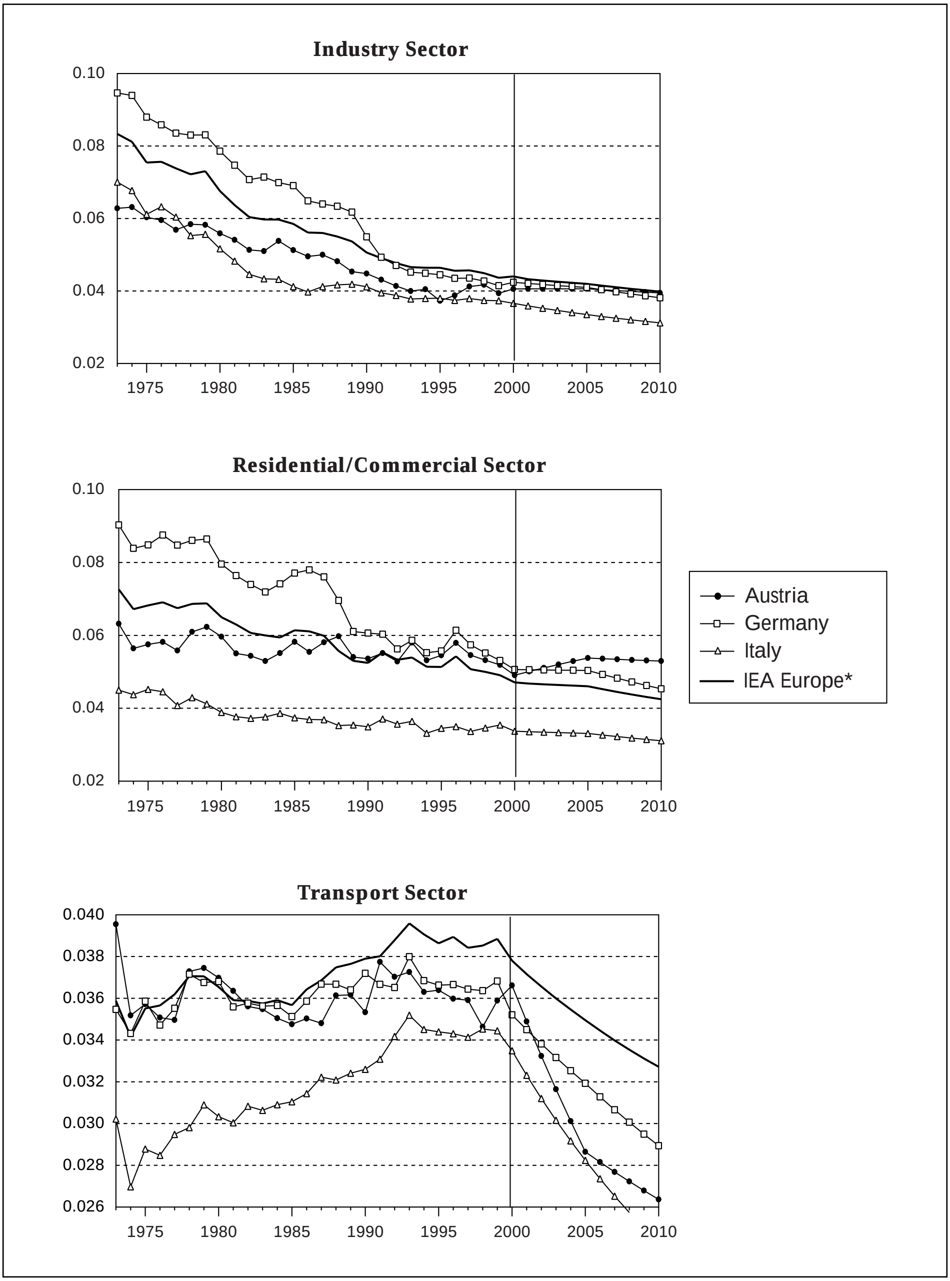
Energy Intensity in IEA Countries, 2001

(toe per thousand US$ at 1995 prices and purchasing power parities)



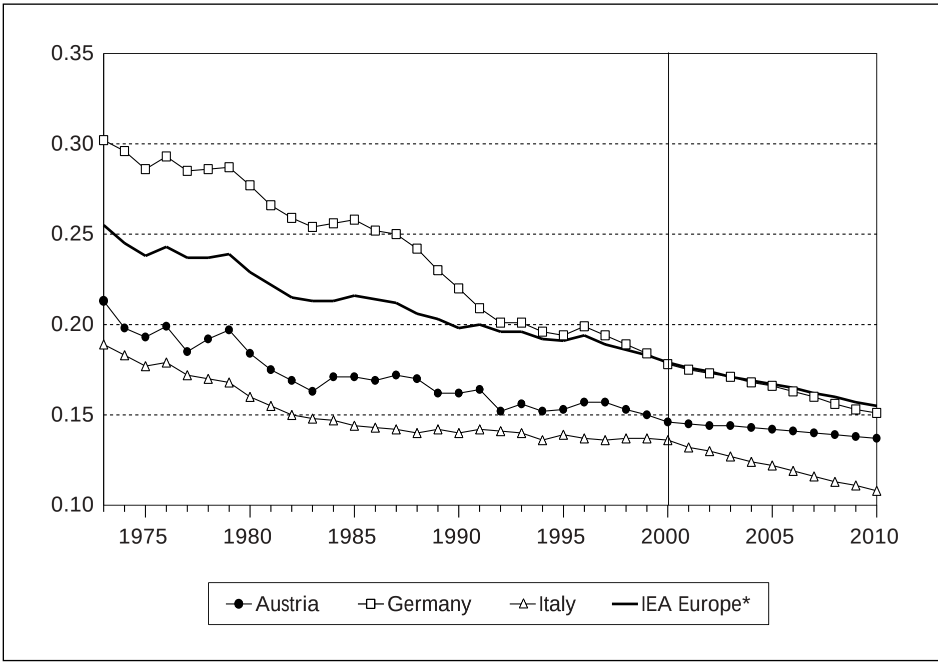
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *National Accounts of OECD Countries*, OECD Paris, 2002.

Figure 14
Energy Intensity by Sector in Austria and in Other Selected IEA Countries, 1973 to 2010
(toe per thousand US$ at 1995 prices and purchasing power parities)



* excluding Norway from 2001 to 2010.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002; *National Accounts of OECD Countries,* OECD Paris, 2002; and country submissions.

Figure 15
Energy Intensity in Austria
and in Other Selected IEA Countries, 1973 to 2010
(toe per thousand US$ at 1995 prices and purchasing power parities)



* excluding Norway from 2002 to 2010.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002; *National Accounts of OECD Countries,* OECD Paris, 2002; and country submissions.

engender a further decoupling of the country's economic prosperity from its final energy consumption. The report makes the avoidance of consumption of raw materials and energy a clear priority, the aim being a reduction in the overall consumption of resources in absolute terms.

DISTRICT HEATING AND COMBINED HEAT AND POWER PLANTS

District heating (DH) and combined heat and power (CHP) plants are widespread throughout Austria, and are often instrumental in meeting the heating and power needs of medium and large cities. District heating schemes produce approximately 12% of the country's heating and hot water, and 27% of the country's electricity. The city of Vienna has the most extensive such system which provides 50% of the city's power and 40% of its heat and hot water. In 2001, the four CHP plants that serve WienStrom, the Viennese energy utility, had a combined electric capacity of 1 050 MW. They operated at a 35% capacity factor over the year and produced

3 255 GWh of output. In additional to such municipal facilities, industrial plants also make use of CHP technology.

CHP has long been supported by the regulatory structure in Austria. In order to survive financially, the majority of Austrian CHP plants require tariffs per kilowatt-hour of electricity above pure market prices. As a result, the Austrian Energy Liberalisation Act allows the Länder to pay CHP plants for their power at rates higher than those of other generation options. Industry experts estimate that the average cost of CHP-provided power would be approximately 5 € cents/kWh while system marginal cost throughout the year would average 3 € cents/kWh. The regulations allow the utilities to recover these additional costs through tariff supplements imposed on all electricity grid users. These payments are in a per kilowatt-hour form. The Land of Vienna makes the most extensive use of CHP plants. To support this system, each Viennese customer pays an additional 0.7427 € cents per kWh of electricity consumed, which goes into a fund used to pay for power coming from CHP facilities. Based on the average retail residential rates for electricity in Vienna of approximately 15 € cents/kWh, the CHP surcharge represents a 5% increase in customers' electricity bills.

While the original Energy Liberalisation Act gave the Länder full discretion in setting these rates as they chose, legislation making its way through the Austrian Parliament establishes one CHP tariff for the entire country. However, neither the original law nor the 2002 update make provisions for the continuation of this system after 2004. No alternative policy for the support of CHP facilities has gathered sufficient political momentum to be considered as a probable replacement to the current support scheme.

ENERGY EFFICIENCY INSTITUTIONS AND INSTRUMENTS

Energy efficiency plays an integral role in Austria's overall energy policy. As previously mentioned, the government recently announced a target of improving the country's energy intensity by 1.6% annually. Government institutions which are working to realise this goal exist on both the federal and the Länder level. In addition, the country engages in international energy efficiency activities, particularly through its EU membership.

On the federal level, the Ministry of Economic Affairs and Labour and the Ministry of Agriculture, Forestry, Environment and Water Management both have a number of agencies under their jurisdiction which promote the efficient production, transformation and consumption of energy. Federal regulations governing the electricity market have a particular effect on national energy efficiency through their support of CHP plants. Lastly, the Ministry of Finance controls taxation of all energy products and can influence consumption patterns with that fiscal tool.

On the Länder level, the state governments are in charge of the legal instruments for energy conservation, primarily building codes which establish required insulation levels and other energy-related standards. State governments also support energy conservation projects through subsidies. They receive 11.84% of total electricity and natural gas taxes collected at the federal level in order to cover these subsidy expenses. In addition, the current electricity regulatory structure leaves at the discretion of each Land the amount and manner in which to support local CHP and DH plants.

The primary international involvement influencing national energy efficiency is Austria's membership with the EU. Austria relies on EU efficiency standards for both home appliances and fluorescent ballast lighting. In addition, the country is involved in the EU SAVE (Specific Actions for Vigorous Energy Efficiency) initiative, a forum for the comparison and exchange of energy efficiency data among member countries.

One private-sector initiative which has historically promoted energy efficiency is a series of electric utility programmes encouraging demand-side management (DSM). Such programmes were carried out by both individual utilities and the Association of Austrian Utilities and included information dissemination, load management to reduce peak demand (through real-time prices and interruptible service) and subsidies for energy-saving appliances. Partly as a result of the liberalisation of the electricity sector, these utilities have cut back on these programmes drastically.

Industrial Energy Efficiency and Conservation Policies

The Austrian government has not established regulatory constraints on industry which mandate minimum energy efficiency standards in the industrial sector. This is partly because of the diversity of production processes in the sector itself and the consequent difficulty in establishing standards which can be applied across different systems. And partly because of the government's federal structure and the corresponding authority held by the Länder governments which make it difficult to sustain nationwide such standards. While industry is subject to environmental laws which can affect energy efficiency, the government's greatest influence in this area is through the financial support of energy auditing and investment in efficient systems. These support systems are described below.

Energy audits of industrial companies are carried out by the Austrian Association of Energy Consumers (ÖEKV). This federal information scheme is funded by the Federal Ministry of Economic Affairs and Labour and, as a result of the financial support, audits are free of charge for the interested companies. The underlying service contract (between ÖEKV and the ministry) for the year 2001 was the 13th of its kind.

Since the programme's inception in 1980, approximately 550 companies have been audited. These audits are intended to show the industrial companies ways in which they can save on their energy use. In addition, since many companies are reluctant to invest in activities not directly connected to their core business, ÖEKV also proposes concrete measures for improvement which have demonstrated payback periods of less than two years. Companies taking advantage of this programme include those working in chemicals, stone and ceramics, pulp and paper, textiles and metal processing.

From 1998 through 2001, this programme worked with 89 companies. These audits identified 171 GWh of annual energy savings potential, an amount equal to 8.1% of these firms' total energy use. For the period from 1998 to 2000[14] the audited firms consumed a total of 2 297 GWh, an amount equal to 1.0% of the total energy consumed in the industrial sector over that time and 0.3% of the country's total final consumption. The targeted potential savings from this programme are equal to 0.8% of the country's total final energy consumption. No comprehensive monitoring system has tabulated data on the actual realisation of these potential projects or the amount of energy that was ultimately saved. Table 6 provides a summary of this project over the last four years.

Table 6

Results of Industrial Energy Efficiency Audits Conducted by ÖEKV

	1998	*1999*	*2000*	*2001*
Number of Companies Audited	26	25	25	13
Potential Energy Savings Identified (MWh annually)	101 000	29 400	13 200	28 000
Potential Energy Savings as % of Companies' Total Usage	10.0%	3.0%	4.3%	8.3%

Source: Country SLT submission.

Industrial energy conservation is also promoted through the Environmental Support Programme. This initiative is managed by a special-purpose bank called Österreichische Kommunalkredit (ÖKK) on behalf of the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Under this federal scheme, companies can obtain subsidies for thermal improvement of buildings, other energy efficiency measures, or connection to the municipal district heating and/or CHP systems. From 1998 through 2000, total subsidies issued through the Kommunalkredit were €12.4 million. Total investments in energy efficiency resulting from these supports amounted to €55.0 million. No data exist on the energy efficiency improvements realised from these investments. Detailed information on the level of subsidies is shown in Table 7.

14. Statistics on total Austrian industrial energy use are not yet prepared for 2001, so one can only look through 2000. Nevertheless, there is no reason to believe that the three years of data from 1998 to 2000 are not representative, or that 2001 figures would be appreciably different.

Table 7
Support and Investment in Industrial Energy Conservation

	Subsidies from Kommunalkredit (million €)			
	1998	*1999*	*2000*	*Total*
Thermal Improvement	0.60	1.20	1.80	3.60
Connection to DH	0.20	0.40	0.50	1.10
Connection to CHP	..	4.80	0.30	5.10
Other Measures	1.20	1.00	0.40	2.60
Total Subsidies	2.00	7.40	3.00	12.40
	Total Investments (million €)			
	1998	*1999*	*2000*	*Total*
Thermal Improvement	2.60	5.00	6.80	14.40
Connection to DH	1.10	1.40	1.70	4.20
Connection to CHP	..	23.00	1.10	24.10
Other Measures	5.10	5.80	1.40	12.30
Total Investments	8.80	35.20	11.00	55.00

Apart from the two schemes described above, there are approximately 30 additional programmes at the Länder level for the support of various energy efficiency measures in the manufacturing sector.

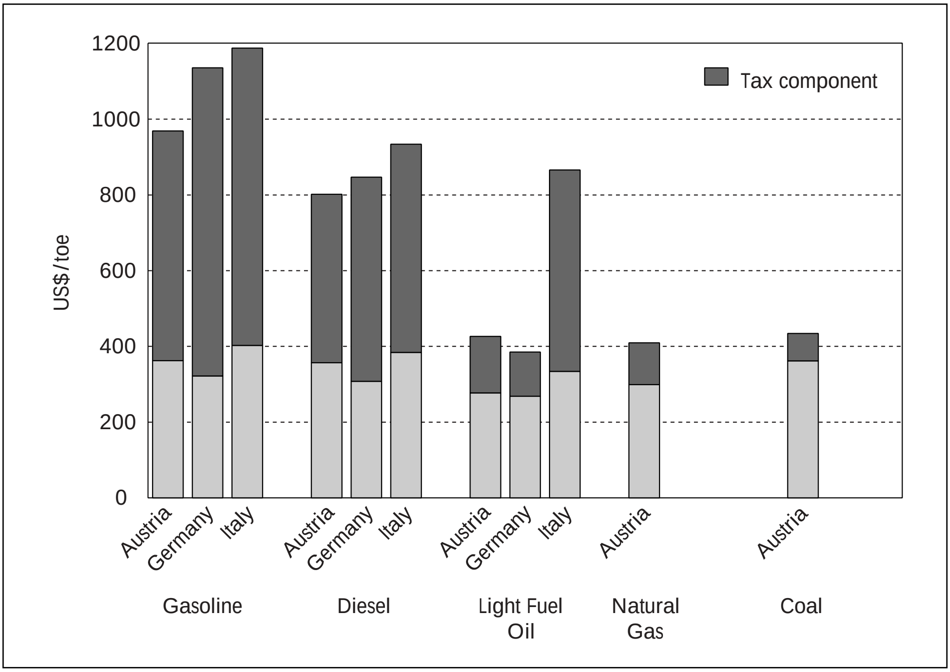
From June 2000 until autumn 2001, EVA, the Austrian Energy Agency, together with partners from Italy and Norway, worked on a project concerning the implementation of Long-term Agreements (LTAs) on energy efficiency in the industrial sector. Various forms of LTA were examined with regard to the elements necessary for success and the possibilities for implementation in Austria. The objective was to determine the optimal design of the LTAs to ensure their successful integration into the mix of Austria's energy efficiency policy instruments.

Transportation Energy Efficiency Programmes

In 1992, a tax on the standardised fuel consumption of vehicles (Normverbrauchs-abgabe/NoVA) was introduced. The NoVA is paid when a vehicle is purchased and is directly proportional to the vehicle's fuel consumption. Austria also has engine-related insurance tax. This tax is paid every month on every vehicle that is publicly registered and its calculation is based on engine performance. Austria also has differential tax treatment of the two major liquid fuels for motor vehicles. Higher taxes for gasoline in relation to diesel fuel provide drivers with financial incentives to purchase diesel-fuelled cars. Figure 16 shows the tax treatment of the different fuels for Austria and selected countries.

Figure 16

Fuel Prices and Taxes in Austria and in Other Selected Countries, 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

This level of fuel taxation has not increased since 1995.

This tax differential favouring diesel fuel is one of the major reasons that more than 60% of new cars entering the market now are diesel-fuelled. Overall, between 40% and 50% of the current fleet of all Austrian cars are run with diesel engines.

Residential and Commercial Energy Efficiency

The Federal Constitution allocates responsibility for the energy efficiency of buildings to the Länder. This issue is addressed for the most part through general building codes. In order to benefit from a nationally co-ordinated approach in this field, the federal government and the Länder themselves entered into an agreement whereby the Länder agreed to undertake strict energy efficiency regulations. This agreement identified the following energy use reduction goals to be reached by 2010: 3.6 TWh annually for new buildings and 21.3 TWh annually for existing buildings. The European Commission has recently presented a proposal concerning the energy performance of residential and commercial buildings and, as a result, this area will very likely undergo a major revision.

Energy efficiency of household appliances is promoted through mandatory EU labelling regulations, which currently cover refrigerators, freezers, washing machines, tumble dryers and dishwashers. In November 2000, the EU directive on energy efficiency requirements for ballasts for fluorescent lighting came into force. The objective of this legal instrument is to reduce the energy consumption of ballasts for fluorescent lighting by means of a transition to more efficient ballasts. Austria has already implemented the directive, and the corresponding decree was published in June 2001.

Energy efficiency measures for buildings such as insulation and connections to district heating systems are given various forms of support by all nine of the Länder governments. This support comes in the form of loans, subsidies, and sureties. In 1998, 41 803 dwellings benefited from such measures resulting in €431.8 million of total expenditures leveraged by €112.9 million of government support. In 1999, 33 736 dwellings benefited from such measures resulting in €228.8 million of total expenditures leveraged by €81.4 million of government support. In total for households there are 26 programmes for the support of various energy efficiency measures and 21 programmes for financial support in connection with district heating. No comprehensive monitoring is implemented to show the amount of energy that was ultimately saved through these programmes.

Federal Buildings

In March 2002, the Federal Ministry of Economic Affairs and Labour together with the Federal Ministry of Agriculture, Forestry, Environment and Water Management started an initiative on third-party financing of energy efficiency measures for federally-owned public buildings. (This programme follows a successful pilot project in 64 federally-owned school buildings with total usable floor-space of more than 500 000 m^2.) A management group consisting of representatives from the Bundesimmobiliengesellschaft (the company which owns the federal public buildings), ministries using energy, the Federal Ministry of Economic Affairs and Labour and external consulting firms was established. This group has selected the targeted buildings, categorised them according to relevant criteria and begun to issue requests for proposals to contractors. The potential annual savings of energy costs after the implementation of all such projects is estimated to be €6.5 million annually.

Energy Efficiency Monitoring

Monitoring the progress of energy efficiency policies and programmes is done at both the overall national level and the individual project level. The calculation of national energy efficiency indicators is conducted as part of the overall energy statistics system in Austria. As mentioned above, the country also participates in the EU's SAVE initiative which includes working with the "Cross-Country Comparison of

Energy Efficiency Indicators". This programme seeks to improve the manner in which member states share energy efficiency data and report indicators of programme and policy successes. Monitoring is also done on a project-by-project basis. Subsidy beneficiaries are obliged to show that money received is used for its intended purpose and also to report the degree of energy savings that such investments have facilitated. However, no comprehensive system exists to systemically monitor the progress achieved by subsidy beneficiaries.

CRITIQUE

Like other OECD countries, Austria has steadily improved its energy intensity over the last thirty years. From 1971 to 2000, Austrian energy intensity has fallen by 1.2% annually, the same rate as the average of all OECD countries in Europe. Recently Austria has laid out very ambitious targets to improve national energy efficiency and energy intensity at an accelerated rate. The new Strategy for Sustainable Development calls for a reduction in energy intensity of 1.6% annually. In order to achieve this goal, Austria must continue to promote energy efficiency measures in an effective manner.

In order to achieve the required effectiveness of the energy efficiency initiatives, all efforts within the sector must be well co-ordinated. Currently, there is a degree of fragmentation within this field which undermines its effectiveness. For example, the Ministry of Economic Affairs and Labour supports the Austrian Association of Energy Consumers while the Ministry of Agriculture, Forestry, Environment and Water Management supports the Kommunalkredit, despite the fact that these two government entities both work to improve industrial energy efficiency. Closer and consistent co-ordination would also benefit the additional 30 programmes which address industrial energy efficiency. On the residential side, there are 26 programmes for the support of various energy efficiency measures and 21 programmes for financial support in connection with district heating. An attempt at either consolidation or greater co-ordination of activities could make these initiatives more effective.

Effective monitoring of policy performance is also essential if Austria is to reach its energy efficiency targets. While energy intensity is monitored at the national and sector levels, less complete records are kept of efficiency improvements resulting from government support programmes. These programmes appear well designed and targeted, but it is difficult to measure their success without a comprehensive system which monitors actual savings achieved. Such a system could be used to modify, strengthen and sometimes even cancel energy efficiency programmes. In addition, the development of a standard of measurement that could be applied across the government's sundry programmes would very much aid this assessment process. While a single assessment parameter such as energy saved per unit of taxpayer money spent might be too difficult to calculate, some type of accepted measurement standard (or standards) would be very helpful in assessing the effectiveness of different energy efficiency programmes.

It is commendable that many Austrian energy efficiency programmes effectively leverage public funds with private funds to increase the size of the total investment made in energy efficiency projects. For example from 1998 to 2000, €12.4 million in government support in the industrial sector was able to produce total energy efficiency investments of €55 million. In the residential sector from 1998 to 1999, government support of €194.3 million produced total energy efficiency investments of €660.6 million. Government spending which acts as a catalyst for private-sector investments not only expands the size and scope of efficiency measures, but also ensures continued private-sector participation in the investments' success for the life of the project.

CHP continues to play an important role in the efficient transformation of energy in Austria. While CHP facilities currently receive financial support in the form of above-market payments for their electricity, this subsidy system is scheduled to terminate at the end of 2004. In Austria, the technology's seasonal production pattern (i.e., greater power generation in the winter when heat is required) fits well with the country's overall power generation pattern (i.e., reduced generation in the winter owing to seasonal precipitation). Despite this apparent advantage, the country's CHP systems as a whole only operate at a 35% capacity factor. Such a low figure gives rise to high system costs, and the consequent need for government subsidies in order to remain in operation.

Policies supporting CHP should be carefully designed to induce efficiency improvements and eventually lead to a phase-out of all such subsidies. A gradual lowering of the support levels for CHP will encourage facilities to increase efficiencies or otherwise improve operating costs in order to remain economically viable. The rate of this subsidy reduction could be based on a benchmarking system which incorporates cost and performance data from CHP facilities in different Länder and in selected EU countries. Upon final elimination of the subsidies, certain inefficient CHP facilities would close while others would continue to operate profitably at a more efficient level without reliance on subsidies.

RECOMMENDATIONS

The Government of Austria should:

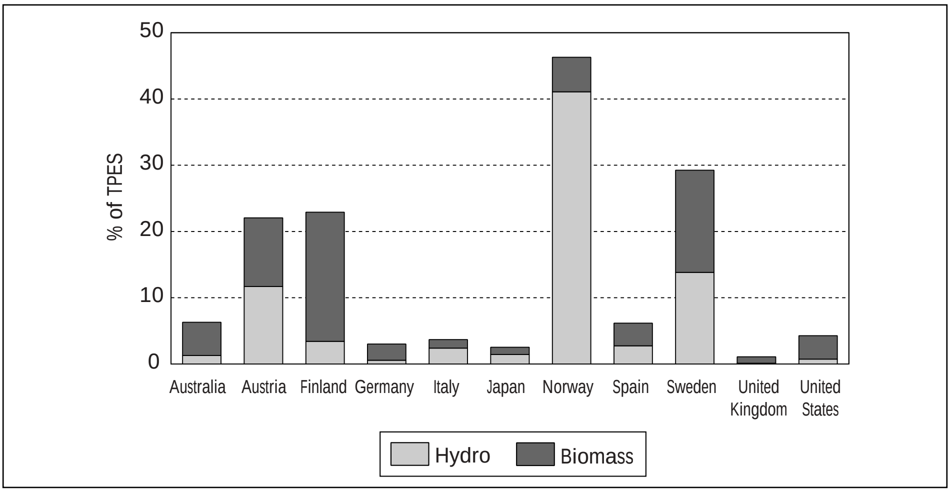
- Further improve co-ordination among the many bodies and programmes which address energy efficiency in the country.
- Institute an effective monitoring scheme for government-sponsored energy efficiency programmes to measure their efficacy in order to both improve them and ascertain their cost-effectiveness.
- Review the support scheme for CHP plants, including its continuation after 2004. Maximise CHP's cost-effective contribution to meeting environmental goals through such measures as a gradual lowering of the support levels in accordance with a benchmarking system which includes minimum efficiency standards.

RENEWABLE ENERGY

POTENTIAL AND PRODUCTION OF RENEWABLES

Among renewables, large-scale hydropower and biomass are both major contributors to Austria's energy portfolio. The use of large-scale hydropower and biomass in Austria is among the highest in Europe. Figure 17 shows the TPES percentage shares of these energy sources for Austria and selected IEA countries.

Figure 17
Large-scale Hydro and Biomass Contributions to Total Primary Energy Supply in Selected IEA Countries, 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002

Large-scale Hydropower and Biomass

In 2000, hydropower provided 3.6 Mtoe to the country's TPES, or 12.6% of the total. Hydropower dominates the electricity sector, consistently generating approximately 70% of all power consumed in Austria. In 2000, run-of-river plants generated 31 128 GWh of electricity and provided 5 245 MW of generating capacity while storage power plants generated 12 412 GWh of electricity and provided 6 403 MW of generating capacity. Large-scale hydropower is not the beneficiary of any government support as are other renewable resources. It is discussed in greater detail in Chapter 9.

Biomass

In 2000, biomass (comprises solid biomass, biogas, industrial waste and municipal waste) provided 3.1 Mtoe to Austria's TPES, or 10.9% of the total. Approximately 60% of all biomass consumption in the country is used for rural space heating. The other 40% is used in the pulp and paper industry, particularly black liquor, district heating facilities, and to a lesser extent, through waste incineration plants. About 600 000 biomass boilers are in use at present, including 70 000 log-fired modern boilers and about 27 000 modern biomass boilers fired with wood-chips and pellets. Overall, the Austrian industrial sector covers 10% of its energy demand through biomass and biogenic waste incineration.

The average efficiency of residential biomass boilers is slightly less than 50%. New models under development have demonstrated up to 90% efficiency in the laboratory, and are expected to achieve efficiencies of about 75% in field conditions. The use of biomass for space heating is falling, however, in large part because of the economic advantages provided by home heating oil. However, the development of new automatic fuelling systems for pellet-fired boilers is acting to reverse that trend. Currently, installation of pellet-fired systems is more expensive than oil-fired systems but the pellets themselves are less costly than oil. In the year 2000, almost 3 500 pellet-fired central heating systems were installed.

The use of bioenergy (e.g. wood-chips) in regional district heating systems is significant. By the end of 2000, 587 biomass district heating systems with a total capacity of 730 MW were in operation, predominantly in rural areas. In 2000 alone, 86 new such systems went into operation. During the period from 1986 to 2000, more than 31 200 central heating systems (up to 100 kW capacity) were installed in Austria with a total heating capacity of 1 175 MW. The medium-sized systems (100 – 1 000 kW) amounted to more than 2 700 units with a total thermal capacity of around 780 MW. During the same time period, 391 units with a capacity of more than 1 MW went into operation with a cumulated thermal capacity of 888 MW.

Other Renewables

In addition to the substantial hydropower and biomass usage, Austria has numerous other renewable resource options. These resources and their contributions to TPES in 2000 are shown in Table 8[15].

Table 8

Austrian Renewable Resource Contribution to TPES, 2000

	Contribution to TPES	
Renewable Source	*ktoe*	*% of National TPES*
Small (<10 MW) Hydropower	378	1.3
Renewable Municipal Solid Waste	56	0.2
Solar Thermal	47	0.16
Geothermal	13.6	0.05
Liquid Biomass	13.0	0.05
Wind	5.8	0.02
Solar Photovoltaics	0.3	< 0.01

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002; "Electricity in Austria, 2000", Association of Austrian Electricity Companies and Austrian Federal Load Dispatcher.

15. This table does not include large-scale hydro or primary source solid biomass, but it does include other types of energy supported by government support schemes, including small hydropower (< 10 MW) and biomass for power generation.

Facility types and numbers (as of year end 2001) are shown below:

- 1 690 hydropower plants of <5 MW capacity connected to the grid[16].
- 4 000 to 5 000 hydropower plants of <5 MW capacity not connected to grid.
- 100 biogas plants.
- 15 landfill gas plants.
- 85 sewage gas plants.
- 20 combined heat and power plants for biomass and black liquor.
- 130 wind converters.
- 4 900 kW (peak) photovoltaic converters (3 200 kW connected to grid).
- 2.18 million square metres of solar thermal collectors.

The 2.18 million square metres of thermal solar collectors represents 0.27 square metres per resident, among the highest ratios in European countries. In addition, approximately 149 000 heat pumps and 7 biodiesel refineries are in operation.

RENEWABLE INSTITUTIONS AND POLICY TARGETS

Institutions

The monitoring and support of renewable energy in Austria is carried out by a number of government bodies. The Ministry of Economic Affairs and Labour promotes renewable energy through its role as the ministry responsible for the energy sector in general. The Ministry of Agriculture, Forestry, Environment and Water Management contributes through its specific support for the environmental benefits of renewable energy technologies. In addition, E-Control Ltd, the body which monitors electricity liberalisation, oversees several aspects of renewable energy which relate to the newly liberalised electricity sector.

Potential for Renewable Energy

The Ministry of Economic Affairs and Labour and the Ministry of Agriculture, Forestry, Environment and Water Management jointly commissioned a study which

16. Hydropower facility numbers for 1998.

analysed the possibilities and potential for renewable energy sources in Austria[17]. This study, published in 2001, examines the current state of the country's renewable energy sector and the factors that will shape its growth in the future.

The authors conclude that there is a substantial technical potential of as yet under-developed renewable energy sources in Austria[18]. According to the analyses performed, the following increases in renewable energy production are possible.

Table 9

Potential New Renewable Energy Usage by 2010

Renewable Source	*Current Contribution*	*Additional Contribution from New Sources (2010)* TWh	*Additional Contribution from New Sources (2010)* PJ	*% Increase in Contribution*
Electricity Generation:				
Wind		2.7	9.6	
Photovoltaics		0.1	0.2	
Biomass		7.8		
Landfill Gas and Sewage		0.6		
Geothermal		0.0	0.1	
Small Hydro		5.7		
Electricity Total	**17.1 PJ**	**6.8**	**24.0**	**140**
Heat Generation:				
Biomass		54.0		
Solar Thermal		2.2	7.8	
Heat Pumps		1.2	4.3	
Geothermal		1.0	3.6	
CHP (all fuels)		0.5	1.9	
Heat Total	**108 PJ**	**20.2**	**71.6**	**67**
Biofuels Total	**1 PJ**	**0.8**	**3.0**	**300**

The authors acknowledge, however, that substantial barriers exist that will impede the introduction of this level of new renewable energies' contributions. These barriers include the high investment costs of most renewables and the often questionable financial viability of the technologies. The authors also point to investor insecurity about the technical maturity and reliability of renewable energy technology in general.

17. *Strategy for the further promotion of renewable resources in Austria with special consideration of the EU's White Paper on renewable energies and to the Campaign for Take-Off*, published in July 2001 by Reinhard Haas, Martin Berger and Lukas Kranzl, all of the University of Vienna.
18. The authors exclude large-scale hydropower and existing biomass in their analysis.

Targets for Renewable Energy

Austria currently has two sets of targets for the increase of electricity generated by renewable energy in the country[19]. The first set of targets is part of the electricity liberalisation laws. These laws mandate that Austrian electricity suppliers source a minimum percentage of their power from renewable resources. The first such requirement involves small hydropower plants. As of 1 January 2002, electricity suppliers must get at least 8% of their power from small hydropower stations, defined as facilities with a rated capacity of less than 10 MW. The second such requirement involves non-hydroelectric renewable energy technologies. Electricity suppliers must source a minimum percentage of their power from non-hydroelectric renewable resources according to the following schedule: 1% in 2001, 2% in 2003, 3% in 2005, 4% in 2007. The details of these schemes are discussed below in the section on support mechanisms.

The second set of targets for the increase of renewable energy use in Austria is the EU Directive 2001/77/EC. This directive, adopted on 27 September 2001, establishes targets for shares of renewables in electricity production that all member states are expected to have by 2010. For Austria, the directive establishes a goal of having 78.1% of gross electricity consumption coming from renewable resources by this time. Currently 70% of Austrian electricity comes from renewable resources[20]. The directive gives member states until 27 October 2003 to enact the laws, regulations and administrative provisions required to meet these targets. Unlike the internal targets of Austria described above, the directive does include large hydropower in its definition of renewable energy sources.

RENEWABLE ENERGY SUPPORT MECHANISMS

In order to meet these targets, overcome the obstacles faced by renewable energy and integrate new renewable energy sources into the liberalised electricity market, the government has instituted two separate mechanisms to support electricity generation from renewable resources. The first is a feed-in tariff which provides above-market prices to power from renewable resources. The second is the pair of minimum renewable sourcing requirements that electricity suppliers must meet.

Feed-in Tariffs

In the feed-in tariff system, Länder-level utilities are required to pay for electricity which comes from renewable sources at above-market rates established by government authorities. The original legislation implementing feed-in tariffs

19. These target systems as well as the feed-in tariff system were modified by legislation passed in August 2002 which will usher in a more nationally unified approach to renewable energy support starting at the beginning of 2003.
20. This percentage can vary from year to year depending on precipitation levels and the corresponding output from the country's hydroelectric facilities. In 2000, hydropower accounted for 70.4% of electricity generation with other renewables contributing approximately 0.1%.

allowed each Land to determine the feed-in tariffs for its territory. Legislation passed through the Austrian Parliament in the summer of 2002, however, modified the system so that feed-in tariffs now are established nationally by the Federal Ministry of Economic Affairs and Labour. Different feed-in tariffs are established for every renewable resource eligible for such support. As a result, each Land now has one tariff for wind power, another for photovoltaic power, etc. The tariffs are set at prices which make generation from each renewable resource competitive. For the majority of Länder, obligations to purchase power from these sources at the prescribed feed-in rate are in place only up to certain levels of generation. Once a utility buys a certain amount of power from these sources, it has no obligation to purchase any additional power from that source.

Under the previous system, the feed-in tariff levels varied widely from Land to Land. For example, wind power in Vorarlberg received over 30% more per kilowatt-hour than it did in Tyrol. In Carinthia, a producer received twice the price for electricity generated from photovoltaics than he would receive for the same power in Tyrol. Table 10 shows representative feed-in tariffs for three different Länder.

Table 10
Representative Feed-in Tariffs, 2001

Renewable Energy Source	*Tariffs for Each Land (€ cents/kWh)*		
	Tyrol	*Vorarlberg*	*Carinthia*
Wind Power	8.28	10.90	10.75
Solid Biomass	5.25 – 8.28	9.44 – 15.98	6.69 – 17.45
Liquid Biomass	8.28 – 11.04	14.53	7.27 – 14.50
Gaseous Biomass	8.28 – 11.04	12.42 – 15.98	12.45 – 16.00
Sewage and Landfill Gas	5.52	9.01	9.00
Photovoltaic	35.88	36.33 – 72.67	54.50 – 72.70

Source: E-Control Jahresbericht 2001.

Differences in the feed-in tariffs among the Länder were a function of three factors. The first was the political support for renewable energy in the respective Länder governments. The second is the methodology used to calculate the feed-in tariffs. There was no established methodology across the Länder. Differences in the methodology used to calculate a "competitive price" gave rise to substantial discrepancies in the feed-in tariffs among Länder. There were no established national parameters on the capital or operating costs of these technologies or on an expected rate of return on investments. The third source of feed-in tariff variation across the country was the Länder's uneven climatic and geographic characteristics. For example, a Land which has wind patterns conducive to the production of wind power generally had lower feed-in tariffs for the purchase of wind power than had another Land with poor wind patterns. However, the correlation with advantageous natural characteristics and lower feed-in tariffs was highly inconsistent across the country. For example, Table 10 shows that Carinthia had significantly higher feed-in tariffs for photovoltaic (PV) power than both Tyrol and Voralberg and yet is one of Austria's most southern Länder. Its location gives Carinthia correspondingly high insolation making PV power less expensive, which in turn would require lower rather than higher feed-in tariffs.

The higher prices paid for power coming from renewable energy represents a cost that is eventually paid by electricity customers. The E-Control estimates that in 2000, the total cost for the feed-in tariffs was approximately €29 million and that this cost is expected to rise to €94.5 million by 2007 if Austria is to meet its 4% goal for electricity generated from non-hydro renewables. Electricity customers pay these costs through a "green" power surcharge added to the system access charge placed on every consumer's electricity bill. This surcharge is added to each kilowatt-hour that the utility sells and, as a result, customers' contribution to paying for renewable energy is directly proportional to the amount of electricity they consume. The surcharge is made explicit in customers' electricity bills. (This "green" surcharge covers not only the feed-in tariffs, but also the additional costs of purchasing CHP power for those Länder that do so.)

The national average for these green surcharges is 0.0727 € cents/kWh. Based on the national average (tax included) price of 13.35 € cents/kWh for domestic customers estimated by the E-Control, this average green surcharge is equal to 0.54% of the average customer's residential bill. Table 11 shows the green surcharge for representative utilities as well as the national average.

Table 11

Representative "Green" Surcharges, 2001

Land	*Surcharge (€ cents/kWh)*
Tyrol	0.060
Voralberg	0.081
Styria	0.029
Carinthia	0.140
National Average	0.0727

Source: E-Control Jahresbericht 2001.

Minimum Level of Contributions from Small Hydroelectric Plants

As of January 2002, each electricity supplier must source at least 8% of the electricity it sells from small hydropower facilities with capacities at or below 10 MW. This requirement is administered via a mini-hydropower certificate trading system. The certificates are issued at the end of each month when the grid operators report the energy produced by small hydroelectric stations around the country. One certificate is issued for every 100 kWh of power generated from mini-hydropower plants. These certificates are automatically credited to the owners of the small hydropower stations which generated the electricity. Suppliers who do not own sufficient small hydropower capacity may purchase certificates from those suppliers that have excess small hydropower capacity. Every six months, the E-Control checks to ensure that each supplier is in possession of certificates equal to 8% of the energy they sold. If suppliers have an insufficient number of certificates, they are reminded of the shortfall and given a grace period to correct their shortfall. If the situation is not remedied, the Land levies a charge on the electricity supplier for failure to comply with his small hydropower requirement. The Länder are in the process of debating how best to make use of these collected fees. In 2000, small hydro generated 7.1% of the nation's electricity. Industry experts believe this has risen to approximately 8% by now, although at times it may be more or less depending on electricity demand and weather conditions.

Minimum Level of Contributions from Other Renewable Resources

Electricity suppliers are also required to meet a certain percentage of all electricity supplies with non-hydroelectric renewable resources, including wind, solar, geothermal power; solid, liquid or gaseous biomass generation; or sewage or landfill gas facilities. Incinerators fired by waste or sewage plants are not recognised as fulfilling this requirement. Starting in 2001, 1% of total energy supplies had to be met by some mix of these sources. That level will rise to 2% in 2003, 3% in 2005 and settle at its final level of 4% in 2007. The requirement for suppliers to source their power from these non-hydroelectric renewable sources cannot be met via a system of trading or swapping. That is to say, each supplier must either own the facilities which generate electricity from renewable sources or must contract directly with a third party for its purchase. In 2000, renewable resources supported under this minimum requirement system accounted for 0.12% of the country's total electricity generation.

Electricity Source Information Disclosure

Regulations also encourage disclosure to consumers of all electricity sources as a means of encouraging demand-side support for renewable energy. Since October 2001, electricity traders and other suppliers of Austrian final customers have been obliged to disclose in electricity bills the percentage shares of the energy sources that are used to generate their electricity. However, while the customers can see the overall cost of this energy mix, there is no requirement to itemise the cost associated with each component of this mix. Austria was one of the first EU member states to require source labelling for electricity suppliers. Through their initiative, labelling was introduced into Article 5 of the EC Directive 2001/77/EC.

The requirement to cite the sources of electricity on customer bills is intended to enable customers to explicitly opt for renewable energy and in that way influence the types of generation employed. For electricity that comes from indeterminate origins, suppliers can give instead information on the aggregate European electricity mix which, in 2000, was 47.0% conventional thermal power, 37.3% nuclear power and 15.7% hydropower and other renewables. Many utilities have been reluctant to provide exact information on the sources of their electricity, citing the difficulty with such sourcing as a result of the repeated trading and re-trading of power that takes place in the wholesale markets. These utilities opt to give the aggregate European electricity mix as their own.

CRITIQUE

Large-scale hydropower and primary source solid biomass provide a combined 23.5% of the country's TPES. These two energy sources have low net emissions and are both indigenous, which is especially important given Austria's limited fossil fuel deposits.

Other renewable resources are currently encouraged by the Austrian government. Such support has been given through the electricity sector and comes in the form of feed-in tariffs and mandatory minimum levels for both small hydroelectric stations and other renewables. Until recently, both of these renewable resources support schemes have had a regional rather than a national scope. With each Land setting its own feed-in tariff for a range of renewable energy technologies, the country has had between 120 and 150 such tariff rates across the country. Legislation passed in the summer of 2002 replaced this segregated approach to establishing feed-in tariffs with a national system. Regarding the minimum resource renewable resource requirements, utilities can meet their minimum hydropower requirements through the national trading of certificates, but no such trading system exists for the other renewables minimum requirements. As a result, each Land must have an individual pocket of renewable power systems in its territory regardless of its natural (climatic or geographic) ability to support it.

This former approach to renewables support could result in an inefficient allocation of resources. In other words, renewable energy technologies were not being located in regions that can best support them. Instead of setting feed-in tariffs at levels that would support renewable energy technologies at the optimal location in the country, each Land set its feed-in tariff according to its own political climate and its natural resources which could support the renewable resources (e.g., wind patterns). This created no incentive to locate technologies in the most appropriate Länder.

Austria is to be commended for changing this system through new regulations passed in July 2002 which do away with the Land-by-Land feed-in tariff in favour of a national system. Such a system will resolve the problem of inefficient resource allocation. Investors will site plants in locations with optimal conditions rather than in Länder that have the highest feed-in tariffs. This will lower the cost of power generation from renewables while maintaining the same level of overall national use of renewables. For example, wind power can be concentrated in the favourable locations of Lower Austria and Burgenland, hydro plants can be sited in the alpine western Länder and biomass plants can be sited in the southern Länder.

Further efficiency gains could be realised by grouping all renewable energy technologies into one common pool. In that way, there would not be a separate requirement for 8% mini-hydro and 4% other renewables, but rather, one requirement for 12% renewable resources, regardless of their type. Individual investors could then choose among all competing renewables to find the most cost-effective option, and provide low- or no-emission electricity at lower overall cost to final consumers. The drawback of such a grouped renewables portfolio requirement is its failure to support technologies that are currently non-competitive. If investors can choose among competing renewable resources to produce power, they will choose the cheapest option. The manufacture and operation of this selected technology gives experience that lowers its costs and further cements its position as the least-cost renewable resource alternative. As a result, technologies which show promise but which are currently not the most cost-effective option will not benefit from the renewables support schemes. Austria's creation of separate pools for both small hydropower and for non-hydro renewables signals its willingness to support the development of renewable energy technologies that do not at present represent the lowest-cost alternative.

Given the additional costs borne by Austrian consumers to support renewable energy, the promise held by each of these technologies needs to be accurately analysed. In Carinthia the feed-in tariff for wind is 10.75 € cents/kWh while the minimum feed-in tariff for photovoltaic power is 54.50 € cents/kWh, or five times the amount of wind power. The government needs to make a case that paying for the higher-cost renewables such as photovoltaics is justified because those technologies have the long-term potential to provide significant cost-effective environment-friendly electricity. By supporting all renewable energy technologies without consideration of their current costs or expected long-term benefits, Austria will not develop a renewable energy portfolio which delivers environmental benefits at the lowest possible costs.

The minimum levels of renewables share in the mix of all Austrian energy suppliers could be revisited and adjusted periodically. The 8% level for mini-hydropower and the 4% level for other non-hydro renewables were both determined during the summer of 2000 when the government was under pressure to finalise regulations that would allow the introduction of competition in October 2001. As a result, minimum percentage figures selected may not have received the analysis needed to determine optimum targets for renewables' share of the electricity mix. For example, the 8% requirement for small hydropower stations is roughly in line with the existing share of small hydropower capacity and has essentially been met without the minimum requirement, so that the law will not really encourage the introduction of new plants. The requirement for sourcing from other renewable energy technologies is much more ambitious, since it was starting at a level barely higher than 0.1% of total electricity production. Meeting the eventual 4% requirement for these technologies in 2007 may be overly ambitious in that, if reached, it would result in excessive costs to the country. The regulators may want to institute a procedure whereby these requirement levels are regularly revisited and adjusted on the basis of the country's experience and the long-term potential of the different sources. Such periodic review should also reconsider the country's commitment under EC Directive 2001/77 to have 78.1% of the country's electricity generated from renewable resources by 2010.

While the cost of electricity produced from renewables is expected to drop as the technologies progress along the learning curve, Austria has made no allowances for this by designing a gradual reduction in the feed-in tariffs. Since the tariffs are designed to provide sufficient payment to renewable energy facilities given today's technology and experience level, they may end up over-compensating renewable resources operators when costs drop. The burden of this over-compensation would fall to consumers. One way to handle this situation would be through a degression scheme, such as the one currently in place in Germany. Under such a system, feed-in tariffs are scheduled for reduction according to a prescribed formula. For example, tariffs can be reduced by a fixed amount per year (e.g., 2% annual reductions) or set at a level inversely proportionate to the number of new installations for that technology (i.e., tariffs for a certain technology fall if more facilities of that type are installed, and vice versa). Such a degression scheme can also motivate and encourage renewable resources operators to reduce their own costs.

Use of such a degression system could contribute to the predictability of renewables support levels that is necessary to induce significant investment in new capacity. Feed-in tariffs without a stated, transparent degression scheme are unsustainable because, as explained above, technological advances and experience will lower costs well below the original tariffs. Without a degression scheme, the Austrian government would therefore have to adjust the feed-in tariffs at some future point. The uncertainty about the timing of this readjustment and the consequent final tariff levels will discourage investors from building new renewable energy capacity in Austria right now. Financing sources will hesitate to invest when their revenue streams are largely subject to political factors outside the market. A well-constructed degression scheme for feed-in tariffs could lend a degree of predictability and stability to tariffs and hence encourage greater renewable energy capacity additions.

Austria's requirement that utilities supply customers with information about the sources of their power is commendable. Such a system is essential to ensuring that consumer concern for the environment effectively stimulates additional renewable energy generation. Austrians who value power generated from renewables will pay more for it, but only if they can identify the sources of the power coming from different suppliers. The current system could be improved in two ways, however. One, it must address the problem caused when utilities cite European sourcing averages as their own. While it can be difficult to obtain accurate sourcing data, as the utilities argue, the government should continue to look into ways in which this problem could be solved so that all customers can accurately determine the source of their power. Two, the labelling could be improved by requiring suppliers to provide cost data for each source of electricity cited on customers' bills. Such transparency would allow consumers to draw a direct correlation between the price they pay for their electricity and the source of that electricity.

RECOMMENDATIONS

The Government of Austria should:

- ☐ Explore the most cost-effective measures to achieve the country's targets for contributions from renewable resources.
- ☐ Explore the introduction of a degression scheme for the feed-in tariffs which lowers prices to consumers, encourages producers to reduce costs and provides investors with a measure of predictability for their revenue streams.
- ☐ Create a procedure by which renewable energy policies can be regularly revisited. This can be done as the costs of the minimum renewables percentage requirements become clearer.
- ☐ Weigh the current costs of renewable energy technologies against their respective long-term potentials when deciding the level of support each will receive.
- ☐ Ensure that electricity source labelling requirements provide customers with reliable information on the sources and costs of electricity generation options offered by different suppliers.

7

OIL

OIL DEMAND

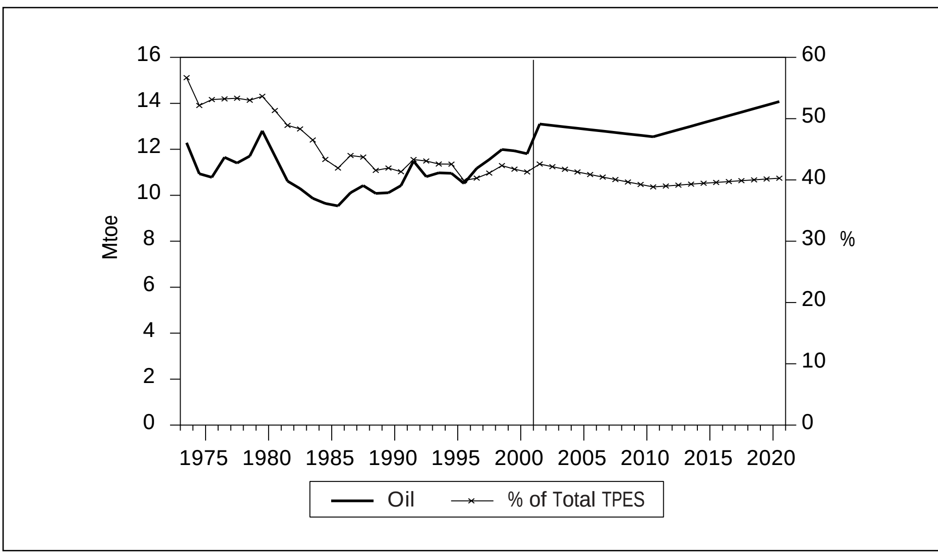
Oil is Austria's primary energy source. In 2000 it supplied 41.3% of Austria's total primary energy supply (TPES). For lack of indigenous domestic resources, the majority of this oil is imported. In 2000, only 8% of the country's demand was met by domestic production with the remainder coming from a variety of exporting countries.

In 2000, oil contributed 11.8 Mtoe to Austria's TPES. Absolute oil supply to the country has changed very little since 1973 when it was 12.3 Mtoe. From 1973 to 2000, oil supply has fluctuated between 9.5 Mtoe and 12.8 Mtoe, responding inversely to price movements of crude oil and related products. Oil's share of TPES has fallen over this time from 57% in 1973 to 41% in 2000. Figure 18 shows both oil's absolute contribution to TPES and its share of TPES from 1973 to 2020.

Figure 18

Oil Contribution to Total Primary Energy Supply, 1973 to 2020

(in Mtoe and as a percentage)



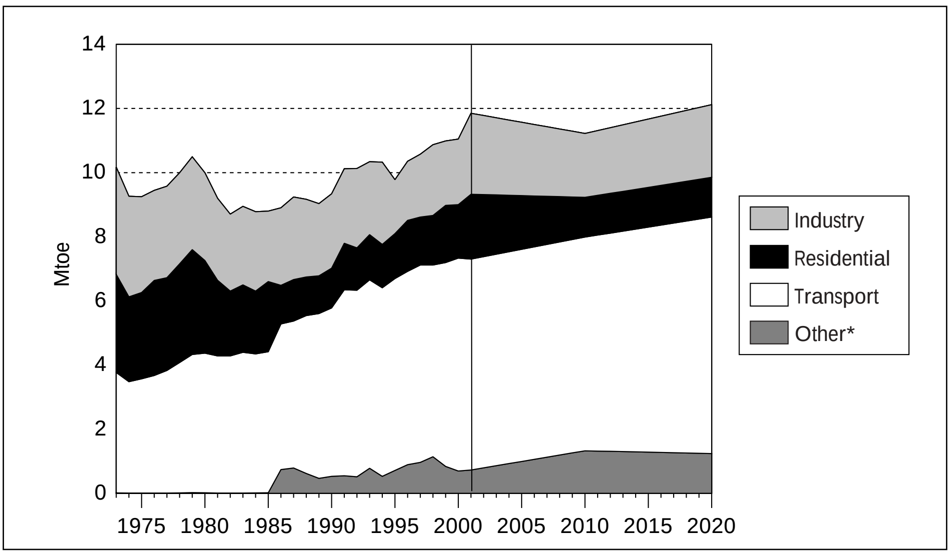
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

More recently, oil contribution to TPES rose from 11.2 Mtoe in 1996 to 11.8 Mtoe in 2000. Nearly 75% of this rise has come in the transport sector. Other sectors increasing their use of oil include industry, residences and non-energy use of petroleum products. The one segment decreasing its demand for oil is electricity (and CHP plants). Since 1996 demand for oil in this sector fell by more than 25%, largely as a result of the rise in oil prices and the increase in hydroelectric production (due to meteorological conditions) occurring in 2000.

In 2000, the transport sector accounted for 60% of the TFC of oil products, or 6.6 Mtoe. Of this amount, 5.9 Mtoe was consumed by road transport. Comparing this to Austria's TFC for all energy sources of 24.8 Mtoe, oil use for road transport accounted for a full 24% of the country's total final energy consumption. The residential sector accounted for 15% of the oil TFC, the industrial sector 7%, the agricultural sector 4% and the commercial sector 3%. Non-energy use of oil accounted for 12% of oil TFC. These percentage shares have been relatively constant since 1997. Figure 19 shows the final consumption of oil by sector since 1973.

Figure 19

Final Consumption of Oil by Sector, 1973 to 2020



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

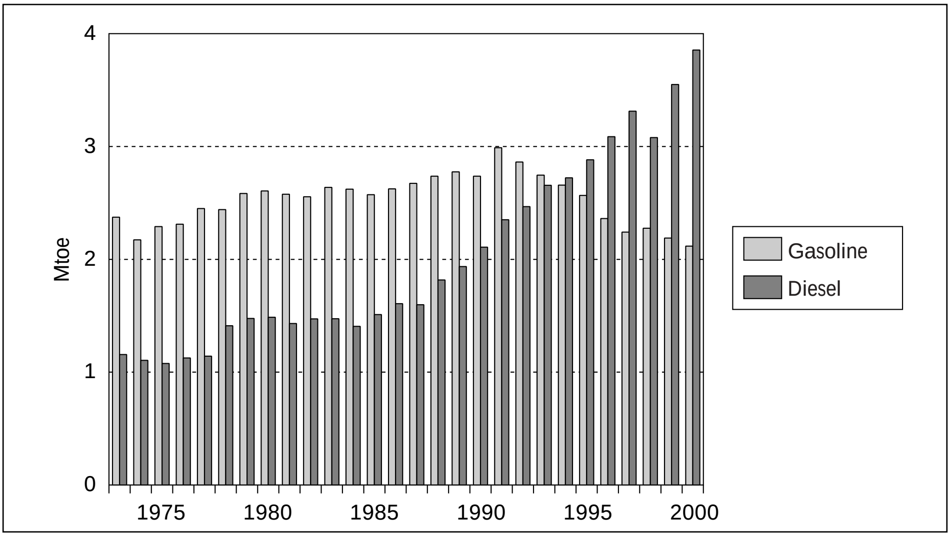
Diesel fuel is the most used oil product in Austria. In 2000, the country consumed 6.0 Mtoe of diesel fuel, or 54% of all petroleum products consumed during the year. The majority of this diesel fuel is consumed by the road transport sector[21]. The demand for diesel fuel within the road transport sector has grown rapidly in recent years. Between 1997 and 2000, diesel fuel use within this sector has risen by 16%, and from 1990 to 2000, by 83%. At the same time, however, gasoline use in the road transport sector has fallen, by 6% since 1997 and by 23% since 1990. This increase in diesel consumption at the expense of gasoline has coincided with the introduction of tax policy in the early 1990s which favoured diesel fuel in comparison to gasoline.

21. 3.9 Mtoe consumed in road transport out of 6.0 Mtoe total diesel consumption, or 64%. The remainder was primarily consumed in the residential sector.

This change in tax policy, accompanied by advances in diesel engine technology, increased the share of diesel-fired vehicles in the Austrian fleet and consequently the amount of diesel fuel consumed. Figure 20 shows the final consumption of diesel fuel and motor gasoline within the road transport sector.

Figure 20

Final Consumption of Diesel and Gasoline in the Road Transport Sector, 1973 to 2000



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

INDUSTRY STRUCTURE

The oil sector's largest commercial player is OMV AG. OMV is also the largest company listed on the Austrian stock exchange and participates in the entire value chain of upstream and downstream operations. It produces nearly 90% of domestic crude oil, owns and operates the country's only refinery and has a 20% market share in retail filling stations. OMV was once entirely owned by the federal government but engaged in a series of privatisations beginning in 1989 when 15% of the company was privatised. This was followed by sales to private owners in 1989 (10% of the company), 1994 (19.6%), and 1996 (20.4%). Currently the company is 35% owned by Österreichische Industrieholding AG (a holding company for the Austrian federal government), 19.6% by the International Petroleum Investment Company of Abu Dhabi, and 45.5% by smaller national and international investors.

Rohöl-Aufsuchungs AG (RAG) is another Austrian company in the sector, mainly involved in domestic exploration and production. It is owned by Shell Austria AG (25%) and RAG Beteiligungs AG (75%), a consortium of German and Austrian energy companies. Since autumn 1996, Van Sickle (another Austrian domestic oil producer) has been a subsidiary of OMV AG with 100 % ownership. Table 12 shows the 2000 domestic crude oil production figures for these three producers.

Table 12
Domestic Oil Production by Company

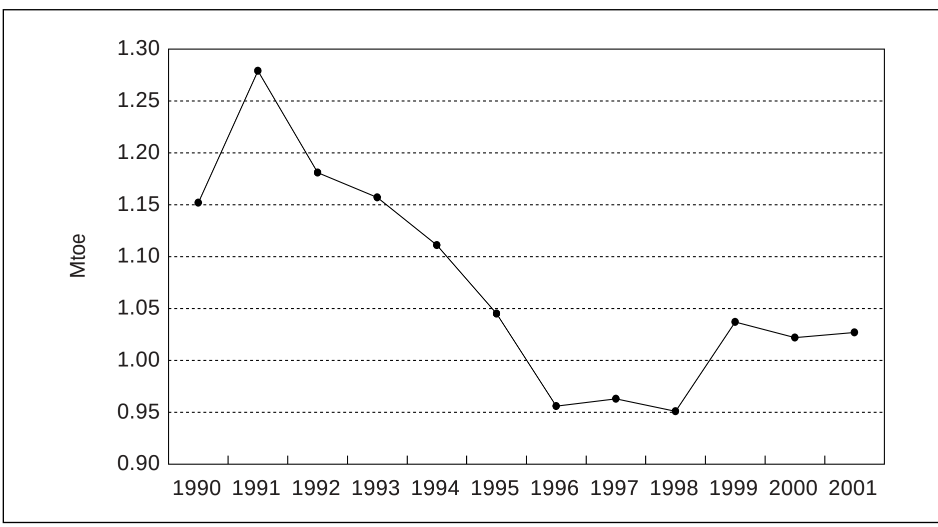
Company	*Production (tonnes)*	*Share of Total*
OMV	855 855	88.5 %
RAG	98 199	9.5 %
Van Sickle	19 354	2.0 %

Source: Country submission.

The combined crude oil domestic production of these companies in 2000 was 1.0 Mtoe[22]. While domestic production is falling, the sector remains active with 19 wells in exploration, development or production being drilled in 1999. Of these 19, 15 are considered successful finds for a success rate of 79%[23]. Recoverable reserve estimates, as of 1 January 2000, compiled by the Geological Survey of Austria (Geologische Bundesanstalt), show 11.8 million tonnes of crude oil (12.4 Mtoe), down from 12.9 million tonnes (13.5 Mtoe) in 1996.

Crude oil is produced from 30 fields in Upper and Lower Austria. Domestic production has declined as major oil fields are depleted and the number of productive wells has fallen. From 1990 to 1999, domestic production fell by nearly 30%, as shown in Figure 21.

Figure 21
Indigenous Oil Production, 1990 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

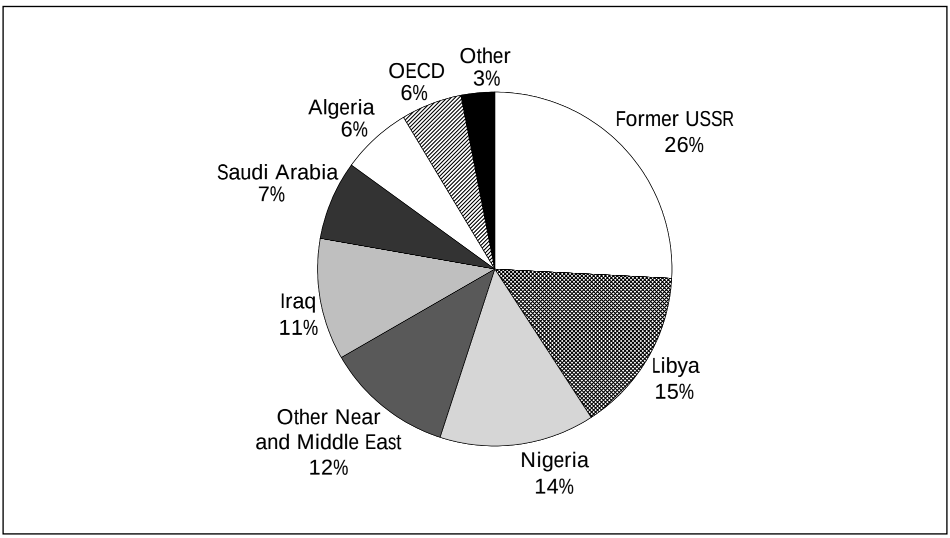
22. This figure does not match data from Table 12 because the caloric value of each tonne of oil produced in Austria is greater than the average caloric value of a tonne of oil used to calculate IEA statistics.
23. Figures include both oil and gas wells.

There are currently two Austrian companies involved in international exploration activities abroad, namely OMV and Shell Austria AG. OMV operates and/or participates in exploration activities directly or via subsidiaries in the United Kingdom, Albania, Australia, Libya, New Zealand, Pakistan, Sudan, Tunisia and Vietnam. In 2001, OMV oil production abroad came from Libya (7.8 mbo) the United Kingdom (4.1 mbo), and Australia (0.7 mbo). Shell Austria AG is active in Egypt.

In 2000, OMV and four international companies (Agip, BP, Esso and Shell) had combined net imports of 7.7 Mtoe of crude oil, natural gas liquids (NGL) and refinery feedstocks. Sources of these imports were diverse with the most important importing countries being Libya, Iraq, Saudi Arabia, Kazakhstan, Algeria and Nigeria. All crude oil exporting countries and the amounts they supplied are shown in Figure 22.

Figure 22

Sources of Crude Oil Imports to Austria, 2000



Source: *Oil Information 2002*, IEA/OECD Paris, 2002.

Imported crude oil is transported via the Transalpine Ölleitung pipeline (TAL) which links Trieste, Italy, with Ingolstadt, Germany. At the city of Würmlach in the southern Austrian province of Carinthia, the TAL is linked with the Adria-Wien-Pipeline (AWP), an 18-inch 450-km-long pipeline which connects to the Schwechat refinery near Vienna. The AWP pipeline has the capacity to pump up to 10 million tonnes of crude oil per year into the refinery and from 1996, it has operated at between 86% and 94% capacity. This pipeline is owned by OMV and the five other companies that have their imported crude processed in Schwechat under contract with OMV according to the ownership breakdown in Table 13.

Table 13
AWP Ownership Structure

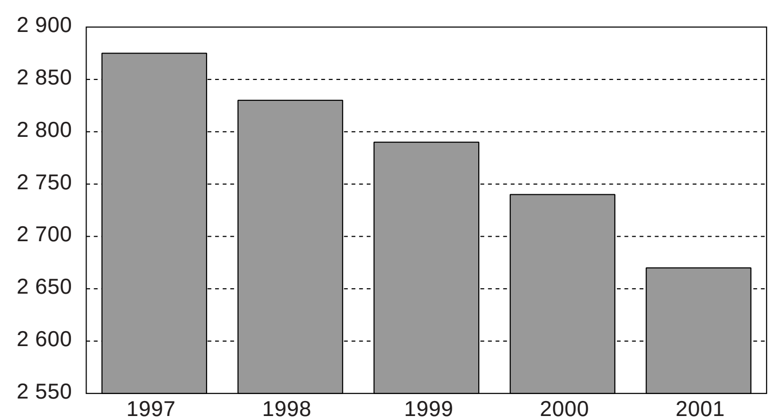
OMV	55.0%
Shell Petroleum Austria	14.5%
Mobil Oil Austria	12.5%
BP Austria	7.5%
Esso Austria	6.5%
Agip Austria	4.0%

Sources: *Oil and Gas in Austria*, The Association of Austrian Petroleum Industries, 2000.

Austria has only one refinery, the Schwechat facility outside Vienna. Schwechat is entirely owned and operated by OMV, and is one of the largest inland refineries in Europe. It processes indigenous and imported crude oil and produces a full range of oil products for domestic consumption. In 2000, the refinery provided 67% of the country's demand for refined products with the remainder coming from imports, primarily diesel fuel. Austria imported 3.0 Mtoe of petroleum products in 2000. The product breakdown of these imports is discussed in the section on refined products below.

There are a number of competitors in the retail market. While OMV is clearly the largest player for the import and refining of oil and oil products, it is not the largest player at the retail level. In 2001, OMV held 20% of the retail market (measured by number of filling stations), which was second behind the largest market player, BP, which held a 25% share. The remainder of the market is divided between national and international competitors. Because of the relatively large number of gas

Figure 23
Number of Filling Stations in the Austrian Retail Automotive Fuel Market, 1997 to 2001



Source: OMV Annual Report, 2001.

stations in Austria, Austrian stations on average have annual volumes that are two-thirds the volumes of comparable stations in neighbouring European countries. The number of filling stations in Austria fell by about 6% from 1997 to 2001 despite a rise of combined gasoline and diesel sales of more than 7% over that same period. OMV expects this industry consolidation to continue.

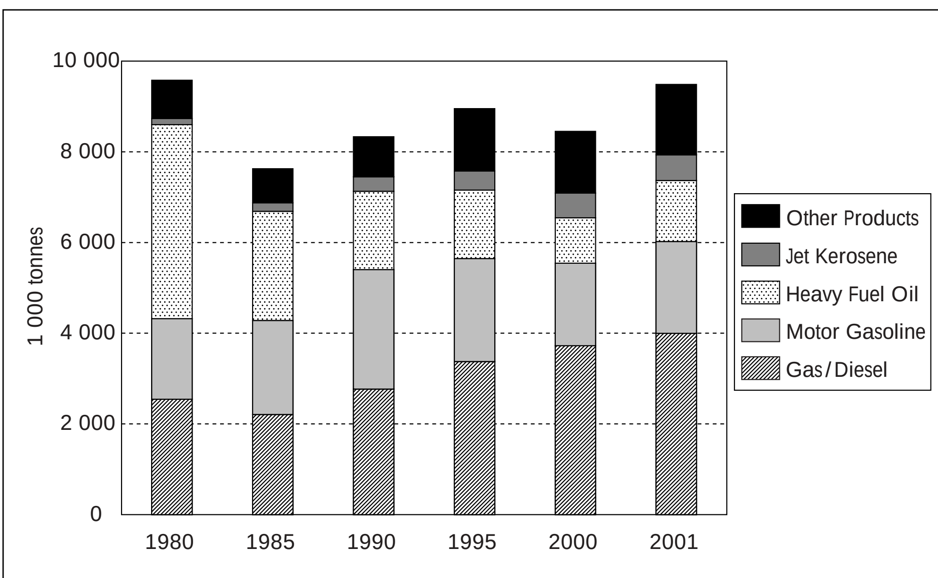
REFINED PRODUCTS

In 1999 the Schwechat refinery processed 9.1 Mtoe of input (91% crude oil, 1% NGL and 9% feedstocks), while in 2000, as a result of maintenance activities performed at the plant, that figure fell to 8.6 Mtoe of input (93% crude oil, 1% NGL and 6% feedstocks). Of the 8.6 Mtoe processed in 2000, 1.98 Mtoe was third-party processing whereby OMV processes crude on behalf of its ownership partners in the AWP. These third-party processing agreements expired on 31 December 2002, but may be renewed depending on negotiation outcomes.

Diesel fuel is the primary product from the Schwechat refinery. In 2000, 45% of the facility's output (by mass) was diesel fuel, an amount equal to 3.9 million tonnes. This compares to production amounts of gasoline (1.9 million tonnes, or 23% of the total), residual fuel oil (1.0 million tonnes, or 11% of the total) and jet fuel (0.6 million tonnes, or 7% of the total). These percentage output shares have stayed in these ranges for the last four years. Figure 24 shows production from the Schwechat refinery (and hence all of Austria) from 1980 to 2001.

Figure 24

Production of Refined Petroleum Products in Austria, 1980 to 2001

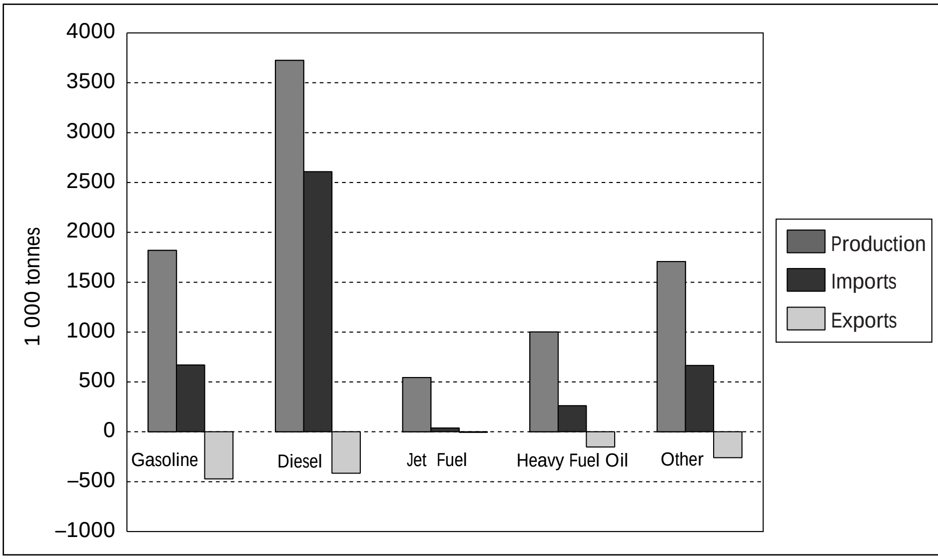


Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Despite the scope and range of Austria's domestic refinery production, the country imports significantly more oil products than it exports. The import share varies widely by product type, however. The import share of diesel fuel, for example, is the

Figure 25

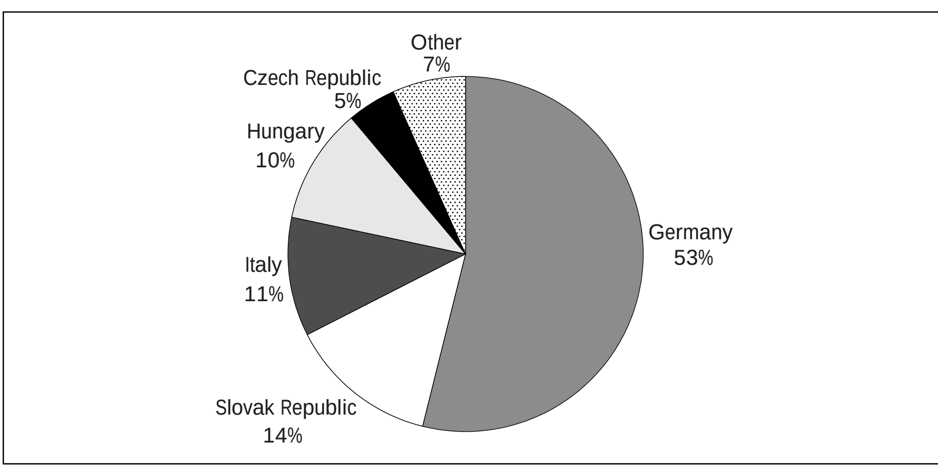
Imports, Exports and Domestic Production of Refined Petroleum Products, 2000



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Figure 26

Sources of Refined Petroleum Product Imports to Austria, 2000



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

highest of all the major oil products. In 2000, net diesel imports were 2.27 Mtoe[24], covering 59% of the domestic production of diesel fuel. Net imports of gasoline, on the other hand, were 2.12 Mtoe in 2000, an amount equal to only 11% of the country's domestic gasoline production for that year. Figure 25 shows the imports and exports of oil products in 2000 and compares them to domestic production while Figure 26 shows sources of these imports.

OIL PRICES AND TAXATION

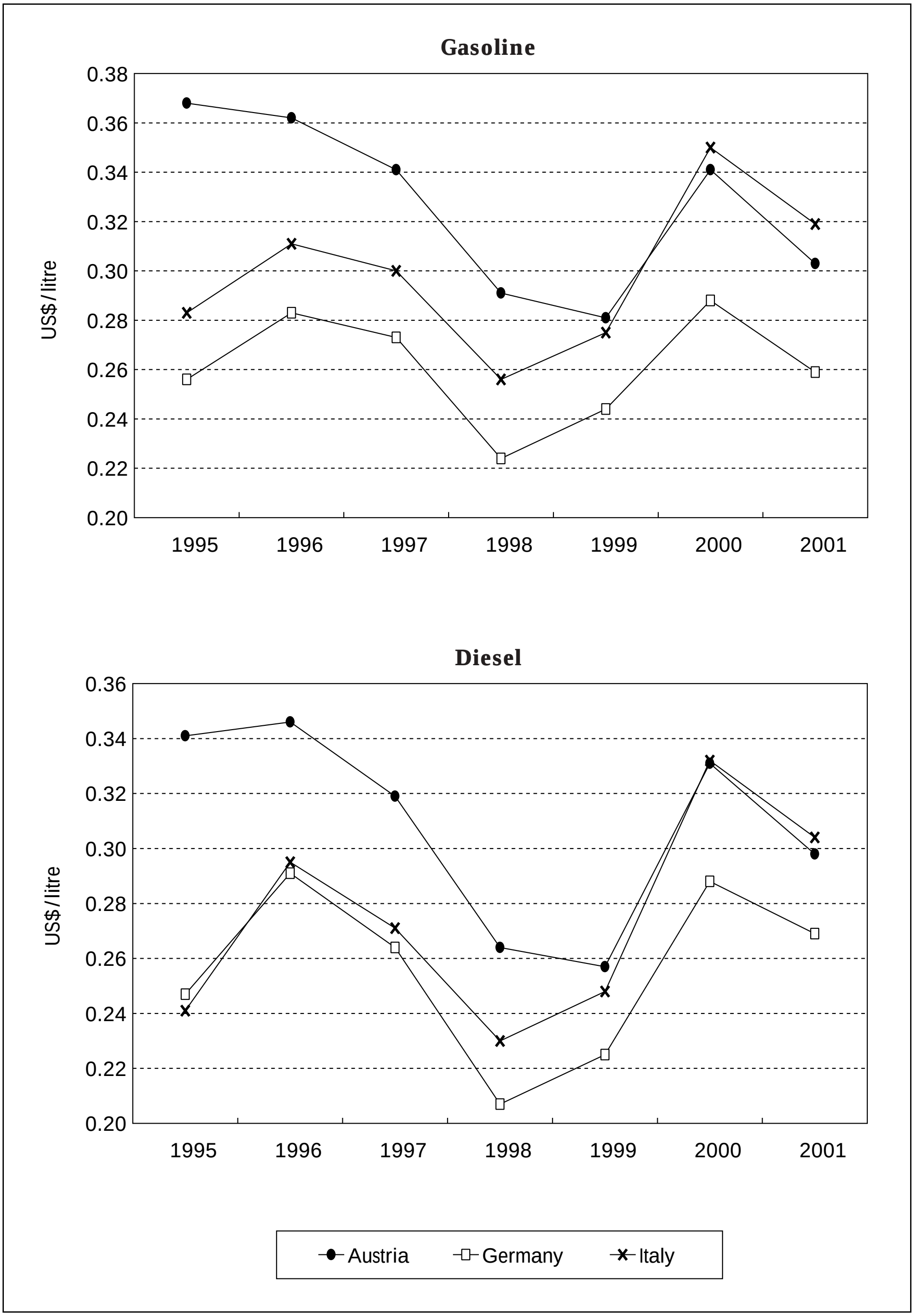
On the retail level, both ex-tax and end-user prices have risen in nominal terms, but significantly less than in other IEA European countries in recent years. Using nominal prices in euros, ex-tax prices for diesel fuel in Austria have risen by 33% from 1995 to 2001 while the IEA European average ex-tax price for diesel has risen by 52% over the same period. For gasoline, ex-tax prices in Austria have increased by 25% while the IEA European average prices have risen by 38%. For light fuel oil, Austrian ex-tax prices have risen by 43% while the average IEA European price has risen by 72%. End-user prices (i.e., including all taxes) have demonstrated similar trends. Again using euro nominal prices, end-user prices for commercial diesel fuel in Austria have risen by 20% from 1995 to 2001 while the IEA European average price has risen by 29% over the same period. For gasoline, end-user prices in Austria have risen by 10% over the same period while the IEA European average prices have increased by just 24%. For light fuel oil, Austrian end-user prices have risen by 34% while the average IEA European price has increased by 55%. Figure 27 shows the development of the ex-tax prices for these products in Austria, Germany and Italy.

Currently, both the ex-tax and the full retail prices for both diesel fuel and unleaded gasoline in Austria are near the IEA Europe averages. In the first quarter 2002, the Austrian ex-tax price for unleaded gasoline was €0.276/litre while the average in IEA European countries was €0.278/litre. For diesel fuel, the ex-tax price in Austria was €0.296/litre while in the other IEA European countries, it averaged €0.304/litre. Figures 28 and 29 show year 2000 price and tax data for selected OECD countries.

As a result of a change in tax policy in the early 1990s, taxation for automotive fuel now favours diesel over unleaded gasoline. In 1991, the excise tax for gasoline (€0.262/litre) was 9% greater than the excise tax for diesel fuel (€0.240/litre). By 1996, the excise tax for gasoline had risen to a level (€0.415/litre) that was 43% greater than the excise tax for diesel fuel (€0.290/litre). This disparity has continued with the same excise tax levels in force currently. While VAT treatment of both fuels is the same at 20% of the ex-tax price plus the excise tax, this also favours the use of diesel since industry, which consumes more diesel fuel through its truck fleet, can pass along the VAT it pays. Full tax treatment on diesel and gasoline throughout the 1990s is shown in Figure 30.

24. The net imports consist of 2.7 Mtoe of gross imports and 0.431 Mtoe of gross exports.

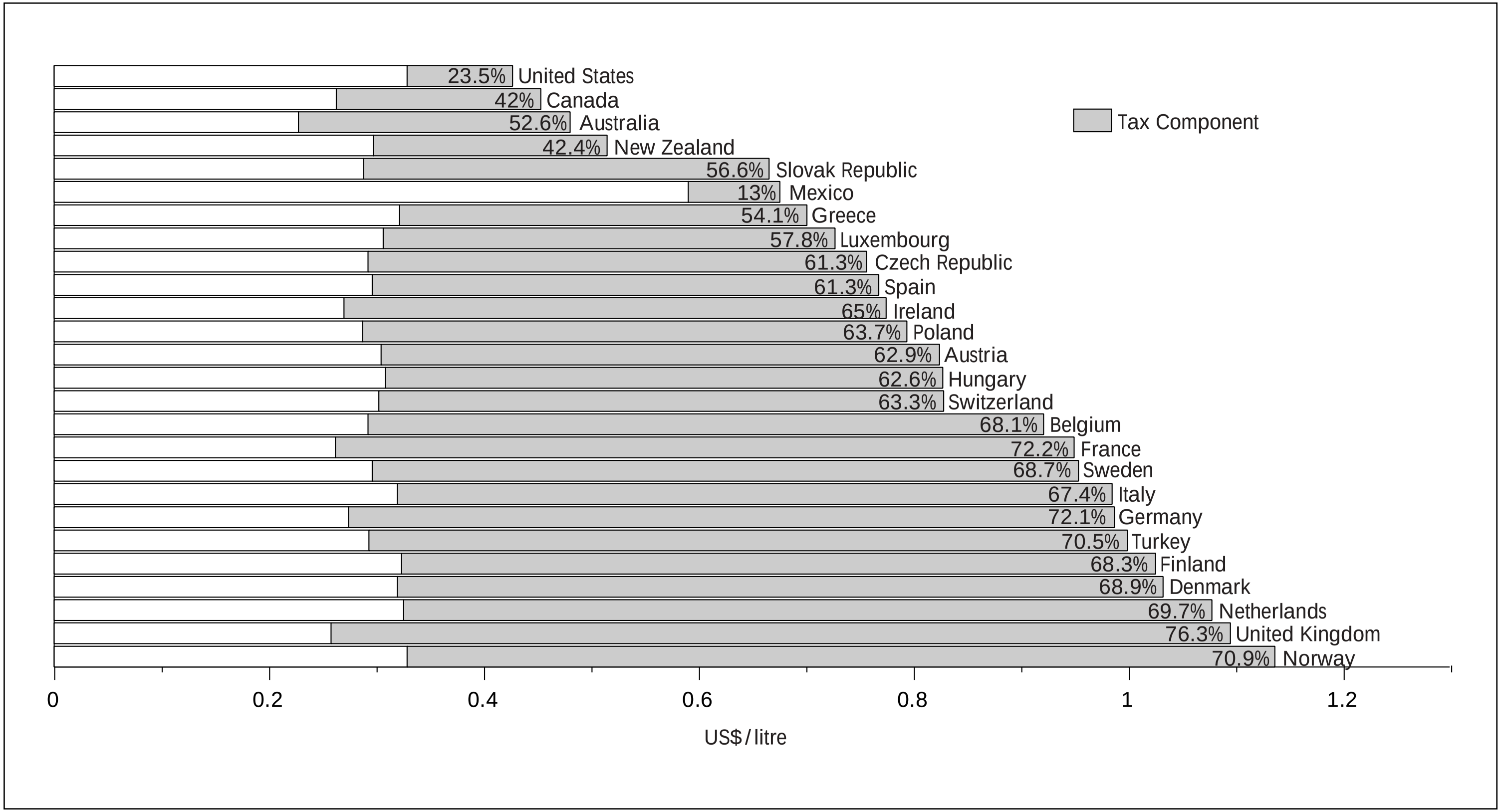
Figure 27
Trend of Ex-tax Prices for Oil Products in Selected IEA Countries, 1995 to 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 28

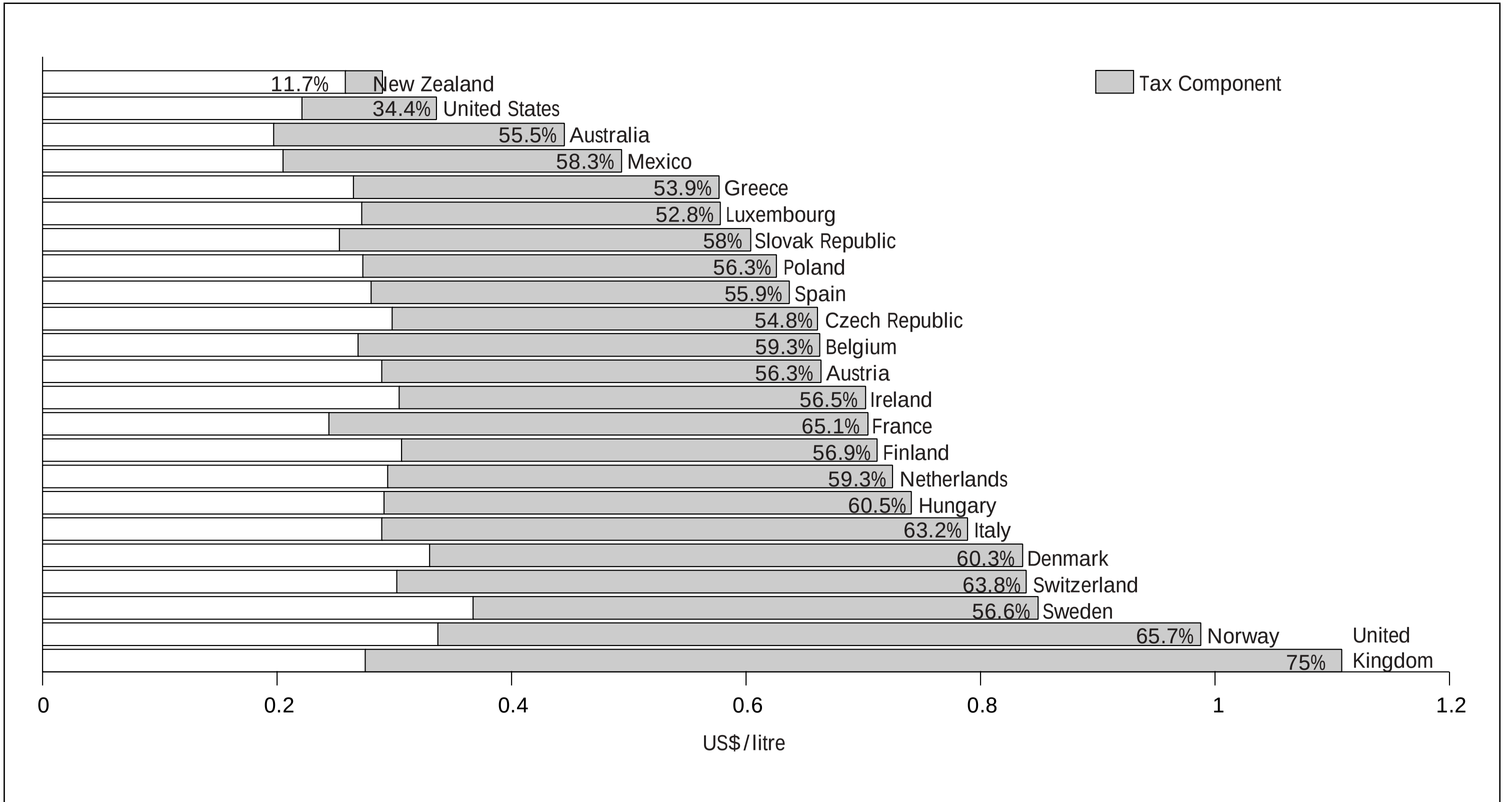
OECD Unleaded Gasoline Prices and Taxes, Second Quarter 2002



Note: Data not available for Japan, Korea and Portugal.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002

Figure 29

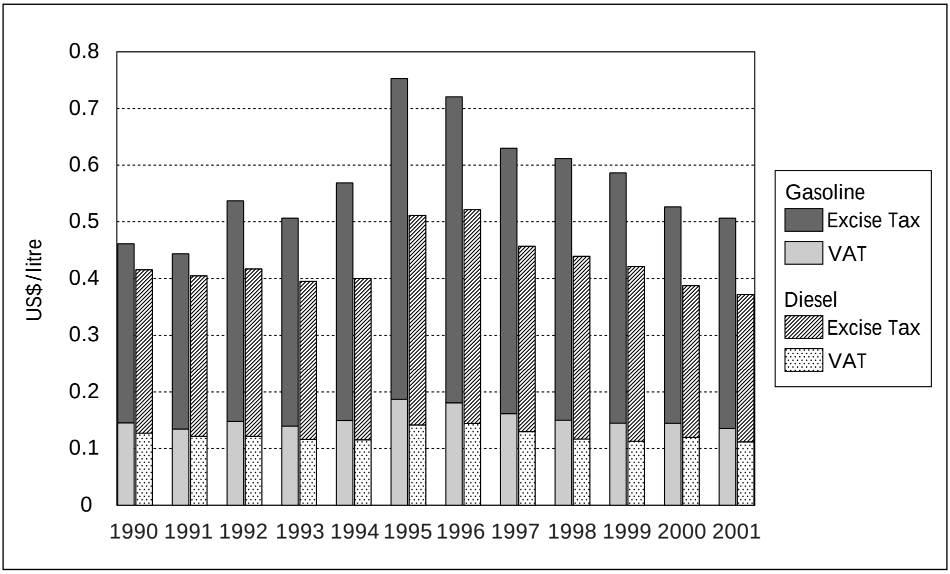
OECD Automotive Diesel Prices and Taxes, Second Quarter 2002



Note: Data not available for Canada, Germany, Japan, Korea, Portugal and Turkey.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 30
Austrian Taxes for Unleaded Gasoline and Automotive Diesel Fuel, 1990 to 2001



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

In the first quarter of 2002, taxes in Austria accounted for 58% of the total price customers paid for diesel fuel and 67% of the total price for premium unleaded gasoline. During the same time period, average taxes in the IEA EU countries accounted for 62% of the total price of diesel fuel and 70% of the price of premium unleaded gasoline. In other words, the tax percentage for gasoline is 9% higher than it is for diesel fuel in Austria, while the tax percentage for gasoline is 8% higher than it is for diesel fuel in the IEA EU countries.

Prior to August 1990, the government imposed price ceilings on oil products. At that time, these ceilings were eliminated and replaced by a voluntary agreement between the Federal Ministry of Economic Affairs and the six leading oil companies. Under this agreement, the participating oil companies had to report certain information to the government, including the purchase price of oil products in Rotterdam, the amount of stocks held in Austria, the retail prices for oil products at their filling stations, and quarterly profit and loss of the oil sales account. In April 1996, the agreement was terminated, only to be replaced by another agreement in October 1996 which instituted a similar but simpler and less demanding information-sharing system.

These information and monitoring agreements were deemed necessary because the Social Partnership has the right to ask the government to intervene if prices are deemed unfairly high. If the government does indeed find prices questionable, the Federal Ministry of Economic Affairs and Labour can invite the oil companies and the social partners to discuss them. If necessary, the oil companies can be asked to provide more data, although the government has no direct influence on prices.

Such a consultation between industry and government took place in the fall of 2000, at which time Europe was experiencing public outrage at prices for automotive fuels. OMV held consultations with the government and announced its intention to establish the average net prices (i.e., without taxes) at a level less than 2.9 € cents above the relevant weighted average values as reported in the weekly *Oil Bulletin* of the European Commission. The company's commitment to this price limit is still in place. While discussed with the appropriate ministries within the government, this price target is not part of any official regulation and retailers are not bound by law to price below this or any other level. As yet, no other filling station operators in Austria have followed OMV's lead in systemically limiting retail prices. The Austrian public is aware of OMV's price limits, in part thanks to the active motor vehicle users associations in the country.

OMV believes that competition in the retail filling station business keeps prices below their self-imposed limits and, as a result, their pricing policy has a minimal effect on actual prices. That is, pricing decisions based on market conditions and the company's own goal of maximising profits would rarely if ever lead them to price their products higher than 2.9 € cents above the EU averages for these fuels, even in the absence of the pricing limitation. For example, they point out that investment decisions regarding the possible construction of new filling stations use financial projections with retail prices well below the maximum levels they have established for themselves. In general, the profitability of OMV's filling stations in Austria is less than those they own and operate internationally.

It should be noted that retailers of diesel fuel and unleaded gasoline in Austria face unique conditions which bring additional costs to retail service of motor fuels. The country's limited domestic crude production and its land-locked position both add expenses to oil transportation. Moreover, environmental regulations for filling stations are highly stringent. In June 2001, regulations were enacted which required all filling stations to use impermeable forecourt aprons, double-walled storage tanks and pipeline systems, and wastewater treatment plants. Austria now has some of the strictest environmental regulations in Europe. OMV estimates that environmental equipment represents about one-quarter of the capital expenditure of a new filling station. These additional costs factor into the retail companies' pricing decisions and resulting profits.

Two working groups have been established under the chairmanship of the Ministry of Economic Affairs and Labour in order to monitor price developments and investigate the potential for changes in the legal framework for filling stations. These are the Working Group on Monitoring Automotive Fuel Prices and the Working Group on Aspects of the Legal Framework concerning Environmental and Commercial Regulations for Filling Stations. These working groups have established the "Benzinpreis Monitor" on the ministry website which shows current and historical prices of various fuels in different regions around the country. It also compares Austrian fuel prices with prices found in other countries. The working groups were also instrumental in relaxing some of the regulations governing sales of non-fuel products at filling stations, making them more in line with other EU countries.

EMERGENCY PREPAREDNESS

The Energy Steering Law and the Stockholding and Reporting Law were both established in 1982 in order to define a strict legal framework to respond to oil supply disruptions. These laws define all measures and responsibilities of the relevant national and regional emergency organisations. In times of oil supply disruptions, the Energy Steering Council, consisting of representatives of various ministries, energy industry and social partners, would act as an advisory body to the Minister of Economic Affairs.

In November 2001, the Stockholding and Reporting Law was revised, mainly to include jet fuel and deliveries to inland waterways transport bunkers in the stockholding obligations of importers, but also to provide for possible penalties against importers who do not comply with their stockholding or reporting obligations.

The Stockholding and Reporting Law guarantees the availability of emergency reserves covering 90 days of net imports and obliges all importers to hold emergency stocks equivalent to 25% of their previous year's net imports plus an additional 10% to account for unavailable stocks. While importers may hold their stocks at the private, non-profit stockholding company ELG (Erdöl-Lagergesellschaft), the majority choose to hold mandatory stocks in their own tanks. Storage costs are included in the retail price and therefore directly borne by the customers. For example, an average cost of approximately €0.0065/litre is passed through to the price of automotive fuels. Since most of the stocks are commingled with operational stocks, drawdown in times of a crisis can be achieved in a very short delay of less than five days. The Energy Steering Law enables the Federal Minister of Economic Affairs to act with a high degree of flexibility with implementing decrees.

The government considers that demand restraint measures would be the main response in a crisis. Measures to restrain oil demand would be phased in three stages, depending on the nature and severity of the crisis, and would mostly concern the transport sector which consumes roughly 50% of total oil demand. While the initial stage of light-handed measures would mostly focus on public campaigns for voluntary energy saving, medium-handed measures would include compulsory restrictions such as lower speed limits and driving bans, and the final heavy-handed stage would rely on coupon rationing for the private sector and allocation for fuel oil use in industry.

Additionally, Austria's short-term fuel-switching capacity of multi-fired plants in the heat and power generation of the transformation and industry sectors could contribute 5 to 7% of total oil consumption by switching to alternative fuels. However, since many of the plants capable of switching may have already switched from oil to an alternative fuel – because of price differentials between fuels or environmental aspects, especially between oil and gas – the effective fuel-switching potential as an emergency measure at the time of a crisis may, in fact, be lower.

Finally, the Energy Steering Law also allows the Minister of Economic Affairs to relax product specifications for a limited period, subject to approval by the Ministry of Environment. The most likely modifications could allow a higher benzene content in gasolines and higher sulphur content in heating oil and gas oils.

CRITIQUE

The Austrian oil sector is clearly dominated by OMV, but there are no signs that such market concentration is undermining effective competition. While five to six years ago Austria had prices that were well above the average of OECD European countries, Austrian prices currently are comparable with or even slightly below this average. Despite these improvements, the scope of OMV's vertical and horizontal spread over the sector is sufficiently large to warrant continued monitoring by the Austrian authorities for any signs that OMV is using its size to manipulate the market at the expense of consumers and/or competitors.

Austria is to be commended for its growing reliance on market forces to determine prices for petroleum products. The abolition of price ceilings in 1990 and the ongoing relaxation of the government monitoring process are important steps in the right direction. The current light-handed price monitoring and OMV's consultation process regarding its self-imposed price cap, which reflects the history of the Social Partnership, does not seem to pose a threat to competition at this point.

The decrease in retail prices indicates that OMV's self-imposed limit on retail automotive fuel prices at a level less than 2.9 euro cents above relevant EU averages does not stifle competition in the sector. Such a voluntary price ceiling is in no way a government mandate and other competitors are not required to follow suit, leaving them free to price as they wish. In addition, Austria has active motorists' lobbies that work on behalf of automotive fuel purchasers and both these groups and the general public are fully aware of OMV's pricing strategy. Nevertheless, OMV's current dominance in the sector means that any arbitrary price levels set by the company could have a range of intended and unintended consequences which discourage competition. As part of its ongoing monitoring process, the government should ensure that this self-imposed price limitation does not act to impede retail competition by either distorting market prices or discouraging new entrants.

RECOMMENDATION

The Government of Austria should:

- Monitor OMV's self-imposed price limitation on retail sales to ensure that it in no way impedes the current high level of retail competition by either distorting market prices or discouraging new entrants.

8

NATURAL GAS

INDUSTRY STRUCTURE

The OMV Group is the most important company involved in the supply, transmission and storage of Austrian natural gas. On the supply side, the company provides 90% of gas used in the country through both its imports and domestic production. It handles the large majority of imports into Austria and in 2000, it produced 59.8% of the country's indigenous domestic production. OMV also owns and operates the 2 000 km of high-pressure transmission pipelines used to transport natural gas both to Austrian demand centres and across the country as part of the substantial gas transit from East to West. Over one-third of all Russian gas exported to Western Europe passes through OMV's Baumgarten gas facility in the far east of the country near the border with Slovakia. OMV would like to use this facility as a natural gas trading hub as the market becomes liberalised. The company also owns and operates 80% of the current gas storage market in Austria. The OMV Group is held 35.0% by the federal government (through Österreichische Industrieholding AG), 45.4% by private diversified shareholders and 19.6% by the International Petroleum Investment Company (IPIC) of Abu Dhabi.

On 20 September 2001, OMV spun off certain gas-related functions into an independent entity, OMV Erdgas GmbH. It was created as a wholly owned subsidiary with operations in transmission, distribution, storage and trading. All gas production activities remained within the parent company, the OMV Group. The 2001 OMV annual report cites greater flexibility in responding to market liberalisation as the motive behind the spin off[25].

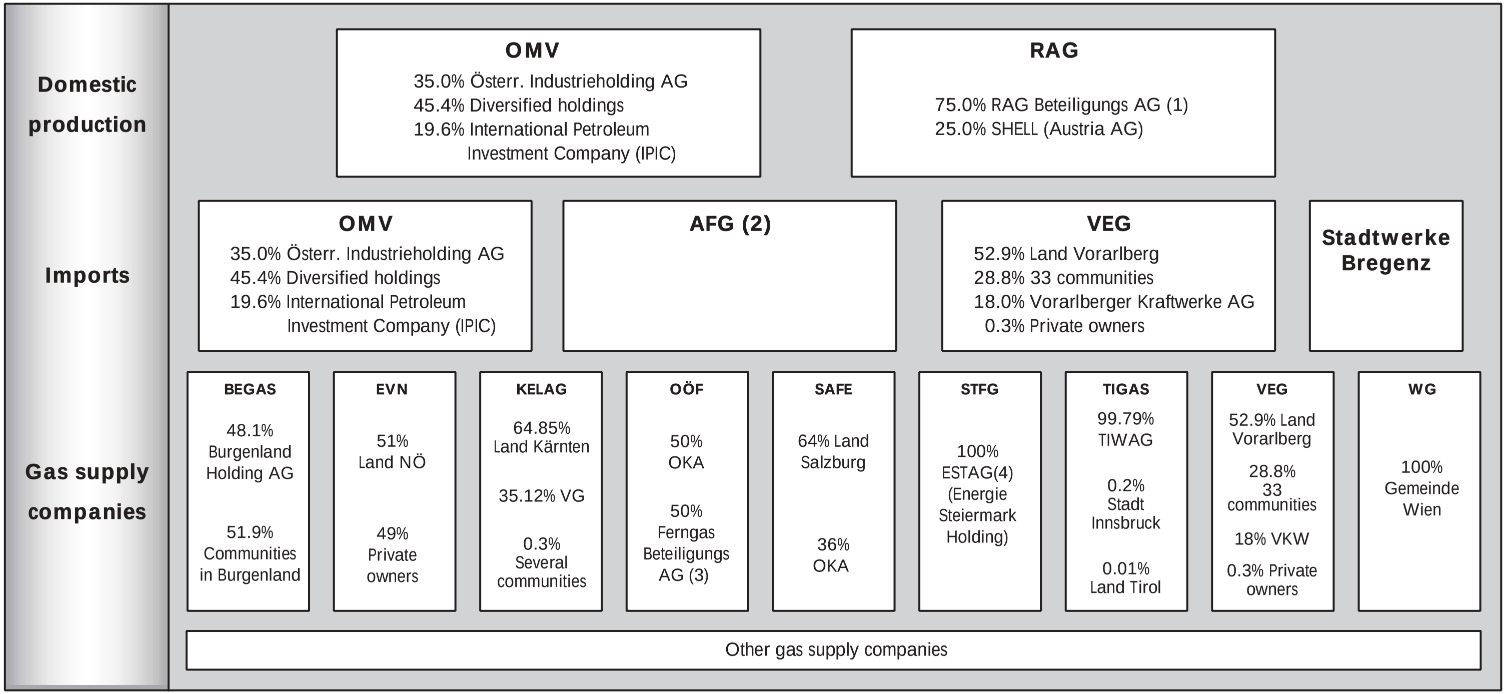
Other important gas companies at the national supply level include RAG, Austrian FernGas and VEG. RAG is an independent domestic producer with operations in the Land of Upper Austria. In 2000, RAG produced 726.1 mcm of gas, or 40% of the supply from domestic sources. Austrian FernGas and VEG are the only Austrian companies besides OMV that import natural gas. Together they both account for approximately 3% of the Austrian import market. In addition, Austrian FernGas co-ordinates the supra-regional activities of the Land-level utilities, negotiating supply contracts on their collective behalf with OMV and RAG.

At the Land level, there are nine natural gas utilities, one for each Land. The largest of these include WienGas in Vienna, EVN in Lower Austria, Linz AG in Upper Austria and Salzburg AG in Salzburg. These companies purchase the majority of their gas from OMV and distribute it to industrial, residential and commercial customers via

25. Hereafter in this chapter, reference to "OMV" will, depending on context, include both the "OMV Group" parent company and its supply operations or OMV Erdgas GmbH and its trading, transport and storage activities.

Figure 31

Structure of the Austrian Natural Gas Sector



(1) RAG Beteiligungs AG
40.00% EVN AG
40.00% Bayernwerk
10.00% Steirische Ferngas AG
10.00% Salzburger AG für Energiewirtschaft

(2) AUSTRIA FERNGAS Gesellschaft mbH.
23.75% Republik Österreich
23.75% EVN AG
23.75% Steirische Ferngas AG
23.75% WIENGAS GmbH
1.00% "BEGAS" Burgenländische Erdgasversorgungs AG
1.00% "KELAG" Kärntner Elektrizitäts AG
1.00% Oberösterreichische Ferngas AG
1.00% Salzburger AG für Energiewirtschaft
1.00% "VEG" Vorarlberger Erdgas Ges.mbH.

(3) Ferngas Beteiligungs AG
68.23% OMV-Erdgas-Beteiligungsges.mbH.
10.59% E-Werke Wels
10.59% SBL
10.59% ESG

(4) Energie Steiermark Holding
75.00% Land Steiermark
25.00% Consortium of Electricité de France (EDF) and Gaz de France (GDF)

Source: Federal Ministry of Economic Affairs and Labour.

their own gas distribution lines. They are also responsible for all billing and customer service to retail customers. Austrian law requires that these companies must be at least 51% owned by the Länder governments, although some have higher government ownership, up to 100%. The Land utilities usually are multi-function companies. In addition to distributing gas to end-users, they also distribute electricity to end-users and have various amounts of electricity generating assets. Many supply additional services such as cable television and Internet access.

Figure 31 shows the ownership structure of the industry.

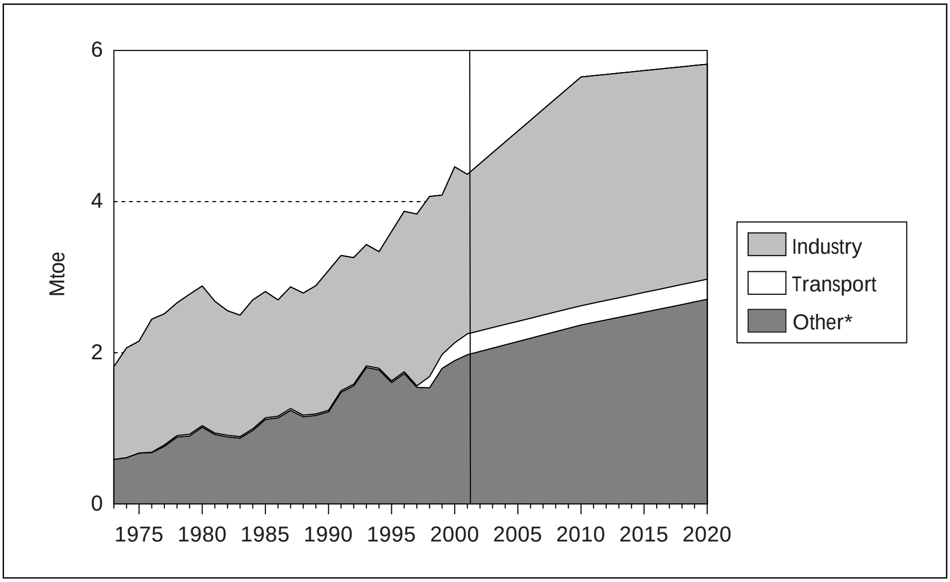
The Austrian natural gas sector is undergoing a process of liberalisation. These reforms have already precipitated a change in the structure of the industry by stimulating a number of alliances among market participants. A recent alliance has formed between OMV and members of an existing coalition of Land-level utilities called Energie Allianz[26]. This new alliance, tentatively termed "NewCo", has yet to be finalised as negotiations between members continue. NewCo would also require Cartel Court approval, although this is thought not to be a formidable hurdle. NewCo is envisaged as a joint-venture sales organisation that will target the country's 450 major industrial consumers of natural gas. Another similar joint sales alliance targeting large industrial customers has recently been announced between Ruhrgas, the German natural gas company, and Salzburg AG, a Land-level utility.

NATURAL GAS DEMAND

In 2000, total natural gas demand in Austria was 6.5 Mtoe, an amount equal to 22.8% of the county's TPES. From 1997 to 2000, overall gas demand shrank at 0.1% per year, and demand in 2000 was 4% below the peak in 1996. This drop is a result of decreased natural gas use for energy transformation purposes, primarily electricity and heat production. From 1997 to 2000, natural gas used for transformation purposes fell by 27% with the greatest drop occurring in 2000 when demand fell by over 20% in one year. This drop comes as a result of three separate factors. One, natural gas prices are normally tied to oil prices which surged from 1999 to 2000. This made non-gas alternatives more attractive. Two, the electricity sector saw an increase in hydroelectric production over those years (owing to meteorological conditions) which resulted in less demand from thermal generation fuelled by natural gas. Three, in expectation of market liberalisation, many electricity utilities offered much lower rates to industrial customers in order to secure their customer base. This made self-generation by these industrial customers less attractive in relation to purchasing electricity from public utilities.

26. The Energie Allianz is a marketing alliance between EVN, Wiener Stadtwerke, Linz AG, BEWAG and Begas. The companies have agreed to market their electricity together on the retail market and to work together in the trading of wholesale power. The alliance was formed gradually with a set of cumulative agreements in 2000 and 2001.

Figure 32
Final Consumption of Natural Gas by Sector, 1973 to 2020



* includes residential, commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

The total final consumption (TFC) of gas (i.e., excluding uses for energy transformation) rose by 15% from 1997 to 2000, an average annual rate of 3.6%. This increase in final consumption was experienced in nearly all sectors, but primarily the residential and industrial. Such a demand increase is consistent with the trends of the last 30 years: from 1973 to 2000, the TFC of natural gas has increased by over 200%, at an average annual rate of 4.2%. The Austrian government predicts that this long-term trend of growing gas demand will continue with natural gas's share of TPES forecast to increase to 29.5% of TPES by 2020.

NATURAL GAS SUPPLY

In 2000, Austria imported 5.3 Mtoe of natural gas, or 78% of its total supply for that year. The share of imports meeting the country's gas demand has risen dramatically over the last 30 years. Imports accounted for 41% in 1973, rose steadily to 80% in 1990 and has now settled into a range between 78% an 81% for the 1990s[27]. For the last four years, import shares have stayed within this range, falling slightly from 81% in 1997 to 78% in 2000 in reflection of the weaker overall gas demand seen in recent years.

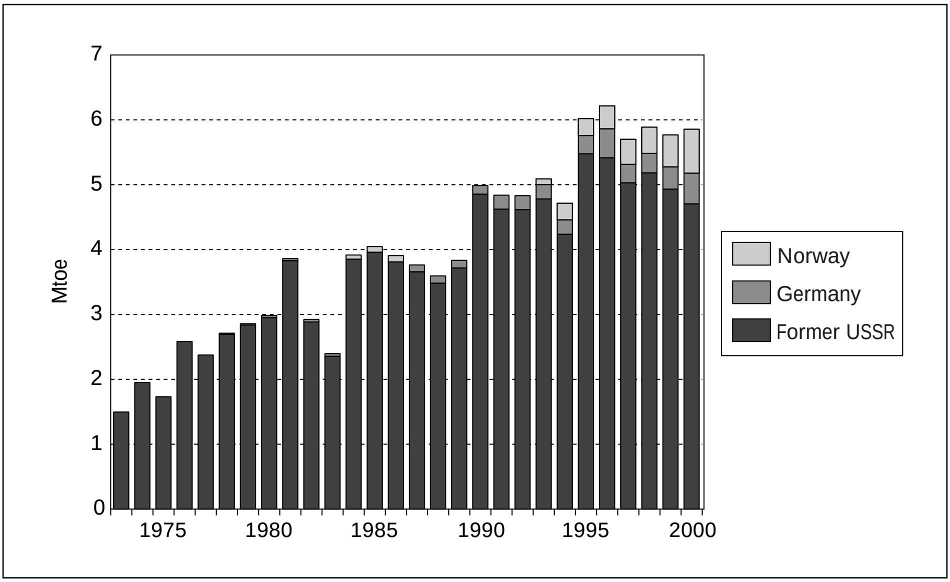
For the last 40 years, Austria has imported large quantities of natural gas for its own consumption from the former Soviet Union and now Russia. Over that time,

27. These percentage shares ignore stock changes for the year and, as such, are only the percentages of the sums of imports and domestic production for each year.

there have been no significant supply interruptions. While the gas coming from Russia continues to supply nearly 100% of the actual physical supply to the country, contractual supply arrangements with Norway and Germany, which now account for nearly 20% of total natural gas imports, have given the country a degree of supply diversification in the case of technical, political or other supply interruptions.

Figure 33

Austrian Natural Gas Imports by Country, 1973 to 2000



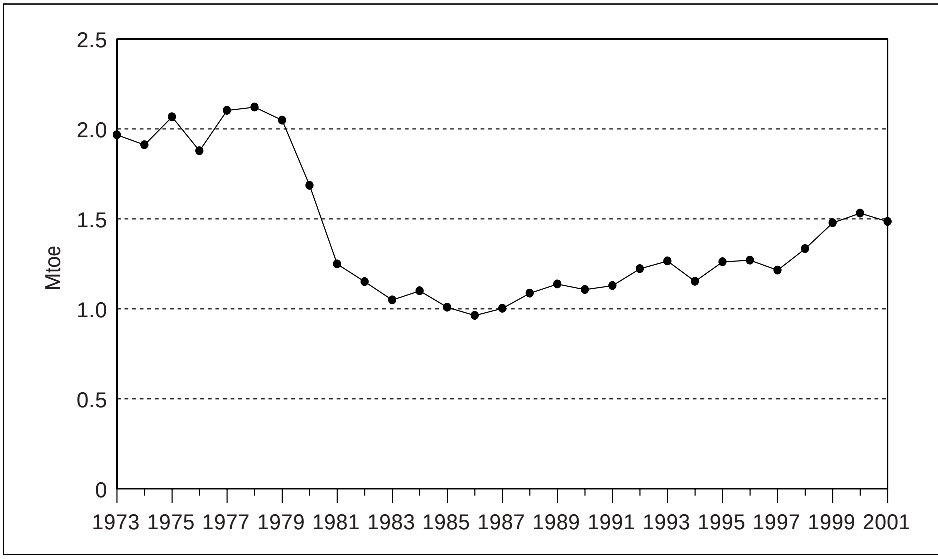
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

In 2000, Austria produced 1.5 Mtoe of natural gas domestically, or 23% of its gas supply for the year[28]. The percentage share of total gas supply coming from domestic production has been relatively stable over the last ten years (between 20% and 23%). Domestic gas comes from approximately 70 gas fields located for the most part in the two Länder of Upper Austria and Lower Austria. While domestic production has risen over the last ten years, the long-term trend is of decreased production. Annual domestic production peaked in 1978 when the country produced 2.1 Mtoe. It fell steadily from that point until it reached a low of 1.0 Mtoe in 1986. While domestic production has risen over the last ten years, the long-term trend of decreased Austrian production is expected to continue as domestic fields become depleted. Reserves[29] as of 1 January 2000 were 26.4 billion m^3. On the basis of the 2000 annual production from indigenous sources of 1.5 Mtoe of gas (approximately 1.9 billion m^3), Austria has a reserve/production ratio of 14 years.

28. Production and import percentages for 2000 add to more than 100% because of rounding.
29. Compiled by Geologische Bundesanstalt (Geological Survey of Austria) in co-operation with OMV, RAG and Van Sickle.

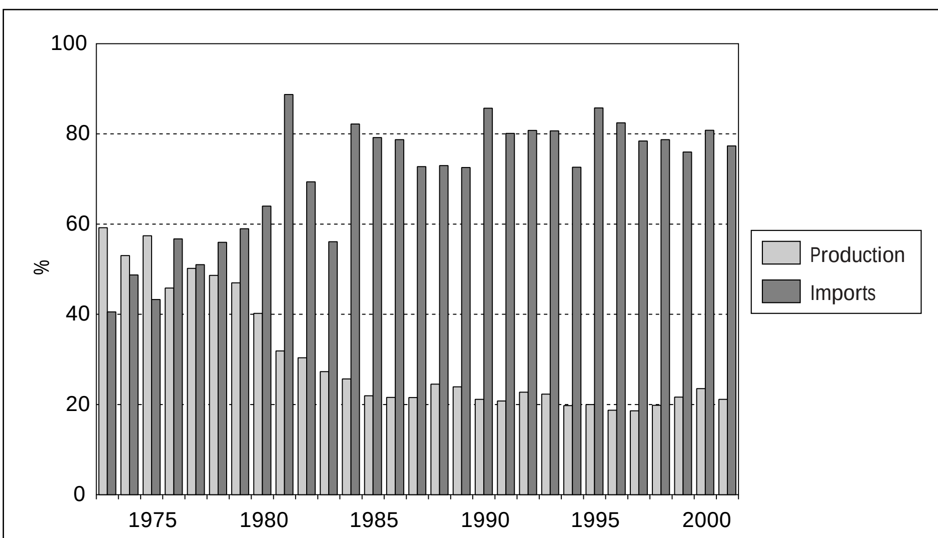
Figure 34 shows domestic consumption over the last 30 years and Figure 35 shows the percentage shares of gas demand met by both imports and domestic production over the same period of time.

Figure 34
Austrian Domestic Natural Gas Production, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

Figure 35
Percentage Shares of Natural Gas Supply Met by Imports and Domestic Production, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

TRANSMISSION AND STORAGE CAPABILITIES

In 1999, 24.7 bcm of natural gas transited Austria from the East to the West, approximately three times more gas than the country consumed domestically. Almost all of the gas was of Russian origin which was passed on to countries of Western Europe. The majority of the gas passed to Italy (18.4 bcm), with lesser amounts flowing to Hungary (2.5 bcm), France (2.1 bcm) and Slovenia (1.6 bcm).

In order to accommodate this high level of imports and extensive transit activity, Austria has developed an extensive network of both high-pressure and lower-pressure transportation and distribution lines. At the end of 2000, the total length of the Austrian distribution network was 27 950 km, of which 4 550 km were high-pressure pipelines and 23 400 km were middle- and low-pressure pipelines. Figure 36 shows the pipeline network.

Six major transit pipelines cross Austria with a combined length of 1 149 km. They are the West-Austria-Gasleitung (WAG, 246 km, diameter of 32 inches), the Hungary-Austria-Gasleitung (HAG, 45 km, diameter of 28 inches), the Penta West-Pipeline (72 km, diameter of 28 inches), the Süd-Ost-Leitung (SOL, 26 km, diameter of 20 inches), and Trans-Austria-Gasleitung I and II (TAG I, 382 km, diameter of 36 inches; TAG II, 378 km, diameter of 42 inches).

Austria’s working gas storage capability was 2.8 bcm in 2000. This represents approximately 140 days of gas storage. The level of Austrian natural gas storage is among the highest in the IEA countries. France has approximately 95 days of storage capability, Germany 77 days and Italy 82 days. Table 14 includes data on all Austrian gas storage facilities.

Table 14

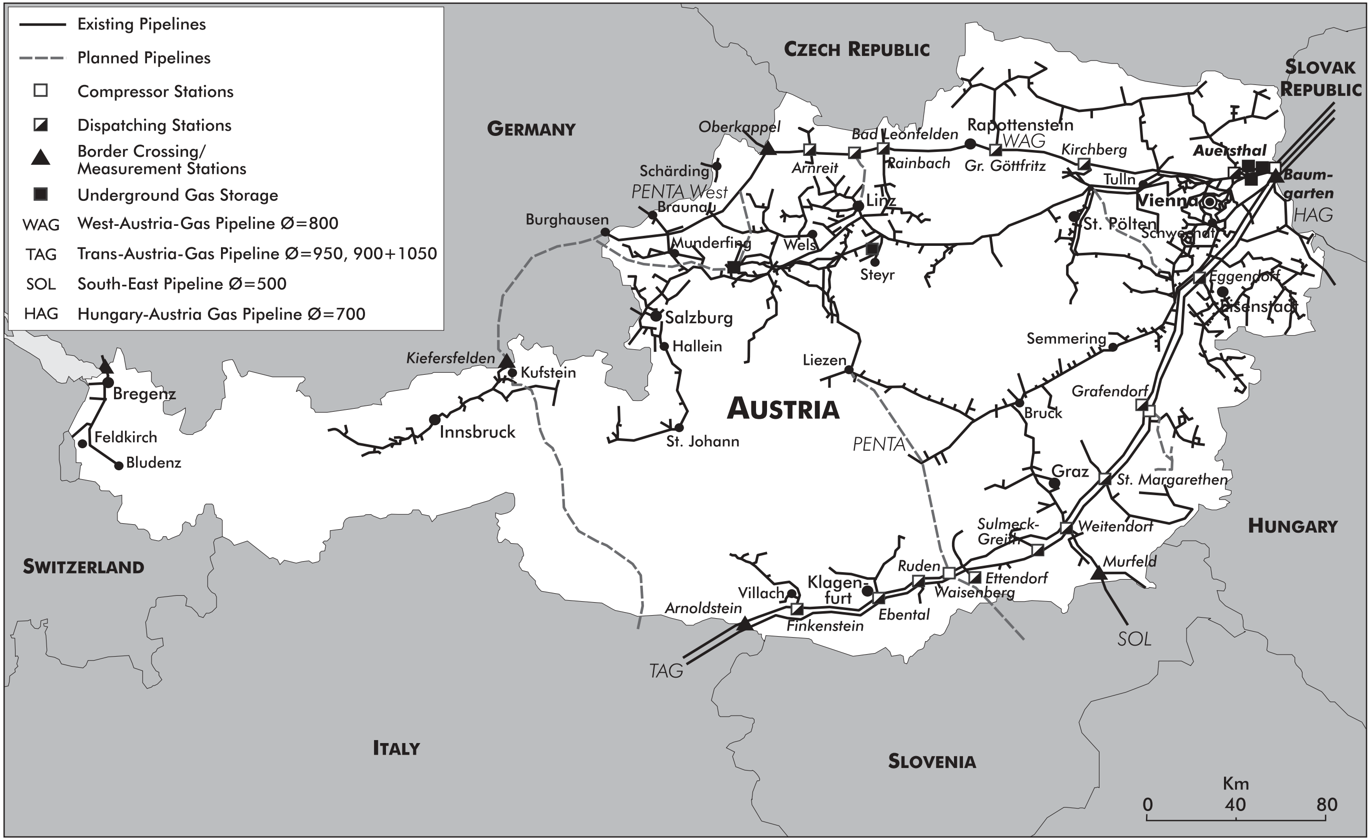
Gas Storage Fields and Capabilities

Name	*Type*	*Operator/ Number*	*Working Capacity (mcm)*	*Peak Output (mcm/day)*
Puchkirchen 1	Depleted Gas Field	RAG	50	0.5
Puchkirchen 2	Depleted Gas Field	RAG	450	4.5
Schoenkirchen/Reyersdorf	Depleted Gas Field	OMV	1 770	17.3
Speicher Vertrag 1	Depleted Gas Field	OMV	300	3.2
Thann	Depleted Gas Field	OMV	250	2.8
Total	**Depleted Gas Fields**	**5**	**2 820**	**28.3**

Source: Country submission.

Figure 36

Map of Austrian Natural Gas Transmission Pipelines

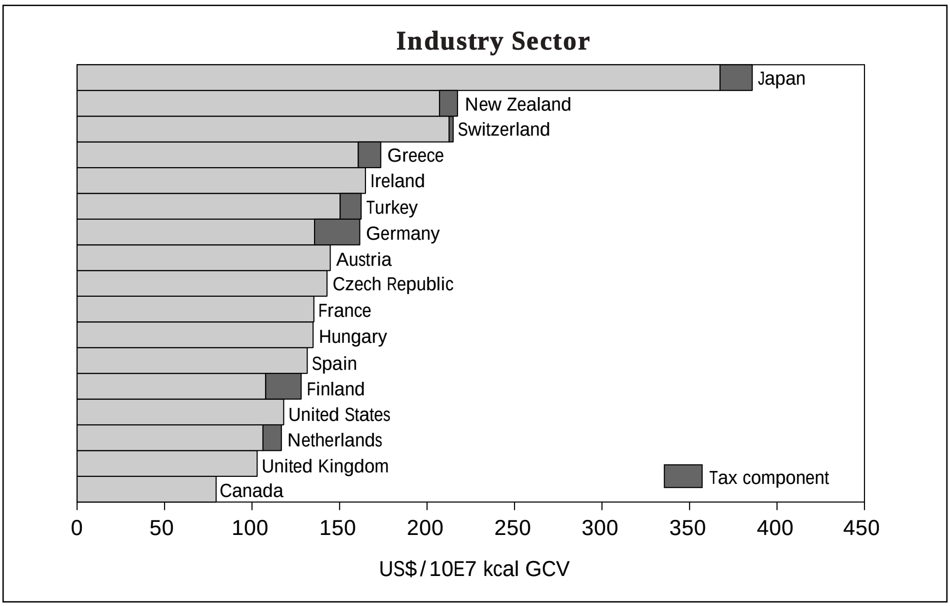


Source: *Natural Gas Information 2002*, IEA/OECD Paris, 2002.

RETAIL NATURAL GAS PRICES

In the 1990s retail natural gas prices for industrial customers fluctuated between €3.17/MBtu and €3.67/MBtu. (There are no taxes due on the purchase of natural gas by industry on the retail level.[30]) Changes within this modest band came largely as a result of changes in the price of gas supplied to OMV through long-term contracts with Russia and not as a result of changes in natural gas suppliers or the system access charges. At the close of the decade (1999), the price for natural gas for industry was in the middle of that range, at €3.42/MBtu[31]. This price places Austrian industrial gas prices at the lower end of the spectrum of industrial gas prices in IEA countries, as shown in Figure 37.

Figure 37
Gas Prices in IEA Countries, 1999



Note: Tax information not available for Canada and the United States. Data not available for Australia, Belgium, Denmark, Italy, Luxembourg, Norway, Portugal and Sweden.

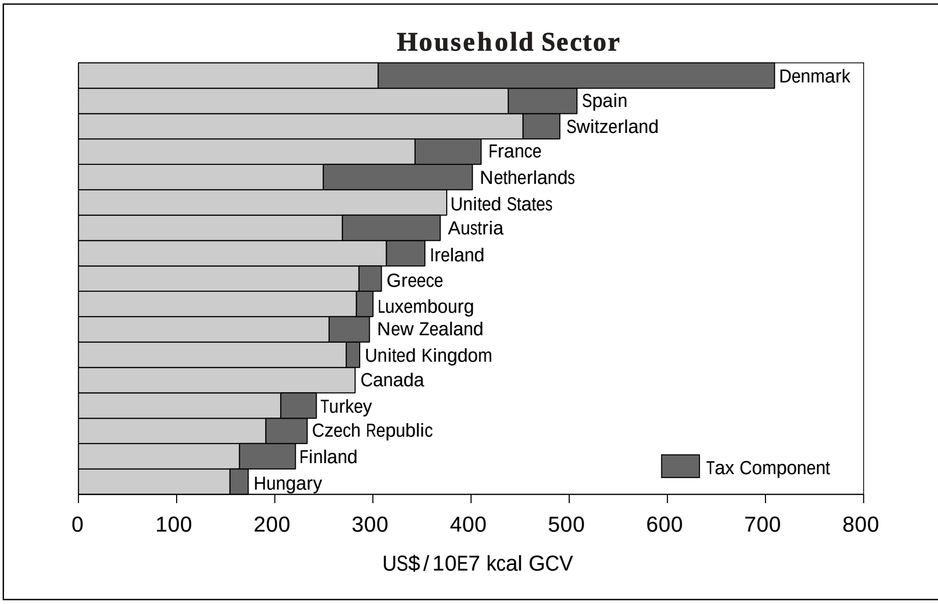
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Retail prices for residences have also stayed within a comparably small band. From 1990 to 2000, the average ex-tax price for households stayed between €6.68/MBtu and €7.09/MBtu. The residential retail ex-tax price in 2000 was €6.68/MBtu. Taxes in 2000 included a 20% VAT, and an excise tax of €1.07/MBtu instituted in 1996.

30. Austria's 20% VAT on natural gas purchases by industry are passed through.
31. Prices are not available at the retail level for industrial customers after 1999. Such a lack of industrial price data in recent years is not uncommon for IEA countries which have liberalised because these data become confidential.

Combined, these taxes added €2.66/MBtu to the customers' final bill for a total price in 2000 of €9.52/MBtu. Both the ex-tax and total retail residential prices for gas in Austria are close to the average for IEA countries, as shown in Figure 38.

Figure 38
Gas Prices in IEA Countries, 2001



Note: Tax information not available for Canada and the United States. Data not available for Australia, Belgium, Germany, Italy, Japan, Korea, Norway, Portugal and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

The residential prices cited above represent an average of prices across the region when, in fact, retail prices to household customers can vary substantially from Land to Land. The E-Control Ltd has estimated representative customer billings from different Länder. (The E-Control Ltd is the regulator for the liberalised electricity market. Its role was expanded to include regulation of natural gas with the full opening of the natural gas market in October 2002. This market opening process is discussed in detail below.) The E-Control estimates that in 2002, a household in Vienna would pay roughly €625 for typical annual gas use of 1 500 m^3 while a household in Graz taking the same amount of gas would have an annual bill of €859. Since the respective local utilities which supply these customers take gas from OMV at comparable rates, the regulator has ascribed the discrepancy in retail prices to varying grid access charges in the different Länder.

Transportation tariffs for Austrian gas are below the averages of other IEA countries. Table 15 shows representative transmission tariffs for Austria and selected EU countries.

Table 15
Gas Transportation Tariffs for Austria and Selected EU Countries (€/MBtu)

Country	*Utility*	*100 km*	*200 km*	*300 km*
Austria	OMV	0.14	0.25	0.36
Belgium	Distrigas	0.13	0.23	0.33
Germany	BEB	0.23	0.45	0.67
Germany	Ruhrgas	0.12	0.23	0.33
Germany	Thyssengas	0.12	0.23	0.34
Germany	VNG	0.13	0.24	0.35
Germany	WINGAS	0.12	0.22	0.32
Germany	*Average*	*0.14*	*0.27*	*0.40*
Denmark	DONG	0.25	0.25	0.25
Spain	Enagas	0.37	0.39	0.42
France	GDF	0.14	0.25	0.35
Ireland	BGE	0.40	0.40	0.54
Italy	*Average*	*0.60*	*0.60*	*0.60*
Luxembourg	Soteg	0.26	0.26	0.26
Netherlands	Gasunie	0.11	0.19	0.19
Sweden	VN	0.55	0.55	0.55
Average (by country)		**0.28**	**0.33**	**0.39**

Source: "First benchmarking report on the implementation of the internal electricity gas market," Commission of the European Union, March 2002.

GAS INDUSTRY REFORM

Austria is reforming its natural gas market as prescribed by the Austrian Gas Act (a part of the larger Energy Liberalisation Act) which was published on 1 December 2000 and entered into force (retroactively) on 10 August 2000[32]. The key element of the act is market opening. Beginning on 10 August 2000, all electricity producers and other gas consumers with an annual consumption greater than 25 mcm were given the right to choose their natural gas supplier. This was in accordance with EU gas directives which mandated such opening at that time for all member states. In Austria, the market opening gave supplier choice to approximately 50% of the market by volume for the country as a whole. From 1 October 2002, all consumers were given supplier choice.

One key structural component of the reform process was the establishment of an independent regulatory body to oversee the liberalised natural gas sector. This

32. The Austrian government passed the amendment to the Austrian Gas Act on 24 August 2002, providing the full legal basis for liberalisation. While this change came too late to be reflected in detail in this review, the structure of the liberalised industry described herein has been maintained.

regulator was created by the expansion of the existing regulatory authority introduced in 2001 for the oversight of the liberalised electricity sector.

The Gas Act divided the natural gas market into three control areas: one covering the seven easternmost provinces which will include OMV, its subsidiaries and other companies operating in this area; one for Tyrol (supplied mainly by Ruhrgas of Germany); and one for Vorarlberg (also supplied mainly from Germany). Each area has its own operations co-ordinator (separate from the federal gas regulator) which acts completely independent from the pipeline owners in each region. These co-ordinating bodies are responsible for distribution system operation, supply management, co-ordination between grid and storage facilities and planning. In addition, these bodies for each unit publicise detailed daily information on grid utilisation.

The new gas liberalisation laws mandated that all gas utilities with transmission pipelines or more than 50 000 household customers are required to functionally unbundle their supply and their pipeline operations through the legal separation of these functions. This requirement applies to OMV and larger Land-level utilities such as WienStrom.

Owners of gas transmission and distribution networks are required to provide third-party access (TPA) to customers and suppliers. This access must be completely non-discriminatory and, as such, a network owner cannot give preference to the transmission of its own gas at the expense of a competitor's gas transmission.

The tariffs for TPA were initially designed to be negotiated on a case-by-case basis between pipeline operator and gas supplier. At the end of 2001, the approach was changed so that a regulated tariff for all third-party access was implemented from October 2002. These regulated tariffs are now determined through cost-plus ratemaking methodology in a process very similar to that used in the electricity sector to determine rates for transmission line access. Grid pipeline owner-operators submit both capital and operating costs to the E-Control Commission to be approved. At this point, the commission rules whether such costs are reasonable and all costs deemed to be reasonable are placed in the rate base. This rate base, along with the allowed rate-of-return for the regulated network operator, is then used to calculate the TPA fees that alternative suppliers pay to use the pipelines.

Two separate tariffs for pipeline access were established for each of the country’s three control areas: *i)* distribution pipelines with pressure greater than 6 bar and *ii)* distribution pipelines with pressure less than 6 bar. These tariffs are based on postage stamp pricing methodologies.

Under the newly liberalised system, storage facilities are treated as entirely separate entities from the pipelines. Owners of gas storage facilities (primarily OMV) are required to provide other companies access to them on a negotiated basis. In addition to its traditional role of balancing gas supply and demand throughout usage cycles, storage facilities in liberalised markets can also be a very effective tool used in gas trading and hedging. The open access laws prescribed by the Austrian Gas

Act prevent OMV from enjoying this unfair advantage. OMV will, instead, negotiate with itself for use of the facilities on the same terms accorded to others. Storage charges, if more than 20% higher than the EU average for comparable services, may be reviewed and a specific tariff decreed by the independent gas regulator.

Impact of Liberalisation to Date

No data exist on the amount of supplier switching or the change in prices coming as a result of the August 2000 partial market opening. This lack of data is a result of the newness of the liberalised regulatory environment and the confidential nature of contracts between large gas consumers and their (incumbent or new) gas suppliers. Nevertheless, a study[33] commissioned by the European Commission to analyse changes in the recently liberalised European gas markets sheds some light on the efforts of both suppliers and customers to take advantage of the new system. (While this study provides valuable data about the initial experience of gas liberalisation in Austria, it only covers the period from August 2000 to March 2001.)

The study found that only one non-incumbent gas company is competing effectively in Austria. This is Ruhrgas, the German gas utility whose service territory abuts on the border with Austria. Ruhrgas had already been a player in Austria prior to market opening, providing gas supplies to the Salzburg and Linz utilities. Since August 2000, Ruhrgas has signed supply deals with 24 of the country's major users. Ruhrgas has plans to expand its market share to 14% by 2003 from the current level of slightly more than 5%[34].

The study also looked at why other gas supply companies had not entered the market. It surveyed 12 potential new gas suppliers and found that 9 of them (75%) had not tried to enter the Austrian market, and of the three that had, only Ruhrgas had been successful in securing Austrian customers. The study also surveyed approximately 28% of the customers eligible to switch suppliers as of August 2000. It found that while 50% of the survey respondents had launched calls for tenders for new suppliers, none of them had received serious offers and none of them switched from their incumbent gas supplier[35].

Difficulty with access to transmission and distribution pipelines was the major reason cited by both potential suppliers and large consumers to explain the limited activity in the liberalised market. One supply company cited difficulty getting access to OMV's high-pressure pipelines while others said they had run into difficulties securing access to the grids of local distribution companies. One gas

33. "Report for the European Commission Directorate-General for Transport and Energy to determine changes after opening of the Gas Market in August 2000" conducted by consulting firm DRI-WEFA, and released in July 2001.
34. This 5% includes Ruhrgas's supply to the Salzburg and Linz utilities which came prior to liberalisation. No public data exist which show how much of that share comes from directly supplying large customers since liberalisation.
35. This sample of large gas users is slightly skewed since none of the respondents reported switching suppliers and yet Ruhrgas has stated they have signed 24 new customers since the partial market opening.

customer claimed that while the local gas utility had unbundled its activities, it had kept all the grid capacity for its own supply division. Other consuming companies said they have not seeked for new suppliers because of existing medium-term contracts with their incumbent local gas utility.

While the study does point out some difficulties encountered in achieving competition in the market, it also notes several factors that portend development of greater competition. These include: *i)* TPA access conditions that are clear and easily available; *ii)* progress in the separation of activities of main incumbents; and *iii)* the successful penetration of Ruhrgas into the market.

Liberalisation could also impact the level of grid access fees. The E-Control believes that the greatest potential for savings to the consumer will be found in a reduction of that mark-up rather than in a reduction of the supply price for gas. The E-Control cites differences in grid access charges between Länder as evidence that these tariffs can be reduced, believing that these differences cannot reasonably be ascribed to differing traits among the respective Länder (e.g., geography, customer concentration). Instead, the E-Control believes that such differences come as a result of cross-subsidisation of other activities not related to ownership and operation of the natural gas grid, such as public transport and other municipal services.

System access charges for natural gas have already fallen as a result of the partial market opening and in anticipation of the full market opening in the fall of 2002. For example, the local gas utilities Sterische Ferngas, Linz AG and OÖF all lowered their tariffs at the beginning of 2002. The E-Control stated its intention to further lower those tariffs beyond 1 October 2002 when its responsibilities expanded to include jurisdiction over the regulated third-party grid access charges.

SECURITY OF SUPPLY

Three main factors will determine the security of Austria's natural gas supply. The first, a potential negative factor, is the rising share of demand to be met by imports. The second and third are potential positive factors: the country's extensive gas storage capacities; and the continued reliability of its import sources.

Regarding the share of demand met by imports, the absolute levels of domestic production have been relatively stable over the last 40 years; for example, average production throughout the 1990s was only 13% below the average production in the 1960s. Nevertheless, overall gas use has risen substantially over that time and domestic production's share has fallen accordingly, from an average of 95% in the 1960s to 21% in the 1990s. This trend is expected to continue as domestic fields are depleted and overall usage rises.

As for internal gas storage facilities, Austria's capacities in this area are very good, with a ratio of storage capacity over national consumption well above those of most other IEA countries. Storage is dominated by OMV which holds 80% of the gas storage market, although all storage capacities will open up as a result of liberalisation which will give third-party access to storage facilities at negotiated terms. The storage capacity should continue to represent a high share of consumption above IEA averages and effectively supplement security.

In regard to reliability of import supply, Austria has imported gas from the former Soviet Union and now Russia for the last 40 years without any significant supply disruption. In recent years, Austria has contractually diversified its import sources. As recently as 1990, over 97% of gas imports came from the former Soviet Union and now that figure has dropped to approximately 80% with new supplies coming from both Germany and Norway. While 80% still represents a high import dependence from a single source, this diversification of supply sources and the reliability that Russian gas has shown over the last 40 years should together provide a reliable import source.

CRITIQUE

Austria's transition towards a liberalised natural gas market in advance of the EU directives is commendable. The current and expected structure of the country's liberalised markets contains many admirable features. These include the full market opening to supplier choice, regulated third-party access to pipelines, establishment of an independent natural gas regulator, unbundling of gas utilities, and third-party access to storage facilities. Despite these commendable design features, several aspects of the Austrian gas market and its new liberalisation may prevent the country from realising the full benefits of market reform.

The greatest impediment to the introduction of an effective competitive market is the limited number of suppliers. Currently, OMV supplies 90% of the gas to the Austrian market through its imports and domestic production. The most effective way to overcome such market power is through the introduction of new entrants. However, only one new company has competed for Austrian consumers since the partial market opening in August 2000. The full market opening in October 2002 is unlikely to induce the entry of many additional competitors since Austria currently has a number of characteristics that make it unattractive to potential new entrants:

- The Austrian market is small in comparison to neighbouring countries such as Germany and Italy and will not, therefore, draw the attention of the larger players.

- The newness of the only recently finalised aspects of the regulations governing liberalisation and therefore their as-yet untested nature could induce companies to assume a wait-and-see attitude for a transitional period before actually entering the market.

- The largest player in the supply market (OMV) is forging an alliance with key distribution companies to target industrial customers. Such an alliance, combining OMV's supply dominance with the distribution companies' knowledge of and access to customers may further ward off potential new entrants.

- The majority of the gas going to Austria is purchased via long-term contracts with the Russian supplier. This can deter market entry because such long-term contracts have been used in some cases to refuse the use of transmission facilities by new entrants.

While some of these impediments to new entry are intractable (e.g., size and growth of the market), the government can take steps to address others. For example, any instances of harmful vertical integration in the market need to be closely monitored to ensure that no preferential treatment is given to gas supplies belonging to the distribution company or to a company with which it is affiliated. The gas market structure is complex and it forces the new entrants to negotiate with many parties. Discrimination at any point can make entry extremely difficult. The "NewCo", if fully realised, would create a joint-venture sales company that could use both OMV's 90% share of the supply market and the local distribution companies' 80% share of the Austrian retail market. Such breadth of both horizontal and vertical integration would allow any preferential treatment to affect the entire marketplace and thus have very far-reaching consequences. Potential market entrants have already complained that they have not been given access to pipelines despite the existing non-discriminatory TPA regulations already in force. Large consumers looking for alternative suppliers have lodged similar complaints. The gas regulator created in October 2002 should act swiftly to address all such disputes in order to ascertain their validity and correct them if necessary.

In addition, the government should adopt a policy towards the long-term take-or-pay supply contracts that are held both externally with Russia and internally between suppliers and large industrial customers. While these contracts may contribute towards security of supply, they can also constitute an impediment to competition. The external long-term supply contracts with Russia account for approximately 65% of Austria's total gas supply. Since the contracts are take-or-pay, this gas will flow into Austria regardless of the price at which competing suppliers can offer gas, a development which discourages new entrant suppliers. Moreover, existing internal long-term supply contracts have been cited as an impediment to supplier switching. In some cases, long-term supply contracts have been used to refuse the use of transmission facilities to new entrants. More liquidity, meaning more possibilities and mechanisms for consumers to access gas, can help address this issue. The establishment of OMV's Baumgarten facility as a trading hub would facilitate such liquidity. Government efforts should be directed towards increasing liquidity as a percentage of the total market while at the same time respecting the interests of the signatories of the long-term contracts.

The recently announced alliances within the natural gas sector merit attention. It will be necessary to assess these alliances from the viewpoint of market power and the goal of ensuring sound competition. The government should consider a review of the market concentration in the natural gas market by the Cartel Court. New laws were adopted in July 2002 to introduce a new set of regulations which define excessive market power in the electricity industry. The government should consider a new approach to the market dominance issues raised in the liberalised natural gas sector.

The greatest benefits from liberalisation may very well come from the reduction of grid access charges. These charges would apply to either the incumbent or the new gas suppliers so they could lower overall prices regardless of the number of new entrants or the share of customers switching suppliers. While the costs for gas transportation are slightly below international averages, the E-Control believes that cross-subsidisation of local grid access charges is causing a discrepancy in prices to the final consumer. The review of costs included in the local grid access charges will allow the recently created gas regulator to explore ways to reduce grid access charges in different Länder around the country.

Austria had originally opted for negotiated TPA for transmission. Now it has chosen to use regulated TPA instead, which is considered to be a sensible decision. While negotiated TPA is a more market-oriented approach where access prices are determined through negotiation by market players, this process is time-consuming and can be disadvantageous for small market participants. Regulated TPA, which has been introduced in most other European countries, is considered more efficient and provides equal opportunities to any potential new entrants to the market and, as a consequence, Austria's choice is commendable.

RECOMMENDATIONS

The Government of Austria should:

- Ensure that non-discriminatory TPA is provided to the entire pipeline system and, if necessary, consider requiring the legal unbundling of all pipeline owners or the divestiture of assets to achieve this goal.

- Assess whether the development of large supply groups overly concentrates market power and, if necessary, consider laws for the Cartel Court to address such market concentration.

- Assess the impact of distribution tariffs on effective competition in the gas market and review which costs should be recovered through clear, transparent access charges which accurately reflect costs.

- Facilitate access to different sources of supply by promoting liquidity in the market; consider the role a gas-trading hub at Baumgarten could play in increasing supply liquidity.

9

ELECTRICITY

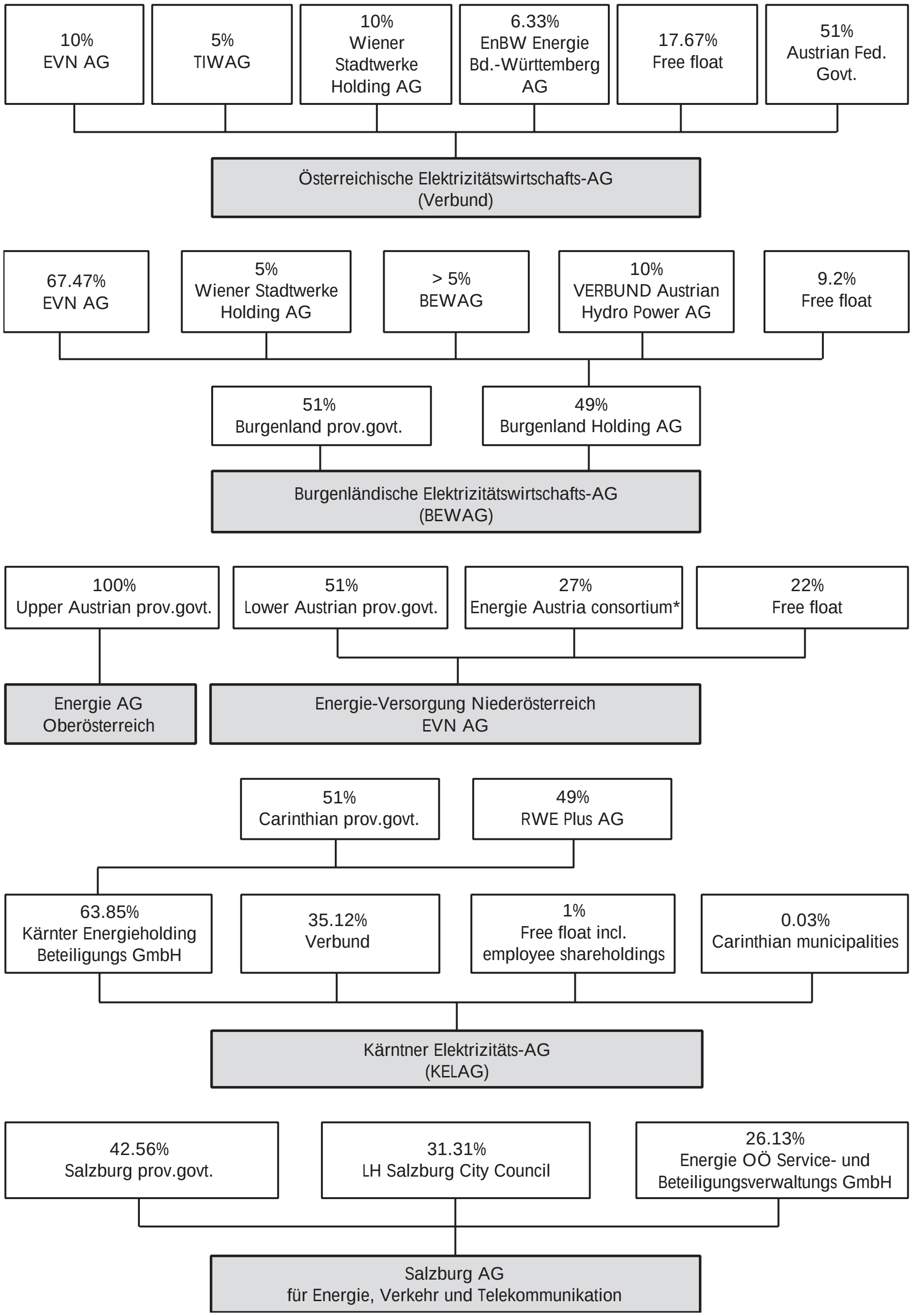
INDUSTRY STRUCTURAL OVERVIEW

The Austrian electricity industry contains three categories of utilities, each with different degrees of horizontal and vertical integration. There are utilities at the federal level, the Land (provincial) level and the municipal level. The largest electricity utility, the Verbundgesellschaft ("Verbund"), is the only one to operate at the federal level with assets spread across the entire country. These assets include the majority of the country's large hydropower generating facilities and the national high-voltage transmission line. At the provincial level, utilities exist in each of the nine provinces. These utilities own the distribution lines connected to final customers and variable amounts of generating capacity. The provincial utilities also engage in other non-electricity activities such as natural gas sales, district heating and transportation. Lastly, smaller utilities exist at the municipal level serving provincial capitals or smaller towns.

Austrian law requires that the government own at least a 51% share of all electricity utilities with generating capacity above 200 kW or with a total supply more than twice their self-generation. In the case of Verbund, this implies ownership by the federal government while, in the case of the provincial utilities, this implies ownership by the Länder governments. Municipal utilities are almost all entirely owned by the respective municipalities. In many cases the government owns more than the minimum 51% share required by law. For example, Energie AG Oberösterreich is 100% owned by the Upper Austrian Land government. In addition, there is substantial cross-ownership of utilities among provincial utilities and between the provincial utilities and the Verbund. For example, the EVN AG, the Lower Austrian provincial utility has a 10% stake in the Verbund and a 33% stake in BEWAG, the Burgenland provincial utility. The Verbund has ownership stakes in two Land-based utilities. Figure 39 shows the ownership structures for the Verbund and the nine Länder utilities.

As the only national electric utility, the Verbund acts as both the largest electricity generator in the country and the owner and operator of the country's high-voltage transmission line. In 2000, the company owned 6 069 MW of hydroelectric capacity (53% of the country total) and 1 281 MW of thermal generation (21% of the country total). During the same year, it generated 30 038 GWh of electricity, 49% of the total generation in Austria. It sells the large majority of its power to the smaller regional utilities which in turn re-sell this power to the final customers. Nevertheless, it does sell approximately 15% of total domestic sales directly to final consumers, mostly large industrial companies, and to ÖBB, the Austrian national railway. As part of a structural reform completed in 2001, the Verbund is divided into a number of smaller companies according to function. While these companies can be described as functionally unbundled they still all operate under the umbrella of the Verbund holding company structure. The major subsidiaries are shown below.

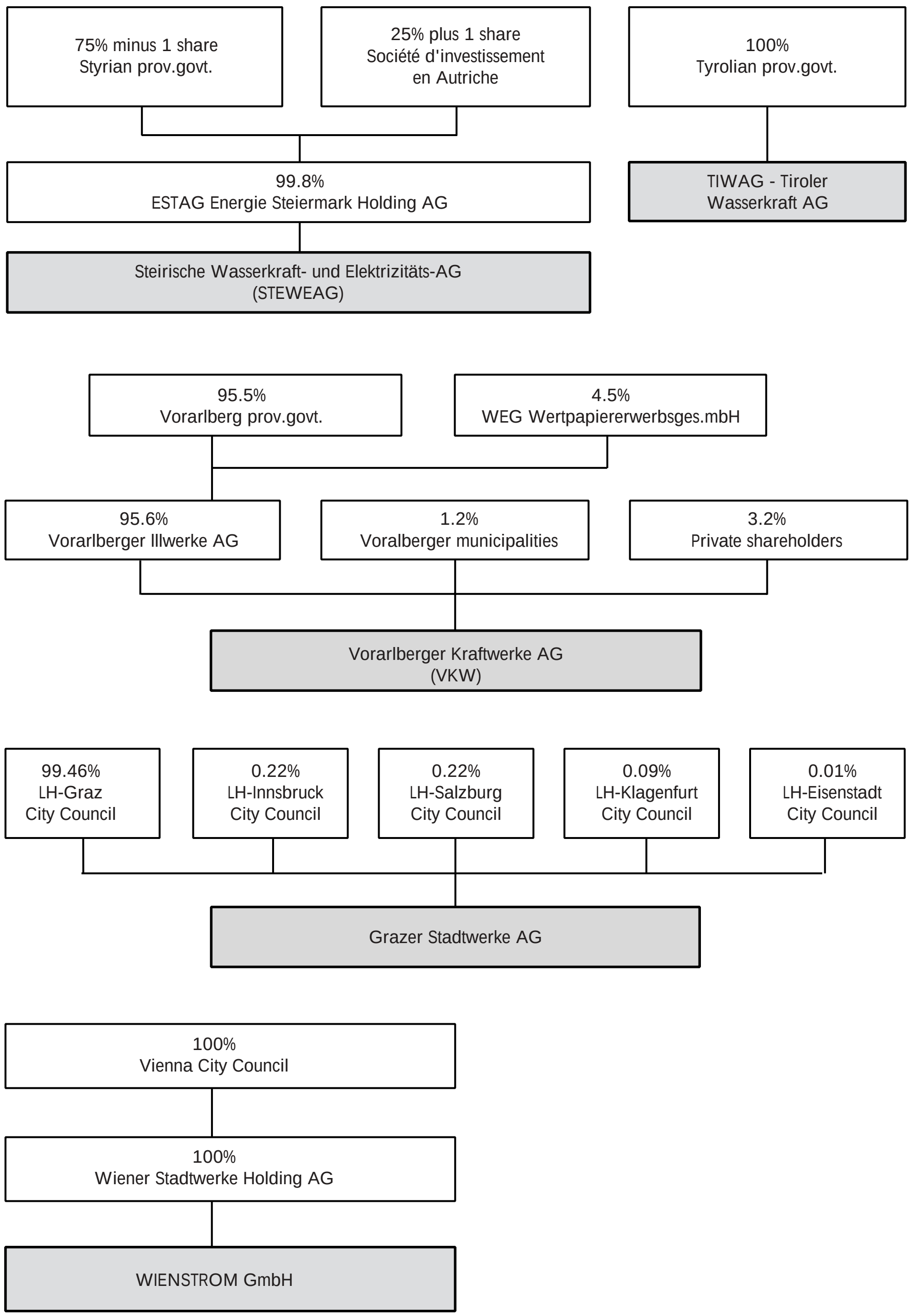
Figure 39
Ownership Structure of Austrian Electricity Utilities



* ESTAG, Energie AG OÖ, Verbund.

Figure 39 (continued)

Ownership Structure of Austrian Electricity Utilities



■ **Verbund-Austrian Hydro Power AG (AHP) –** This group owns and operates Verbund's hydroelectric facilities.

■ **Verbund-Austrian Thermal Power (AG) –** This group owns and operates Verbund's thermal power plants.

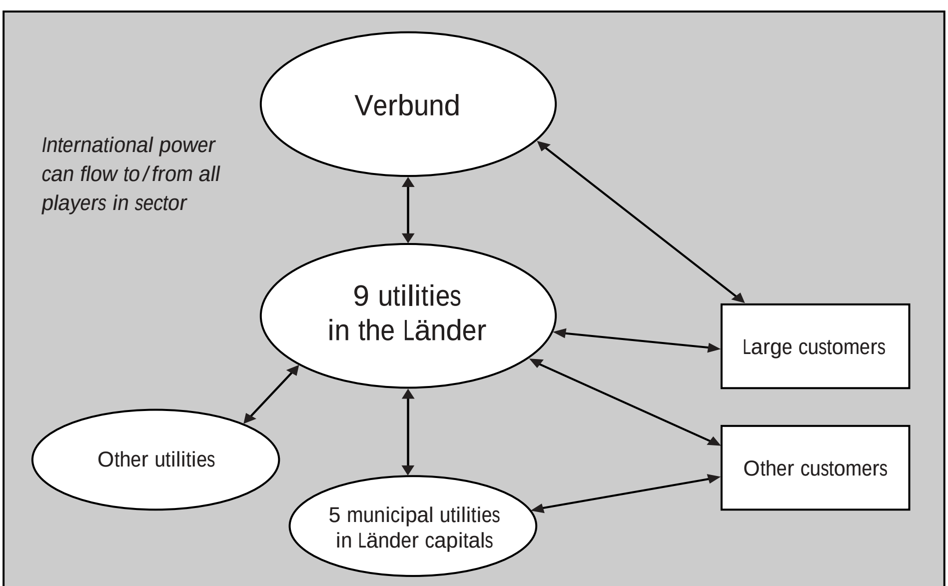
■ **Verbund-Austrian Power Grid AG (APG) –** This group owns and operates the national high-voltage transmission grid.

■ **APT Power Trading GmbH (APT) –** This group performs electricity trades and sells power to domestic and foreign resellers.

■ **Verbund Stromvertriebsgesellschaft GmbH –** This group sells power directly to larger customers.

The smaller Länder utilities own a small portion of the country's high-voltage transmission lines, all of the lower-voltage distribution lines in their respective territories, and a range of generation assets. In 2000, the Länder utilities generated a total of 24 937 GWh of electricity, or approximately 40% of the country's total (including self-generators). This included 18 064 GWh of hydropower (42% of the hydropower total) and 6 873 GWh from thermal stations (38% of the country total). The remainder of domestically generated electricity comes from Verbund facilities with smaller contributions from self-producers. The smaller utilities at the municipal level own both low-voltage distribution lines and occasionally power stations. The basic structure of the electricity supply industry with generation, transmission and retail sales is shown in Figure 40.

Figure 40
Schematic of Austrian Electricity Flows



Source: Institute of Energy Economics, Vienna.

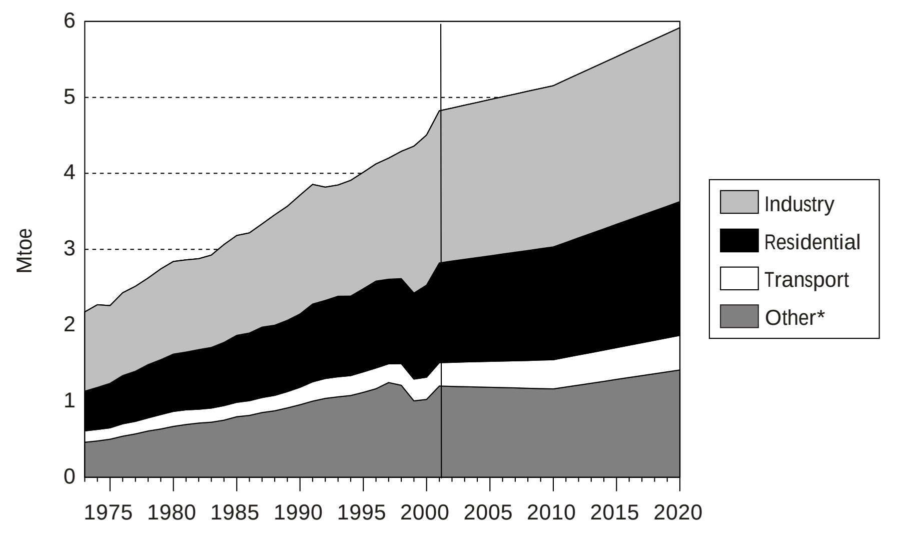
ELECTRICITY DEMAND

In 2000, Austria consumed 4.5 Mtoe (52.3 TWh) of electricity, or 18.2% of the country's total final energy consumption (TFC). Electricity counted for 24.8% of the energy consumed in the industrial sector and 23.3% of the energy consumed in the combined residential, commercial and agricultural sectors. Electricity made very little contribution to the transport sector, mostly in the form of local rail systems.

Electricity consumption has increased steadily over the past thirty years, rising at an average annual rate of 2.7% from 1973 to 2000. This compares with an average annual growth rate of overall TFC of 1.45% over the same period. As a result of these disparate growth rates, electricity's share of TFC has risen from 12.9% in 1973 to 18.2% in 2000. Since 1997, electricity final consumption has grown at a pace of 2.2% annually, slightly below historical trends but still above the growth of overall TFC of 1.5% over that period. Figure 41 shows historical and projected final consumption of electricity by sector.

Figure 41

Final Consumption of Electricity by Sector, 1973 to 2020

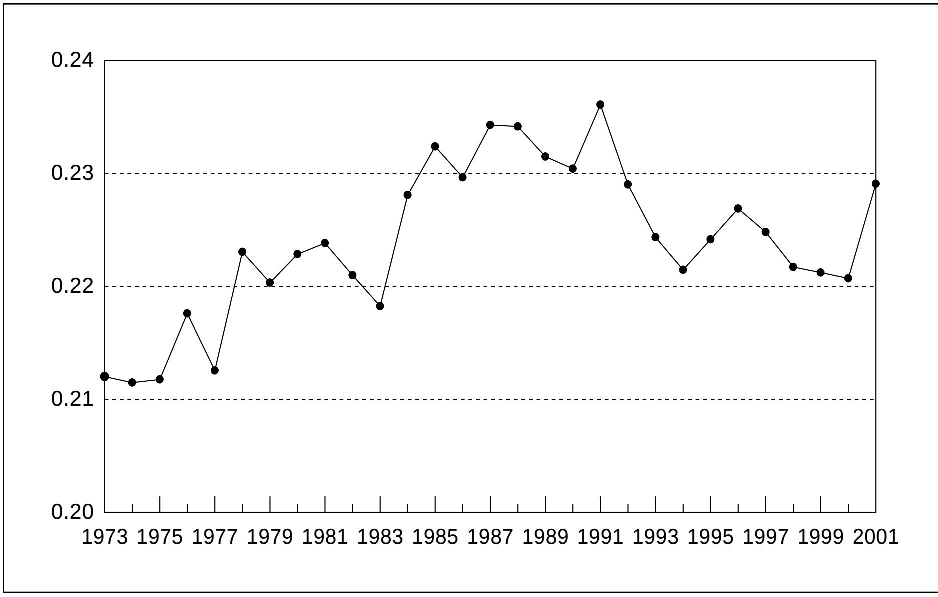


* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

Austria has a lower electricity intensity than most OECD countries. In 1999, Austrian electricity intensity (measured by kWh of final power consumption over national GDP in 1995 US$ PPP) was 0.21, while the average for OECD European countries was 0.28 and the average for all IEA countries was 0.33. This discrepancy is due mostly to the country's industrial structure (i.e., absence of electricity-consuming industries such as aluminium smelting). It also results from the modest use of electric space heating systems (6% nationwide) and from efforts to reduce public electricity use such as street lighting. Figure 42 shows the historical trend in electricity intensity for Austria.

Figure 42
Electricity Intensity*, 1973 to 2001



* calculated as production plus net imports divided by GDP and measured in kWh per dollar of GDP at 1995 prices and exchange rates.

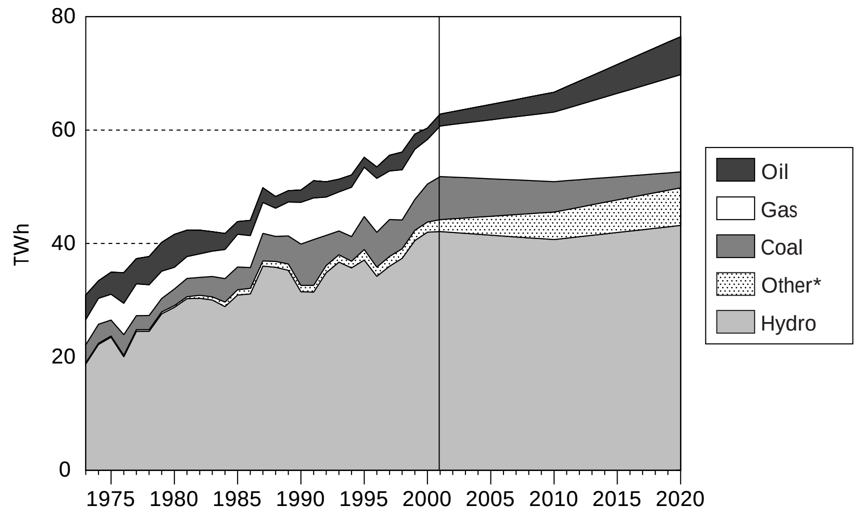
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and *National Accounts of OECD Countries*, OECD Paris, 2002.

GENERATION

The Austrian electricity system is predominantly based on hydroelectric stations. At the end of 2000, Austria had a total maximum electricity-generating capacity of 17 600 MW, of which 11 500 MW (or 64%) was hydropower, 6 535 MW (36%) was thermal power stations, and some 40 MW was wind and photovoltaic plants. This provides substantial capacity to cover the national maximum power demand of less than 10 000 MW, even in the winter months when hydropower is often unavailable. In the winter of 2000, a retrospective power balance analysis showed that Austrian utilities had between 3 600 and 4 800 MW of surplus capacity. This provides more than sufficient capacity to meet the country's peak electricity demands.

In 2000, hydropower produced 70.4% of the country's total generation, which is one of the highest shares of hydropower in the European Union. The remainder of the country's generation comes from thermal plants burning coal, fuel oil, natural gas and biomass. Figure 43 shows the breakdown of all generation sources.

Figure 43
Electricity Generation by Source, 1973 to 2020



* includes solar, wind, combustible renewables and waste.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002, and country submission.

As a result of seasonal precipitation patterns, hydropower production in the summer is higher than in winter. This affects the country's pattern of electricity imports and exports as well as the country's use of CHP technology. The need for electricity generation in the winter because of reduced hydroelectric production has advantages for CHP plants since these plants can sell their electricity in the winter months when there is high demand for their heat output.

The structure of fuel use for Austrian power plants has changed within the last three decades. Oil product use has declined substantially, falling from 14.1% of total generation in 1973 to 3.3% of total generation in 2000. The contributions of both gas and coal to electricity generation have remained relatively stable at around 13% and 11% respectively. Hydropower production has increased from 61% of total generation in 1973 to 70% in 2000. Since 1997, hydropower use has increased at the expense of oil products and natural gas. However, fluctuations such as this over the short term have more to do with annual changes in precipitation levels and resulting hydropower production than structural changes in the electricity mix

In 2000, hard coal and brown coal (i.e., lignite) plants combined to generate 5 724 GWh of electricity, or 9.3% of the country's total domestic generation. The country's only remaining domestic coal mine produces lignite and is owned by the private Austrian company GKB-Bergbau GmbH. This company has signed a long-term contract with Austrian Thermal Power AG (a subsidiary of the Verbund) to supply lignite at rates and terms which are more favourable to the seller than international market-driven conditions. According to Article 88 of the EC Treaty and the decision of 25 July 2001 of the European Commission, the contract will be abolished in 2004. Without the aid of this above-market contract, the domestic coal industry may find it difficult to compete with international producers.

Nuclear power is prohibited in Austria by a federal constitutional law which was passed by public referendum in 1978. Although one nuclear power plant has been constructed, it was never operated. The ban in no way leaves Austria short of generating capacity. In addition to the rejection of nuclear power as a domestic generation alternative, there is public and political controversy surrounding the import of power from countries that have nuclear power and the safety of other countries' plants that lie within proximity to Austrian borders.

TRANSMISSION AND DISTRIBUTION

Austria has an extensive and reliable system for the transmission and distribution of electricity. While some minor bottlenecks still exist on an isolated basis, heavy investment in the power grid over the last twenty years has insured its performance through the near future. The length of the Austrian high-voltage grid system was about 9 500 km in 2001. This includes lines at voltage levels of 380 kV, 220 kV and 110 kV. Expansion programmes in recent years have mainly concentrated on the 380 kV lines.

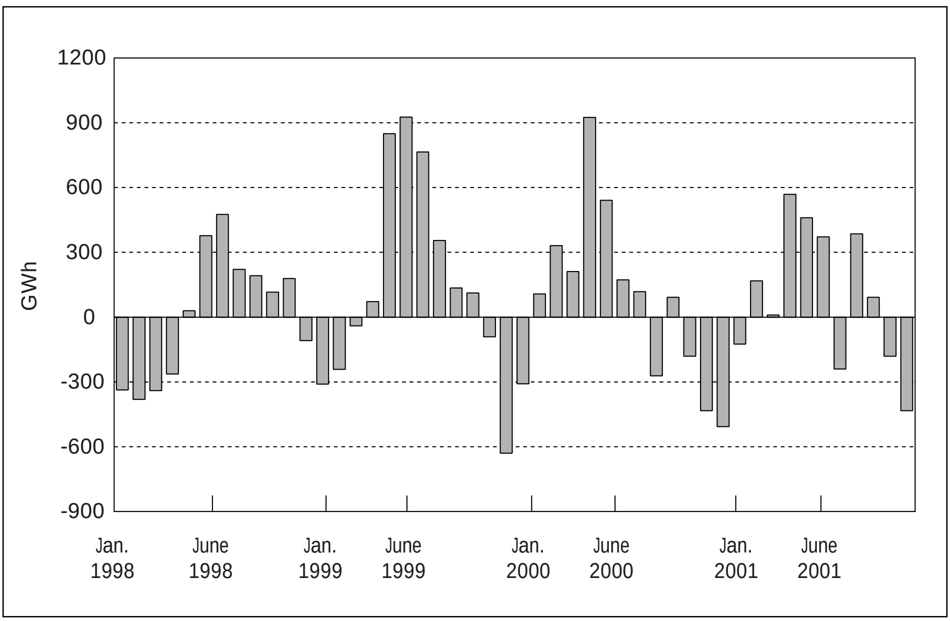
There are about 150 grid operators in Austria, but the ten largest operators (i.e., the Verbund-owned APG and the nine regional utilities) own 98.5% of the combined length of the transmission and distribution systems. APG owns some 92% of the 380 kV and 220 kV lines and the regional utilities own about 80% of the 110 kV lines. In 2000, the total resistive transmission losses in Austria due to physical resistance was 3 200 GWh, or 4% of total power transmitted.

The Austrian power system is divided into three Control Areas. The Verbund-APG control area covers the provinces of Burgenland, Carinthia, Lower Austria, Salzburg, Steiermark, Upper Austria and Vienna. The TIWAG (Land utility) control area encompasses the province of Tyrol and the VKW (Land utility) control area covers the province of Voralberg. The country has three control areas owing to historical reasons. The TIWAG control area was made separate because it was developed along with the German electric system more than the rest of Austria. The VKW control area was developed along with the Italian electric system so it too was separated from the rest of Austria. The main obligations for Control Area Managers are providing network-related services, mutual co-ordination of schedules with other control areas, organising and dispatching balancing energy, preparing a load forecast and taking measures to balance transmission constraints.

ELECTRICITY TRADE

Austria engages in significant electricity trade with its neighbours. All electricity imports and exports are subject to a cross-border tariff of €1/MWh. Because of the seasonal nature of the country's large hydropower capacity, it is a net exporter during the summer months and a net importer during the winter months. Figure 44 shows monthly net exports from 1998 through 2001.

Figure 44
Monthly Net Electricity Exports, 1998 to 2001



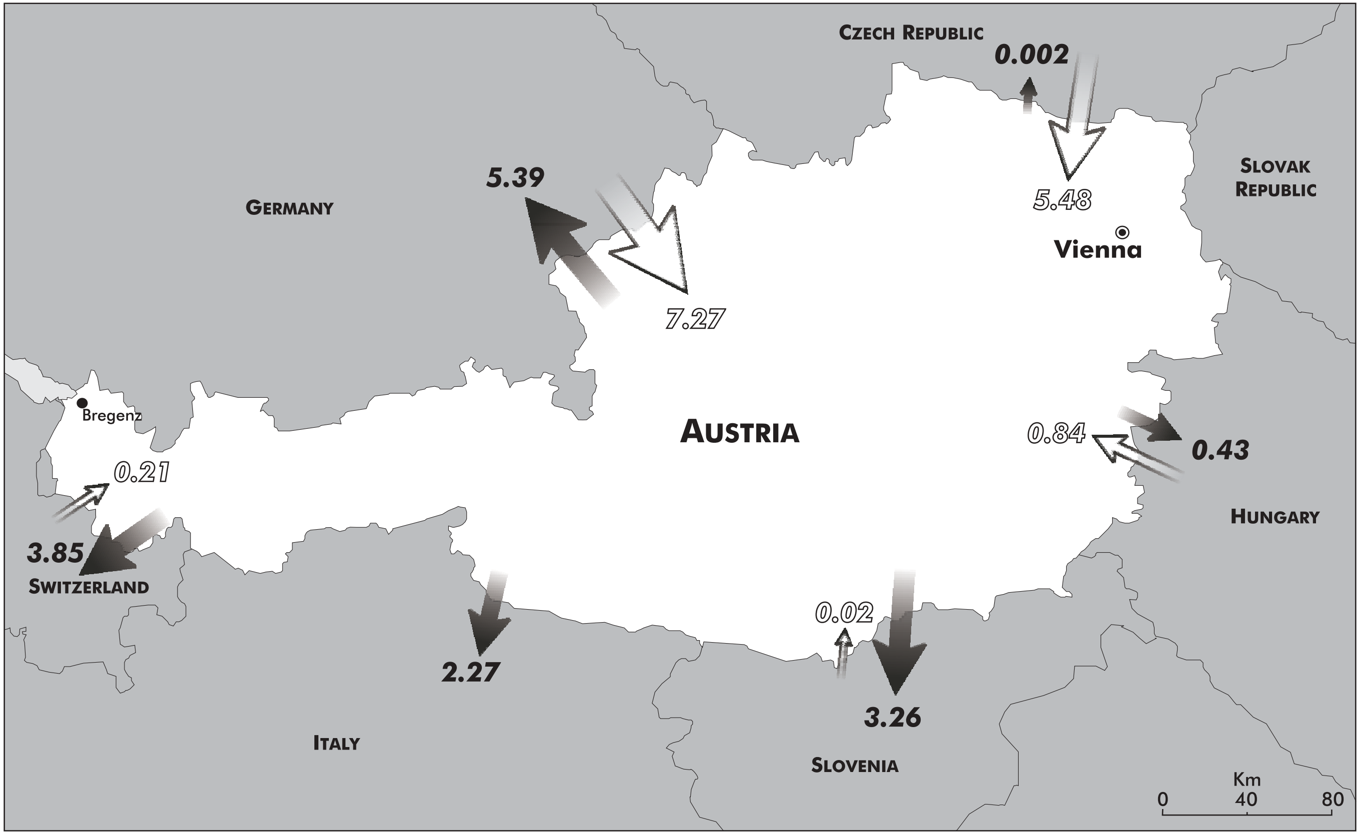
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

In 2000, Austria imported 13 824 GWh, an amount equal to 25.7% of the country's final electricity consumption in that year. At the same time, the country also exported 15 192 GWh, or 28.3% of the country's final electricity consumption. The country was a net exporter of 1 368 GWh, or 2.6% of domestic power consumption. Figure 45 shows Austria's imports and exports by trading partner in 2000.

Austria's electricity trading activity has increased over the years. Exports are becoming an increasingly important revenue source for domestic suppliers and the

Figure 45

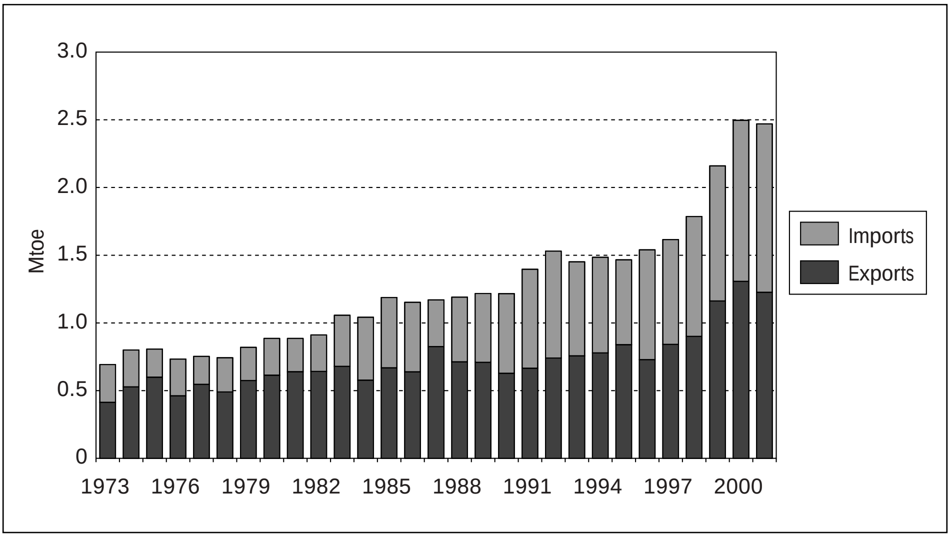
Map of the Electricity Trading Activity, 2000 (TWh)



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

net imports are becoming an increasingly useful way to meet fluctuations in supply and demand at minimum overall cost. From 1973 to 2000, total electricity trade (i.e., imports plus exports) rose by 260% and this increase has been particularly significant in recent years. From 1995 to 2000, trade increased by 99%. Figure 46 shows historical Austrian electricity trade.

Figure 46
Annual Austrian Electricity Trading Activity, 1973 to 2001



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2002.

RETAIL SUPPLY AND PRICING

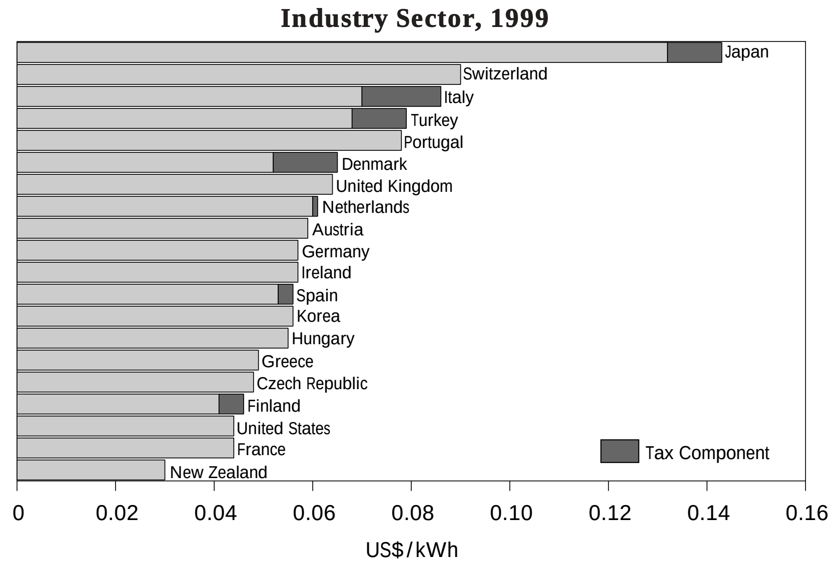
Austrian electricity tariffs are comparable to European averages for retail sales at both the residential and industrial levels. In comparison with its immediate neighbours, Austrian electricity rates are similar to Germany's and lower than Italy's.

In Austria all retail electricity sales have tariffs with three major components. These are:

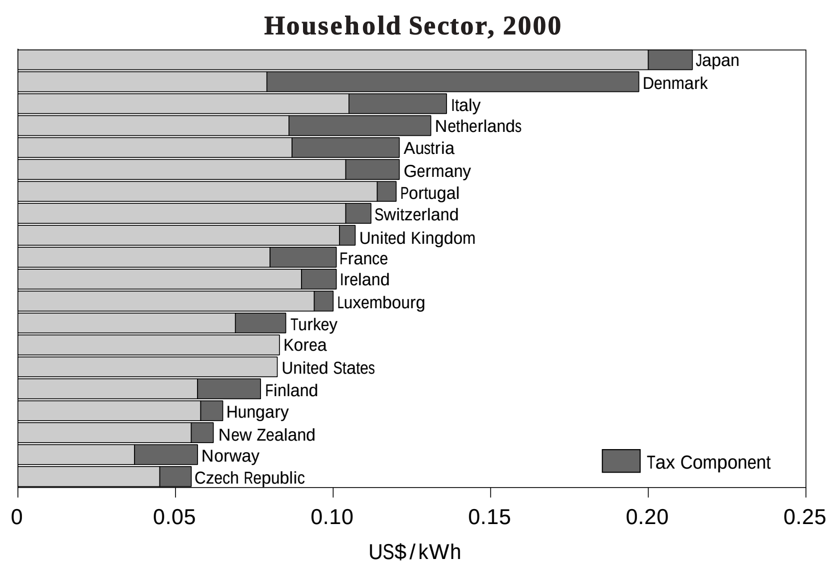
- Energy price – relates to the generation of electricity.
- System access charge – covers grid utilisation and transmission losses.
- Taxes and levies – includes taxes, stranded cost recovery, and surcharges to support renewable "green" energy technologies and CHP plants.

Of these three charges, only the energy price is set by competitive forces and, in the case of residential customers, this component averages slightly more than 20% of the customers' total bill. Table 16 shows the components of a typical residential customer's electricity bill from utilities in each of Austria's nine Länder.

Figure 47
Electricity Prices in IEA Countries



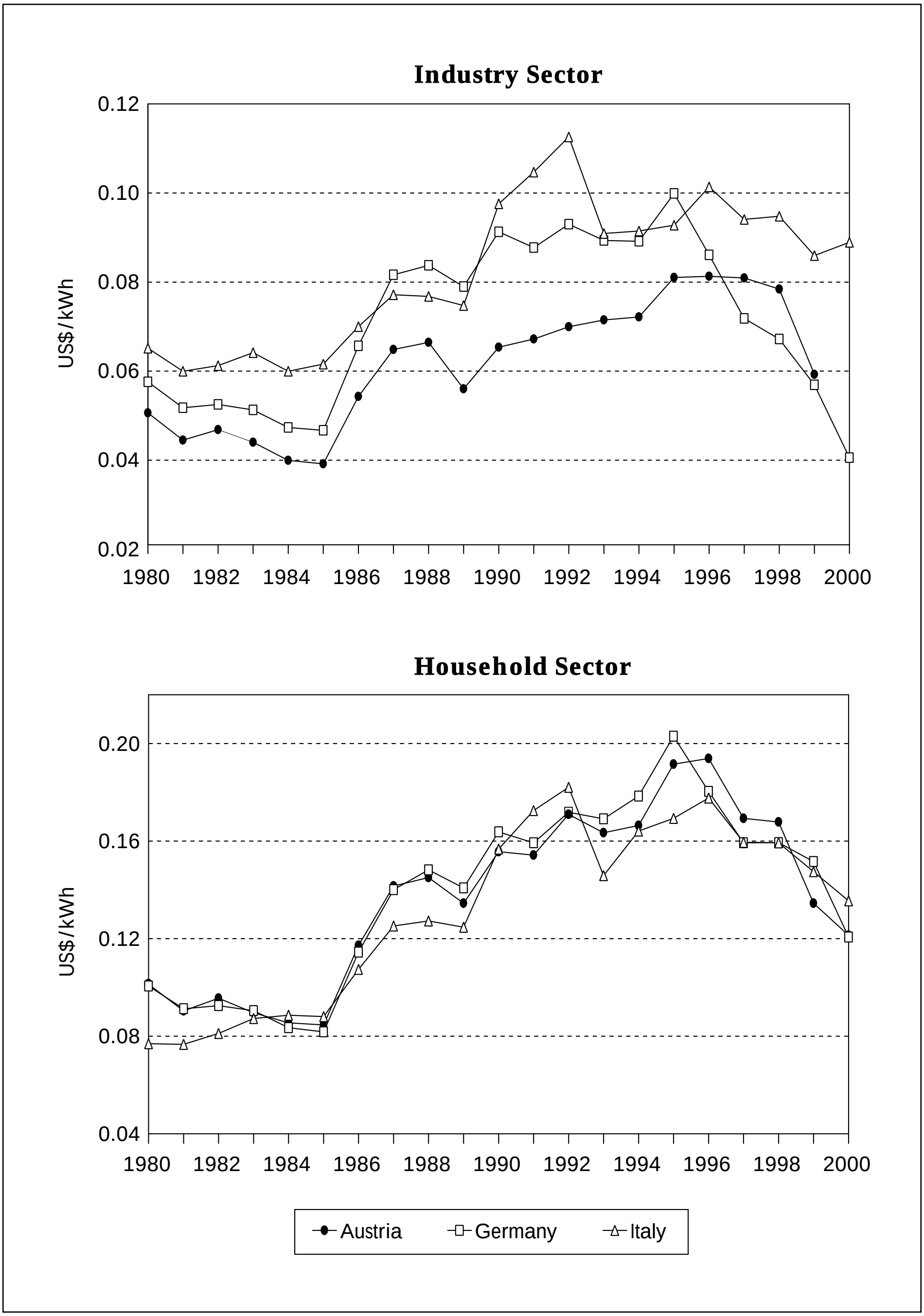
Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Luxembourg, Norway and Sweden.



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Greece, Spain and Sweden.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Figure 48

Electricity Prices in Austria and in Other Selected IEA Countries, 1980 to 2000



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2002.

Table 16
Composition of Residential Electricity Prices

	Price Components (€ cents/kWh)			
Land Utility	*Energy*	*System Access*	*Taxes and Levies*	*Total*
Salzburg AG	3.34	8.79	4.14	16.27
Energie AG	2.83	9.08	4.36	16.27
STEWEAG	3.05	8.65	4.43	16.13
BEWAG	2.18	9.16	4.22	15.56
WienStrom	3.05	6.18	5.45	14.68
KELAG	3.05	7.49	3.92	14.46
EVN	3.12	7.19	4.00	14.31
TIWAG	3.05	5.89	3.56	12.50
VKW	2.98	5.67	3.63	12.28
Average	2.96	7.57	4.19	14.72
Average (%)	20.1%	51.4%	28.5%	

Source: *Jahresbericht 2001*, E-Control.

It is important to note that both industrial and commercial customers pay much lower taxes and system access charges than do residential customers. As a result, the energy supply percentage of their total bill is much higher. Industrial customers pay approximately 1.5 € cents/kWh for the combined costs of access charges and surcharges, while the energy component of their bills is around 2.0 € cents/kWh. Commercial customers pay a higher percentage of non-energy components in their bill than industrial customers pay, but still considerably less than residential customers.

The system access charges and the taxes are themselves made up of various sub-components. The component percentages of a typical residential electricity bill[36] are shown in Table 17.

Table 17
Component Breakdown of a Typical Residential Electricity Bill

Price Component	*Percentage of Total Bill*
Energy Supply Price	**21.0**
System Access Charge	**42.0**
Grid Utilisation Charge	35.2
Network Loss Charge	1.7
Metering Charge	5.1
Taxes and Levies	**37.0**
Value-added Tax	16.6
Energy Tax	10.2
"Green" Electricity Surcharge	0.4
CHP Charge	5.0
Vienna City Council Usage Charge	4.4
Stranded Costs Charge (WienStrom)	0.4

Source: *Jahresbericht 2001*, E-Control.

36. Based on a residential customer in Vienna receiving 3 500 kWh of electricity annually, as of 31 December 2001.

Based on the above representative bill, that part of the customer's final payment (the energy component) that is now subject to competition is quite small at slightly more than one-fifth of the total price. Any percentage reduction realised in that component will only reduce the customer's total bill by an amount one-fifth as much. For example, if the energy portion of the bill is reduced by 25%, this would produce a 5% reduction in the customer's total bill.

The system access charge represented by the 42% of the customers' bills shown in Table 16 is among the highest in Europe. According to a study[37] published by the European Commission in December 2001, Austrian system access charges fall into the category with the highest such charges among European countries. Other countries with similarly high system access charges include Germany, Spain and Portugal. Table 18 below shows the low- and medium-voltage networking charges for EU countries.

Table 18
Electricity Distribution Tariffs

	Medium Voltage		*Low Voltage*	
Country	*Average Charge (€/MWh)*	*Approximate Range (€/MWh)*	*Average Charge (€/MWh)*	*Approximate Range (€/MWh)*
Austria	22	18-33	66	43-83
Belgium	15	..	..	..
Denmark	13	..	20	..
Finland	14	..	26	..
France	10	..	..	..
Germany	..	15-30	65	35-80
Italy	15	..	..	..
Ireland	10	..	33	..
Netherlands	8	7-10	35	26-49
Portugal	19	..	..	..
Spain	16	..	49	..
Sweden	9	8-11	30	25-40
UK	10	8-13	24	18-38

Electricity regulator E-Control (described below) attributes these relatively high rates to three factors. One, the historical over-building of the transmission line. Two, cross-subsidisation of costs not actually related to the distribution services. Three, operation of the distribution network at suboptimal efficiencies.

GOVERNMENT INSTITUTIONS

Federal Ministries

The Federal Ministry of Economic Affairs and Labour (BMWA) is the main body responsible for electricity (and other energy) matters at the federal level. The minister has three main areas of responsibility:

37. "First report on the implementation of the internal electricity and gas market"; Commission of the European Union (3 December, 2001).

- Supervising the activities of E-Control.
- Supervising the federal government's shareholding in E-Control.
- Establishing E-Control's terms of reference.

In addition, the ministry issues and administers the rules required for the performance of international agreements such as the general framework governing the treatment of cross-border supplies. The Electricity Advisory Board has been established at the ministry to co-ordinate the efforts of other federal ministries as well as representatives of the Länder and the social partners.

The Electricity Control Commission

The E-Control Commission is a three-member body that rules on issues relating to the regulation of the electricity sector. Its three members are appointed by the federal government but are not bound by ministerial instructions in the exercise of their office. The chairman is drawn from the judiciary and the other two members must have a relevant technical, legal or economic background. The term of office of members is five years.

The primary E-Control Commission function is to rule on the general terms and conditions for the utilisation of the transmission and distribution networks. Since the introduction of liberalisation (explained in greater detail below), grid owners must provide non-discriminatory third-party access to their lines. The E-Control Commission sets the system access charges at a fair rate. This process begins with the utilities submitting technical and cost data to the E-Control Commission and using these data to make a case for the tariff level and conditions it is requesting. The E-Control Commission examines the data and decides the appropriate tariffs.

The E-Control Commission arbitrates disputes in the liberalised electricity sector. This could include an *ex post* dispute over a utility's refusal to provide non-discriminatory network access or any other dispute between market participants. The E-Control Commission also arbitrates disputes concerning the settlement of the balancing of power.

Electricity Control Ltd.

The E-Control was established to discharge the government's tasks in the electricity sector and to work as the secretariat for the E-Control Commission. It is a limited liability company with about 40 employees and a share capital of €3.6 million.

The E-Control's primary duty is to monitor compliance with competition rules. Towards this end, it prepares and publishes comparisons of electricity prices for final customers (see box for one means of price data distribution), monitors the unbundling process for electricity utilities and monitors imports of electricity from countries which are not members of the European Union. It also has an ongoing role to formulate proposals for market rules and to monitor compliance with the obligation to contract sufficient power from environment-friendly technologies, including the small hydropower certificate trading system. In addition, it settles the balancing payments between line owners who belong to the same network. Such payments are required when the network operator orders an exchange of power between two different companies within its balancing group in order to maintain system network viability. In addition, the E-Control collects fees necessary for the recovery of stranded costs associated with market liberalisation.

Tarif-Kalkulator

In its role as a publisher of retail prices for electricity consumers in the newly liberalised market, the E-Control has developed a section of its website which allows the public to calculate the tariffs they could receive if they chose a different supplier. This application, called the "Tarif-Kalkulator", is accessible to the public from any Internet-accessible computer. It addresses the need for a common denominator which allows easy comparison among competing tariffs, a process often complicated by differing consumer behaviour, contractual terms and payment methods. In order to provide accurate information, the site solicits relevant data from the user:

- Consumer's location within Austria.
- Consumer tariff class (i.e., whether residential, industrial, agricultural, etc.).
- Consumer power use (e.g., whether or not electricity supplies the major space heating source and when this is used).
- Summer and winter estimated power use.
- Preferred or excluded origins of the electricity (e.g., fossil fuel, hydropower, nuclear, etc.).
- Payment preferences.

The website then lists all of the suppliers that can serve the consumer with details of the offers from competing suppliers. This information includes the price of power (broken down into its component parts), payment methods and timing, and, in certain cases, information on the source of the electricity offered.

From the introduction of the Tarif-Kalkulator in September 2001 until the end of December 2001, 120 000 consumers visited the site in order to compare the different electricity tariffs available to them. In addition to this pricing service, the E-Control has engaged in other information schemes to inform the public about energy liberalisation. A brochure describing the liberalisation process and its effects on the consuming public was launched in July 2001 and in August, the E-Control set up a telephone hotline to address public queries on all electricity liberalisation matters.

Länder Governments

The Länder governments issue operating licences for power stations and for distribution system operators. In accordance with the law passed by the Austrian Parliament in the summer of 2002, they ceded to the federal government responsibilities they previously held relating to renewable energy. The Länder governments previously set the minimum price for the feed-in tariffs paid by the local utilities for power coming from renewable energy technologies and, in some cases, CHP plants. In the past, they also determined the surcharges that the utilities were allowed to charge all customers in order to recover the payment of these feed-in tariffs.

ELECTRICITY MARKET REFORM

Reform Legislation and Market Operation

The first step towards Austria's power sector liberalisation was the Electricity Industry and Organisation Act (ElWOG) which entered into force in February 1999. This did not provide full market liberalisation but only offered choice to certain segments of large power consumers. ElWOG was subsequently amended to give supplier choice to all customers. Austria is the fifth EU country to offer this level of competitive choice to its electricity consumers. Table 19 shows the percentage of the electricity markets open in the EU countries (as of 31 December 2001) as well as the years in which they opened or plan to open their markets completely.

Table 19
Electricity Market Opening in EU Countries

Country	*Market Opening*	*Year of Full Opening*
Austria	100%	2001
Belgium	35%	2007
Denmark	90%	2003
Finland	100%	1997
France	30%	None
Germany	100%	1999
Greece	30%	None
Ireland	30%	2005
Italy	45%	None
Netherlands	33%	2003
Portugal	30%	None
Spain	45%	2003
Sweden	100%	1998
United Kingdom	100%	1998

Source: "First report on the implementation of the internal electricity and gas market", Commission of the European Union (3 December 2001).

As a result of the liberalisation process, the generation and wholesale purchase or trading of electricity is no longer regulated (except for environmental and safety regulations which remain in place unchanged). Such activities can be done by any party in any location at prices and terms which are subject to private negotiations. The transmission and distribution functions continue to be treated as a natural monopoly and, as such, remain under a largely unchanged regulatory structure. There is regulated third-party access to the networks, which remain a legal monopoly under the jurisdiction of the E-Commission. On the retail level, consumers are free to have any party provide their electricity. While companies which own and operate local distribution lines are certainly one of the parties able to compete to supply that energy, they must always offer their transmission and distribution services to bring the power to the customer, even if they are not the selected supplier.

The ElWOG 2000 requires all utilities to separate their accounts into generation, transmission, distribution and retailing activities. There is no further requirement that the companies legally separate these functions into separate companies or that they divest the assets of each function.

With this market opening, balancing groups were introduced to replace the system of closed supply territories. These balancing groups represent the aggregation of suppliers and consumers into a virtual group, within which supply and demand are balanced. As of year-end 2001, there were 29 commercial balancing groups in Austria as well as a number of special-purpose balancing groups for calculating network losses, for environmental power and for CHP plants.

Initial Impacts of Liberalisation

Price Developments and Supplier Switching

Price reductions as a result of liberalisation vary substantially by customer class. Residential customers have seen ex-tax retail price drops of approximately 10%, although increases in existing taxes and the introduction of user surcharges to support environment-friendly technologies have largely eliminated this price saving. When considering the total price customers pay (including surcharges and taxes), regulators estimate that two-thirds of residential customers now pay lower prices, while the other third pays the same or more, but in any event, the change has been minimal. The ex-tax prices paid by small business customers have fallen by approximately 40% (although prices for this group are already showing signs of rising as initial aggressive pricing by suppliers to secure market share in the newly opened markets is lessening). Rates charged to industrial customers are less transparent since they are often negotiated on a case-by-case basis, normally resulting in a confidential contract. Nevertheless, it is believed that they have realised substantial price cuts as a result of liberalisation. The E-Control Ltd estimates that the overall effect of these price reductions – net of all surcharges and taxes – has been an annual saving of approximately €440 million.

This disparity in price drops by customer class is reflected in the switching rates. After six months of liberalisation, about 1% of all Austrian retail customers have changed suppliers. This proportion is considerably higher for large energy consumers (mostly industrial), approximately 20% of whom have switched. Smaller industrial customers have shown more reluctance to change suppliers with 8% to 10% of small and medium-sized enterprises, and less than 1% of residential customers switching. On a volume basis (number of GWh), 6% to 8% of the country's electricity is coming from a new supplier. There have been no instances of any customers prevented from receiving power, whether they stayed with their incumbent utility or switched to a new, alternative supplier.

Strategic Alliances in Electricity Sector

While there have been no substantial ownership mergers between any electricity utilities as a result of liberalisation, a number of significant strategic alliances have formed. The most established of these is the Energie Allianz, a marketing alliance between EVN, Wiener Stadtwerke, Linz AG, BEWAG and Begas. The companies have agreed to market their electricity together on the retail market and to work together in the trading of wholesale power. In spring 2001, the Verbund announced a tentative alliance with E.On, the German energy company, whereby each utility would pool its hydropower assets in an international joint-venture company. This agreement was never finalised, however, and looks unlikely to be consummated at any time.

The largest potential alliance in the newly liberalised Austrian electricity sector was announced in the spring of 2002 when Verbund and the members of the Energie Allianz announced they would form a new alliance called AustrianEnergie. This group would pool their electricity assets to compete in the Austrian liberalised market. In addition to ownership of Austria's high-voltage transmission line (via Verbund) and much of the country's distribution system (courtesy of the member Länder utilities), the combined generating capacity of the new group will be nearly 70% of the country's total generating capacity.

Liberalisation has not prompted many new companies to enter the market to compete for customers. Two new companies have been formed to target retail sales (Switch and MyElectric), but these companies are owned by existing Austrian electricity utilities that are members of the proposed AustrianEnergie alliance. Two other new companies in the market, Oekstrom AG and Alpen Adria Energie AG, offer electricity with high levels of power from environment-friendly technologies. While no foreign companies are currently competing for residential retail customers, some German energy companies have targeted industrial companies in certain Länder.

The announced but as yet unrealised AustrianEnergie as well as the limited number of new entrants to the market have focused attention on the question of market power in the liberalised electricity sector. The E-Control, for example, has stated that it is opposed to AustrianEnergie on the grounds that it would be too great a concentration of electricity assets. Austria has recently modified its cartel laws and a new set of regulations regarding definitions of excessive market power in the electricity sector was introduced on 1 July 2002. These laws are used by the Cartel Court to rule on the market dominance of Austrian companies.

These new laws define companies (or alliances) in the electricity sector which are deemed to hold excessive market power and which should, as a consequence, be broken up. A company is too large if one of the following conditions is met regarding its market share in Austria or the relevant regional market:

- The company has a market share greater than 30%.
- The company has a market share greater than 5% and there are only three competitors in the market.
- The company is one of the four largest competitors who together have a market share of 80%, and the company has an individual market share of more than 5%.

Since AustrianEnergie has a market share of generation in Austria of nearly 70%, it would clearly be considered dominant under the new laws if the market is defined as being within Austrian national borders. However, the law states that the relevant market can be either Austria itself or the "relevant regional market" but provides no guidance as to how this relevant regional market should be defined.

CRITIQUE

Austria's natural abundance of hydropower and its location at the heart of Central Europe both work to benefit its electricity sector. This indigenous renewable resource provides an emissions-free power generation source which enhances energy security for a country with limited domestic fossil fuel resources. Austria's long border and geographic position allow for extensive trade of electricity. The country has maximised this potential by building substantial international transmission connections which allow for export during the summer and imports during the winter. This trade allows domestic generators to maximise revenue in the months of oversupply and to minimise costs during months of lower generation.

Austria is to be commended for the steps it has taken in liberalising its electricity sector. By fully granting supplier choice to all customers well in advance of EU directives, the country has placed itself in the forefront of the move towards competitive markets in Europe and around the world. The use of regulated third-party access, mandated unbundling of integrated utilities and enactment of laws addressing market concentration are all important components for a successful liberalised electricity market. Also commendable is the establishment of the E-Commission and the E-Control, regulatory bodies with the strength, jurisdictional reach and independence to monitor the liberalised market.

Austria should continue with this forward-thinking approach to liberalisation by closely monitoring developments in the market and adjusting its policies accordingly. For example, benefits of liberalisation have not as yet been evenly spread among all customer classes. In short, larger customers have enjoyed reduced power prices while smaller customers have seen little or no change to their overall bills. Such a pattern of results is not endemic to the Austrian liberalisation, but rather, has been seen in a number of other countries, especially in the early stages of the competitive market. Nevertheless, steps can be taken to ensure that competition will benefit all Austrians. Two of the major steps are discussed below: *i)* the lowering of system access charges and *ii)* the mitigation of potential market power.

High system access charges impede competition in two ways. First, high system access charges minimise the percentage of the customer's total bill that is subject to competition. As a result, any price reductions realised in the competitive portion of the bill are rendered smaller, on a percentage basis, when the customer considers his total bill. Since a customer really only cares about the total percentage reduction he gets, high system access charges will discourage switching of suppliers, which will in turn discourage the entrance of new market suppliers and hence stifle competition.

The second way in which high access charges can impede competition is through cross-subsidisation. In a utility that has historically integrated its now competitive functions (supply and trading) with its still regulated functions (grid operation), it is very difficult to accurately separate out the different activities that should be allocated to each function. If the costs of certain competitive functions are being recovered by the utility through the system access charges because they are being treated as costs related to the regulated functions, the utility would have an unfair advantage in its competition with the alternative suppliers. That is, since they will already get certain of their generation-related costs covered by the captive customers using their transmission and distribution lines, they will be able to offer lower supply prices to their customers than their competitors who receive no such cross-subsidisation. The E-Control has expressed its belief that such cross-subsidisation is occurring in Austria.

Austrian system access charges have already begun to fall since the introduction of full competition. In addition to a round of rate decreases at the start of 2002, the regulator reduced tariffs for major utilities in the Länder of Upper and Lower Austria in the spring of 2002, lowering system usage fees by between 4.4% and 10%. The E-Control would like to realise further reductions in access charges of 10% in the short term with additional reductions of between 20% and 30% in the coming years. The regulator is encouraged to pursue this goal in a manner consistent with its mandate and the regulations introduced in the ElWOG.

If the continued efforts of the E-Control to reduce system access charges and eliminate alleged cross-subsidisation do not succeed, Austria may want to consider more complete unbundling as a means of reducing system access charges. As stated above, it is very difficult to accurately separate accounts in utilities that have been historically integrated. The utility itself must reorganise its entire accounting system and the regulator will have difficulty in ascertaining whether the utilities' costs are being properly allocated. Legal unbundling by function (e.g., transmission, distribution and supply) provides much greater clarity which will likely provide more accurate system access charges. Divestiture of assets would also bring clarity to the cost structures of different utility functions.

Another means of lowering system access charges would be through the consolidation of the country's distribution system. There are currently 150 grid operators in Austria and seven voltage levels on the grid. This creates nearly 1 000 different tariffs in the country. The introduction of greater uniformity within the grid could lower prices, provide a simpler system for competing suppliers and even lower costs by encouraging co-operation among line operators.

Austria will be able to ensure more effective competition in the liberalised electricity market-place by making a thorough examination of market power issues in the sector. The Verbund itself owns some 7 350 MW of generating capacity, or nearly 40% of the national total. Energie Allianz, a coalition of major Austrian utilities, owns about 20%, and the newly proposed AustrianEnergie would own over 60% of the country's total generating capacity. This goes well beyond the 30% market standard that the new law has established to define market power (as well as beyond any other market power standard used around the world). However, the law specifies that the market need not be Austria *per se*, but can be the "relevant regional market" which, given Austria's substantial electricity trading, could include some neighbouring countries. Austria is encouraged to investigate and debate the proper definition of the scope of the market used in defining excessive concentration since it will determine the size of the companies and the extent to which they will be able to profitably raise prices at the expense of consumers.

New entrants (and the threat of new entrants) can be an effective means of mitigating any abuse of market power that might take place in Austria. However, several characteristics of the Austrian market may deter the construction of new generating capacity and thus lessen the impact new entrants will have on the market. One, the high level of generating overcapacity within Austria makes new plant construction unattractive since it implies low prices for generators. Two, much of the existing plants in Austria is hydropower which not only tends to have a low overall cost but which also has a variable cost of essentially zero. Using thermal plants to compete against hydropower plants with a variable cost of zero is very difficult since hydropower plants are able to price their electricity below the variable cost of thermal plants and still make some profit to contribute to their fixed cost. Three, the large incumbent player in the market, Energie Allianz, has not only substantial generating capacity but also ownership of the country's transmission and distribution lines. While the regulations in place requiring non-discriminatory third-party access are strong and have proven adequate thus far, potential new entrants may nevertheless wait until the regulatory regime has established a track record of insuring such access for all suppliers.

Import of electricity from neighbouring countries can also act to mitigate possible market power in Austria. The country already engages in substantial international trade, meeting over 25% of its demand with imports in 2000. However, imports will only do so much in deterring the potential abuse of market power by the incumbent utilities. Austrian transmission experts estimate that the country has international transmission connections with a combined capacity equal to its native demand, or approximately 10 000 MW. If that 10 000 MW is added to the existing generating capacity in Austria (approximately 18 000), this creates a total supply market of

28 000 MW. AustrianEnergie's total capacity would be approximately 11 000, or 39% of this total. Such a market share is above the 30% threshold prescribed in the new cartel law, suggesting that even the threat of substantial imports would be insufficient to fully undermine the market dominance of the proposed AustrianEnergie alliance.

Austria's energy supply from electricity is secure for the next five to seven years. The country currently enjoys a 40% reserve margin within Austria, a high import capacity and comfortable reserve margins in other countries of Central Europe. Over the past decade the Austrian electricity market has registered a decline in the share of total supply accounted for by domestic generation, which fell from 88% in 1990 to around 82% in 2000 before rising slightly to 83% in 2001 owing to the preponderance of native hydropower in that year. Despite this rising use of foreign electricity, the historical and expected reliability of imports into Austria, coupled with the country's extensive international line connections which, by some estimates, would allow all domestic demand to be met by imports, indicates that such electricity trade does not pose a threat to security. Even Austria's large hydropower use, whose production relies on unpredictable rainfall, does not threaten security, since sufficient domestic and imported capacity would still be available even in drought conditions. One possible development which might call for additional attention to security would be the closure of German nuclear stations, which could jeopardise the seasonal imports Austria receives. Another uncertainty may arise from the large share of renewable capacity (i.e., hydropower) with stochastic production subject to unpredictable meteorological fluctuations. The E-Control Ltd is mandated with reviewing energy security for electricity.

RECOMMENDATIONS

The Government of Austria should:

- Monitor and evaluate the performance of the full liberalisation, particularly the way in which price reductions are spread across customer classes.

- Continue to lower system access charges.

- Maintain the independence of the electricity regulator.

- Consider the option of further unbundling, if account unbundling has not ensured transparency, as well as the accurate reflection of costs in the pricing of the network services.

- Investigate the consolidation of the numerous distribution operators.

- Pay special attention to the issue of market power, particularly the definition of the relevant market in making any assessments.

10

ENERGY RESEARCH AND DEVELOPMENT

ENERGY R&D POLICIES AND PRIORITIES

In 1998 the Austrian Energy Agency (EVA) conducted an in-depth review of energy-related R&D. The EVA is a private, non-profit organisation which co-ordinates the efforts of public and private stakeholders in the energy efficiency sector. The review was carried out at the request of the Federal Ministry of Transport, Innovation and Technology in response to a number of developments in the energy R&D sector. First, the liberalisation of the electricity and natural gas markets was taking place or anticipated both in Austria and other EU countries. This tended to reduce utilities' R&D budgets, shorten their research horizon and reduce co-operation between utilities. Second, the market was shifting so that the energy services sector rather than the energy supplies sector offered the best opportunities for technological advancement. Third, the government felt that changes in the international situation regarding general research and technology policy necessitated a review of the way in which Austrian energy R&D was carried out. In particular, the government felt that Austria's accession to the European Union, the movement towards a European Research Area and the Kyoto Protocol obligations all contributed to create a new context for energy research and technology. Together, these institutional and market changes had led to both a shortening of the time horizons for energy research and technological development and an increased competition between national innovation systems.

With these changes in mind, the EVA suggested an energy R&D policy which endeavours to establish medium-term focus points which cover the areas not sufficiently dealt with by existing instruments. It also recommended placing resources into technology areas where the country has existing core competencies. Another important goal was to determine which areas in the European research field Austria should concentrate on.

In order to best meet these goals of its R&D policy, six focus areas were developed:

1) Bioenergy and Hydropower

Achievement and/or maintenance of leadership in the field of bioenergy and hydropower technology.

2) Electricity Supply Systems Oriented Towards Climate Protection

Development of technologies and management systems for electricity grids in the liberalised market which will guarantee high security of supply combined with a high exploitation of renewable energy sources and stronger decentralised production.

3) Sustainable Buildings

More efficient energy use in new and renovated buildings with special consideration of CO_2 emissions. This area has drawn special attention because 40% of Austrian energy is used to provide space heating and hot water.

4) Industrial Processes and Concepts

Optimisation of existing industrial processes and development of new ones with a view to reducing energy demand and increasing the share of renewable energy sources and waste heat recovery.

5) Energy-efficient Mobility

Optimisation of the transport system with a view to reducing energy consumption and making sure it is increasingly covered by renewable energy sources.

6) Long-term Climate Protection Technologies in International Networks

Support for participation in international research efforts in fields where Austria does not have sufficient expertise to justify development of a national programme.

Activities within each of these six focus areas include technological research, concrete product development, pilot and demonstration projects, information dissemination of project results, and measures used to support the increased integration of key Austrian competencies with experts in European networks and projects.

ENERGY R&D INSTITUTIONS

Austrian government research and development policy makes no institutional delineation between energy research and general industrial research. While individual programmes may target energy research exclusively, they are not administered by any specialised policy or funding policies devoted exclusively to energy subjects. Three major institutions act to shape the policy direction for national research and development. These institutions operate at the federal level; there is very little Land involvement in this area.

The first major institution dealing with research and development policy is the Federal Ministry of Transport, Innovation and Technology (BMVIT). This ministry is the major organiser and facilitator for public R&D activities in Austria. The majority of public R&D programmes operate under the BMVIT. The ministry does not deal exclusively with energy-related research, nor does it have any type of internal division which handles that field. However, it does have a number of programmes which focus on energy-related fields. The major programmes directly or indirectly dealing with energy technology are described below.

The second such institution is the Austrian Council for Research and Technology Development. This body acts as a consultant to the government to develop the overall long-term RTD strategy for the country. The council was established by federal law (BGBl.Nr.48/2000 "Bundesgesetz zur Förderung der Forschung und Technologieentwicklung" (FTFG)) in 2000. It consists of eight members, nominated four each by BMVIT and the Ministry of Education, Science and Culture (BMBWK). Members represent universities, research institutes and industry. The major impact of the council has been the development of the strategy "2.5% + Plus: Prosperity by Research and Innovation". This programme provided the policy framework for the country to target an increase in R&D spending reaching 2.5% of GDP by 2005. In addition, the council is responsible for evaluating proposals for new programmes.

The third institution that shapes the policy direction for the energy R&D in Austria is the Austrian Energy Agency (EVA). As mentioned above, the EVA conducted a major review of the policy in this sector in 1998 at the request of the government. The EVA is a private, non-profit energy research and policy institution which works closely with the government to promote macro-economically efficient production and a rational use of energy.The EVA has a board of directors comprising the Federal Minister for Environmental Affairs, the Federal Minister for Energy Affairs and a representative from the Länder governments. General membership is open to representatives from the relevant federal and Länder agencies and private companies working in this field. EVA's work with energy R&D policy largely consists of the type of strategic reassessments it conducted in 1998. It also evaluates technology prototypes and diffuses information on promising technologies to the appropriate sectors of the economy.

ENERGY R&D BUDGETS

Public Sector

There is a broad consensus within Austria to raise public R&D expenditures for all research areas. The Austrian government declared a target of 2.5 % total R&D spending related to GDP by 2005, based on the strategy "2.5% + Plus: Prosperity by Research and Innovation" developed by the Austrian Council for Research and Technology. This change represents a substantial increase from the current level of 1.8% of GDP which is near the average for all EU countries. This increased funding would apply to R&D expenditures in all fields, not exclusively energy. Nevertheless, environment and energy (in particular sustainable energy) was explicitly marked as one of the forward-looking key technology areas to be supported as part of this overall increase in public funding.

In energy-related fields exclusively, Austria is at a medium level among the EU countries in public spending for research and technology development (RTD). In 2000, the government sponsored approximately €24 million of energy-related R&D funding, or about 3 euros per inhabitant. This R&D budget represents a decrease from the period between 1995 and 1999 when energy-related R&D budgets were consistently above €25 million. Experts within the Austrian government attribute this drop in funding to a decrease in the number of research proposals received rather than to less overall funding available. Many research institutions were assumed to have deferred submitting proposals until 2001 when some of the features of the biomass funding were scheduled to become slightly more attractive. Initial indications from 2001 bear out this hypothesis, with preliminary budget figures showing that energy-related R&D public funding for 2001 rose by 25% to €29.9 million. This most recent figure continues the long-term trend in increasing R&D funding in Austria. In 1990, the level of energy-related public R&D funding was slightly less than €10 million.

The priorities for energy-related R&D over the last decades are reflected in the expenditures for each field. Both conservation and renewable energy continue to be the areas given the highest priorities. Since 1995, they have each received a fairly constant 30% share of the total funding. Fossil fuel spending was left at a minimal level throughout the entire decade. Nuclear-related R&D spending has stayed within 5% to 10% of the budget. Approximately 90% of this expenditure goes towards nuclear fusion technology with the remainder spent on public safety technologies. Power and storage spending decreased while spending on both nuclear technology and cross-cutting technologies which combine a number of categories both increased.

Figures 49 and 50 track this spending in absolute and percentage amounts.

Renewable energy received 28% of the Austrian R&D energy budget in 2000. The majority of this has been spent on biomass research (Figure 51). From 1990 to 2000, over 50% of the total renewables budget has been spent on biomass, and from 1997 to 2000 biomass has been given an even greater priority, receiving 60% of renewable energy R&D funding. This is consistent with the government's planned strategy to concentrate on areas where it has already demonstrated an expertise. Austria also has substantial biomass resources in the form of its extensive forests. The renewable field receiving the second-highest priority is solar energy, which comprises solar heating and cooling (SHAC) and photovoltaics. Total funding for all solar energy R&D was equal to 30% of the renewable energy R&D budget. While Austria has only modest degree of insolation, it does have a number of companies which have demonstrated leadership in the SHAC field.

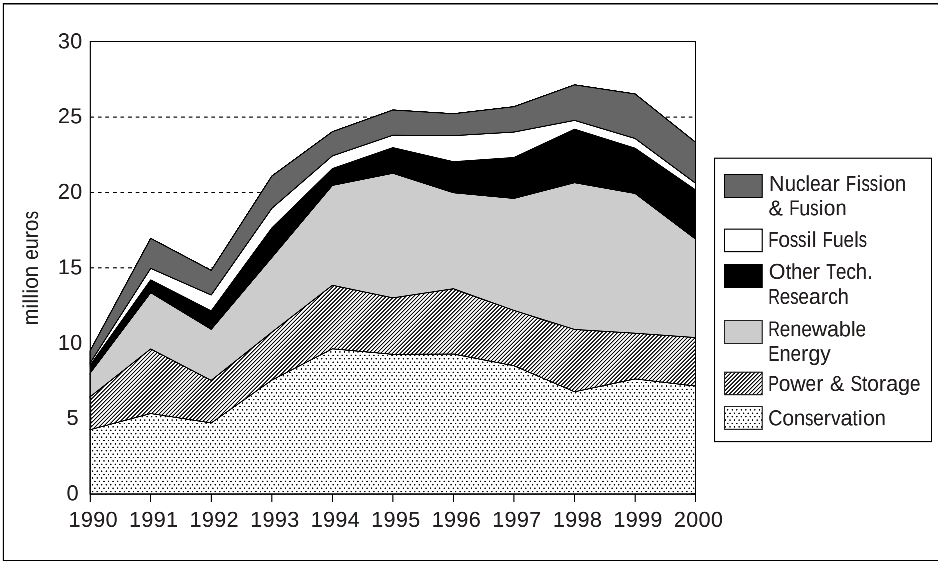
Private Sector

According to the Association of Austrian Electricity Utilities, private-sector R&D spending increased continuously throughout the 1990s until it peaked at €14.7 million in 1999. Since that time, however, it has fallen significantly. In 2000, the private sector spent only €10.2 million, more than a 40% reduction from the previous year. The Association of Austrian Electricity Utilities reports a further reduction in private R&D spending to €8.7 million in 2001, an amount equal to the spending level of 1994. The utilities attribute the decrease to the liberalisation of the electricity sector and, to a lesser extent, the natural gas sector. The related restructuring of the industry means that utilities are no longer allowed to recover their R&D costs through regulated rates paid by captive customers. This places

Figure 49

Energy-related Public R&D Spending, 1990 to 2000

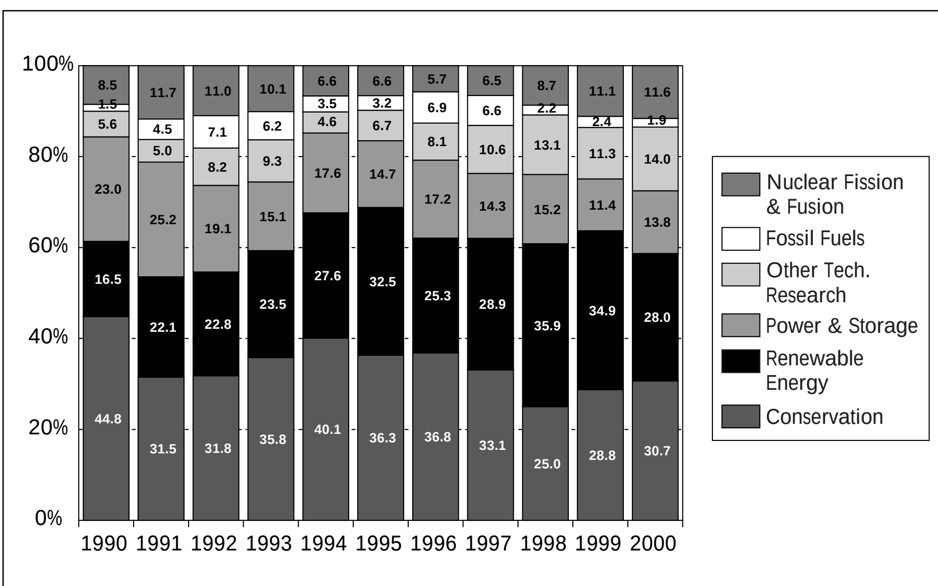
(absolute amounts)



Source: Country submission.

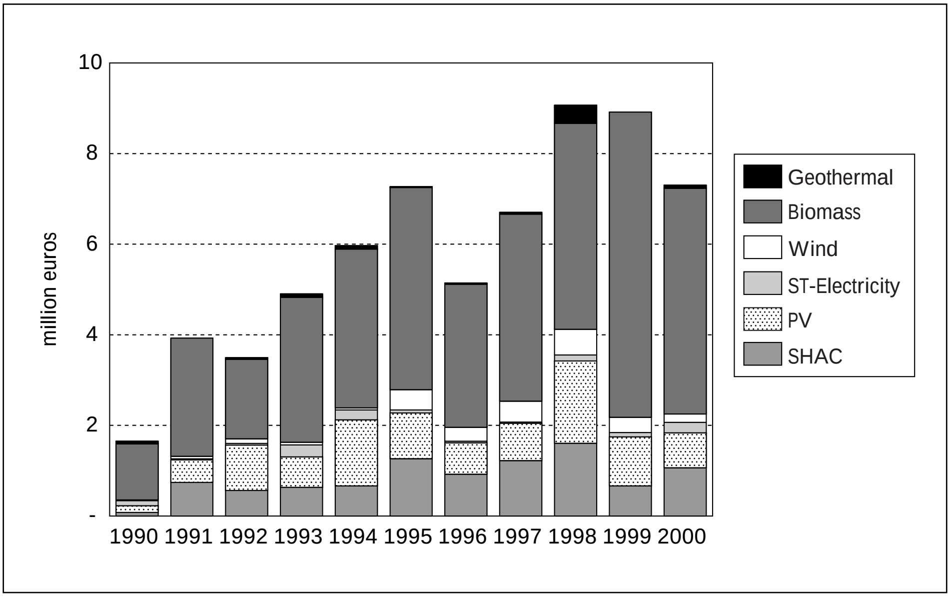
Figure 50

Percentage Breakdown of Energy-related Public R&D Spending, 1990 to 2000



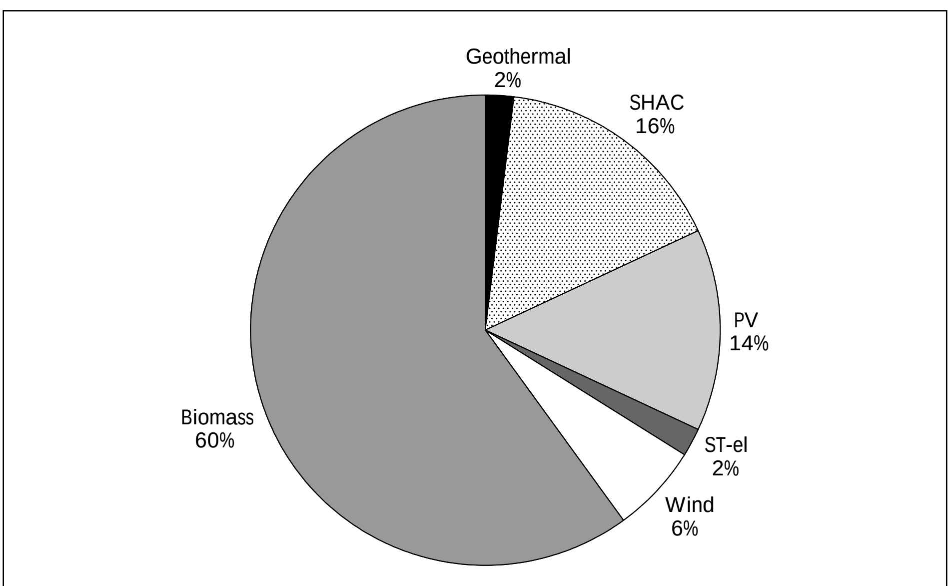
Source: Country submission.

Figure 51
Public R&D Expenditure on Renewables (excluding Hydropower), 1990 to 2000



ST: Solar-thermal.
Source: Country submission.

Figure 52
R&D Spending Shares on Renewables, 2000



Source: Country submission.

greater pressure on the utilities to select only those R&D activities which will bring quick returns on investment and, as a result, spending has dropped and projects focus on those technologies with decidedly shorter time horizons.

ENERGY R&D PROGRAMMES

Austrian Programme on Technologies for Sustainable Development

This research and technology programme has been developed by the Federal Ministry of Transport, Innovation and Technology (BMVIT). It initiates and supports research and development projects and the implementation of selected pilot projects.

The programme pursues clearly defined emphases, selects projects by means of tendering procedures and is characterised by networking between individual research projects and by accompanying project management. The ministry invites tenders in two subprogrammes and is in the process of preparing a third one.

Subprogramme "Building of Tomorrow"

The subprogramme's goal is the development and diffusion of components, prefabricated parts and building methods which correspond to the main principles of sustainable development. It makes use of: the passive house principle and the low-energy solar building method. "Buildings of Tomorrow" are residential and office buildings. They differ from current construction practice in Austria by having higher energy efficiency, by greater use of renewable energy sources and sustainable raw materials, or by increased consideration of user needs and services. The "Building of Tomorrow" subprogramme has a planned duration of five years. Since 1999 projects have been supported with an amount of about €7 million of public funding which has leveraged an overall budget of €120 million spent on projects falling under the "Buildings of Tomorrow" rubric.

Subprogramme "Factory of Tomorrow"

This subprogramme was designed to develop zero-waste and zero-emission technologies and methods of production and to increase the use of renewable sources of energy in the production process. Since 2001, additional energy-related projects have been carried out by the this subprogramme, such as a survey on the potential for the use of solar-thermal energy in industry.

Subprogramme "Energy Systems of Tomorrow"

Currently a new subprogramme "Energy Systems of Tomorrow" is under preparation. It will focus on three topics in the Austrian energy research and energy technology concept:

- Bioenergy and hydropower.

- Electricity supply systems oriented towards climate protection.

- Long-term climate protection technologies in international networks.

This subprogramme will focus on electricity and will address the challenge of increasing the share of renewables in electricity supply while maintaining a high level of reliability. It will include basic analyses of the Austrian energy system, studies on the interaction of the persons and institutions involved, technology development and demonstration activities in a selected region.

Strategy Programme: Intelligent Traffic Systems and Services

This programme was developed by the BMVIT and addresses the transportation industry. As such, certain activities of the programme relate directly and indirectly to energy-related matters. For example, some €7 million will be spent for R&D in the new A3-Technology Programme (Austrian Advanced Automotive Technology) for the development of advanced propulsion systems, energy-efficient auxiliary devices and alternative fuels. The programme "MOVE – Mobility and Transport Technologies" promotes research and development projects in the field of transport and mobility by funding demonstration projects capable of triggering innovation in the transport system. Approximately €2.9 million are budgeted annually for the MOVE programme and its activities.

K-plus Competence Centre Programme

K-plus is an R&D programme under the auspices of the Ministry of Transport, Innovation and Technology. It establishes and supports Competence Centres around the country which act as groups of scientific research centres and a minimum of five private institutions. The goal of these centres is to contribute to a lasting improvement in the co-operation between science and industry. K-plus Competence Centres are often located at universities, although an extra-university research institution or an enterprise may also form the core of a Competence Centre. Energy-related K-plus Competence Centres include the one for applied electrochemistry (ECHEM) and a new K-plus Competence Centre for bioenergy which was launched in January 2002 with a total budget of €12.3 million over four years.

Christian Doppler Research Centres

The "Christian Doppler Gesellschaft (CDG)", is an association consisting of representatives of public administration, industry and science. Its aim is to initiate application-oriented basic research as a necessary part of a mid- to long-term research strategy for innovative enterprises. The central instruments of the CDG are the "CD-Labs", which are appointed to single scientists with quality experience in the field. Although CD-Labs do not perform contracted research in a narrow sense, the R&D work done there is oriented to the needs and problems of the respective industrial partners. CD-Labs are funded partly by public means and partly by industrial partners. Examples of energy-relevant CD-Labs are the "CD-Lab on Thermodynamics of Combustion Engines", the "CD-Lab on Plastic-Solar Cells", the "CD-Lab on Fuel Cells" and the "CD-Lab on Fluidised Bed Systems".

Programme for Industrial Centres of Competence and Networks (Kind / Knet)

In the framework of the "Kompetenznetzwerk Energie aus Biomasse" (Güssing, Wr. Neustadt), innovative biomass CHP plants are developed and realised. There is a broad partnership of universities, industry and the utility sector.

CRITIQUE

Austria's attention to energy-related R&D has increased dramatically from 1990 through 2000. Public-sector spending in this area has tripled from 1990 to 2001. This can be expected to increase as national plans call for the expansion of total R&D spending from the current 1.8% of GDP to 2.5% by 2005. This increase in energy-related R&D is timely given the energy-related objectives the country now has, primarily its commitments under the Kyoto Protocol to reduce GHGs by 13% below 1990 levels, targeted energy efficiency improvements of 1% above historical EU averages and minimum levels of renewables sourcing in electricity generation. While Austria began from a relatively low level in 1990, it has now reached spending levels equal to or slightly above European levels on a per capita basis. The Austrian government is to be commended for the weight it has given to R&D and encouraged to follow through on its plans to increase expenditures.

EVA's 1998 review of energy R&D strategy is also commendable. Its recognition of the effects of market liberalisation, greater import of energy services and the added impact of international agreements enabled EVA to shape a strategy that would best position the country's research in order to meet the needs of the future market. The inherently long lead-times in R&D investments make such far-sightedness particularly necessary.

A monitoring process could help Austria meet its policy goals for energy-related R&D. Currently the government does not explicitly monitor energy-related R&D policies as a coherent whole. While such monitoring occurs on a case-by-case basis, no comprehensive effort is made to co-ordinate the R&D activities which address energy issues. Such co-ordination could be particularly helpful given the range of government and non-government bodies involved in this field. The lack of oversight across these bodies and their programmes will make it more difficult to ascertain what progress is being made towards the impressive energy-related R&D policies that Austria has developed. Expressly monitoring all energy-related R&D can ensure the policy is being implemented effectively and identify setbacks which may require attention.

Austrian energy R&D policy has a mixed record *vis-à-vis* focusing resources on technologies that are well suited to serving Austria's specific energy requirements. On the one hand, the country channels the majority of spending to biomass, a strategy consistent with both Austria's current significant use of biomass and its substantial natural endowments of this fuel[38]. On the other hand, the country spent

38. One positive example of such R&D is the recent introduction onto the market of a new technology for the filling of woodchip-fuelled home heaters.

30% of its renewables budget on solar energy, including 14% on photovoltaic technology, despite the fact that solar energy provided Austria with only 0.17% of its TPES in 1990 (compared with biomass's 10.9% contribution) and that the prospects for increasing this figure dramatically are not promising[39]. Photovoltaic electricity generation has poor prospects for becoming cost-competitive with other generation options since the country as a whole has only very modest insolation resources in the first place. While Austria may want to support solar technologies as part of industrial or trade policies (i.e., in support of Austrian industry), it should review its priorities in order to maximise the cost-effectiveness of limited government R&D expenditures needed to realise mid- to long-term objectives in the energy sector.

Austria has an impressive record of teaming public-sector and private-sector efforts in R&D. Many of the programmes under the BMVIT are especially designed to get both sectors working together. Other programmes act to leverage all public spending with commensurate or greater private-sector investments. In addition, the public policy is responding to changes in private-sector R&D, as can be seen in its response to utility research as a result of liberalisation. Such co-ordination and partnerships provide effective means to draw upon the respective strengths of both the public and the private sectors.

RECOMMENDATIONS

The Government of Austria should:

- Further clarify the objectives the R&D programmes are designed to meet in order to accomplish particular energy and environmental policy objectives and allocate resources appropriately, based on the national goal of expanded R&D expenditures.

- Enhance monitoring of progress in reaching the energy-related R&D goals Austria has established.

- Review energy R&D priorities in order to maximise the cost-effectiveness of finite government R&D expenditures in relation to mid- to long-term objectives in the energy sector.

39. It should be noted, however, that much of the non-PV solar research involves solar architecture, the gains from which are not recorded in TPES unless they are provided by active solar technologies such as solar collectors.

A

ANNEX

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2001P	2010	2020	2030
TOTAL PRODUCTION		**7.9**	**8.3**	**9.7**	**9.7**	**10.4**	**11.6**	**..**
Coal[1]		1.0	0.6	0.3	0.3	0.0	0.0	..
Oil		2.7	1.2	1.0	1.0	1.0	1.1	..
Gas		2.0	1.1	1.5	1.5	1.8	2.1	..
Comb. Renewables & Wastes[2]		0.7	2.7	3.2	3.2	3.8	4.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.6	3.6	3.5	3.7	..
Geothermal		–	–	0.0	0.0	0.0	0.0	..
Solar / Wind / Other		–	–	0.1	0.1	0.3	0.4	..
TOTAL NET IMPORTS[3]		**14.0**	**17.2**	**18.7**	**20.0**	**22.0**	**23.9**	**..**
Coal[1]	Exports	0.1	0.0	0.0	0.0	0.0	0.0	..
	Imports	3.1	3.1	3.0	3.3	3.0	2.1	..
	Net Imports	3.0	3.1	3.0	3.3	3.0	2.1	..
Oil	Exports	0.1	0.4	1.5	1.7	1.6	1.8	..
	Imports	9.9	10.0	12.1	13.3	13.4	15.1	..
	Bunkers	–	–	–	–	–	–	..
	Net Imports	9.7	9.6	10.6	11.6	11.8	13.2	..
Gas	Exports	–	–	0.0	0.4	0.0	0.0	..
	Imports	1.3	4.5	5.3	5.4	7.1	8.4	..
	Net Imports	1.3	4.5	5.3	5.1	7.1	8.4	..
Electricity	Exports	0.4	0.6	1.3	1.2	1.3	1.3	..
	Imports	0.3	0.6	1.2	1.2	1.4	1.5	..
	Net Imports	–0.1	–0.0	–0.1	0.0	0.1	0.1	..
TOTAL STOCK CHANGES		**–0.3**	**–0.3**	**0.2**	**1.0**	**–0.2**	**–0.6**	**..**
TOTAL SUPPLY (TPES)		**21.7**	**25.2**	**28.6**	**30.7**	**32.3**	**34.9**	**..**
Coal[1]		3.9	4.1	3.6	3.7	3.0	2.1	..
Oil		12.3	10.4	11.8	13.1	12.5	14.1	..
Gas		3.3	5.2	6.5	7.0	9.0	10.3	..
Comb. Renewables & Wastes[2]		0.7	2.8	3.1	3.2	3.8	4.2	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.6	3.6	3.5	3.7	..
Geothermal		–	–	0.0	0.0	0.0	0.0	..
Solar / Wind / Other		–	–	0.1	0.1	0.3	0.4	..
Electricity Trade[4]		–0.1	–0.0	–0.1	0.0	0.1	0.1	..
Shares (%)								
Coal		*17.9*	*16.4*	*12.6*	*12.1*	*9.2*	*6.0*	..
Oil		*56.7*	*41.3*	*41.3*	*42.6*	*38.9*	*40.3*	..
Gas		*15.3*	*20.8*	*22.8*	*22.8*	*28.0*	*29.5*	..
Comb. Renewables & Wastes		*3.3*	*10.9*	*10.9*	*10.4*	*11.8*	*12.1*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*7.4*	*10.7*	*12.6*	*11.7*	*10.8*	*10.6*	..
Geothermal		–	–	–	–	*0.1*	*0.1*	..
Solar / Wind / Other		–	–	*0.2*	*0.3*	*0.8*	*1.1*	..
Electricity Trade		*–0.6*	*–0.2*	*–0.4*	*0.1*	*0.4*	*0.4*	..

0 is negligible, – is nil, .. is not available, P: preliminary.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2000	2001P	2010	2020	2030
TFC	**16.8**	**20.9**	**24.8**	**25.5**	**26.9**	**29.0**	**..**
Coal[1]	2.0	1.6	1.2	1.0	0.9	0.7	..
Oil	10.2	9.3	11.0	11.8	11.2	12.1	..
Gas	1.8	3.1	4.5	4.4	5.6	5.8	..
Comb. Renewables & Wastes[2]	0.7	2.5	2.5	2.5	2.6	2.8	..
Geothermal	–	–	0.0	0.0	0.0	0.0	..
Solar / Wind / Other	–	–	0.0	0.1	0.1	0.1	..
Electricity	2.2	3.7	4.5	4.8	5.2	5.9	..
Heat	–	0.6	1.0	0.9	1.2	1.5	..
Shares (%)							
Coal	*11.8*	*7.5*	*4.7*	*4.1*	*3.4*	*2.5*	..
Oil	*60.4*	*44.8*	*44.6*	*46.4*	*41.7*	*41.8*	..
Gas	*10.8*	*14.8*	*18.0*	*17.1*	*21.0*	*20.1*	..
Comb. Renewables & Wastes	*4.1*	*12.2*	*10.0*	*9.6*	*9.8*	*9.6*	..
Geothermal	–	–	–	–	–	–	..
Solar / Wind / Other	–	–	*0.2*	*0.3*	*0.5*	*0.5*	..
Electricity	*12.9*	*17.8*	*18.2*	*18.9*	*19.2*	*20.4*	..
Heat	–	*2.9*	*4.2*	*3.6*	*4.5*	*5.1*	..
TOTAL INDUSTRY[5]	**6.4**	**7.0**	**8.0**	**8.1**	**8.7**	**8.9**	**..**
Coal[1]	0.7	0.9	0.9	0.8	0.7	0.6	..
Oil	3.3	2.3	2.0	2.5	2.0	2.3	..
Gas	1.2	1.8	2.3	2.1	3.0	2.8	..
Comb. Renewables & Wastes[2]	0.0	0.4	0.7	0.7	0.8	0.8	..
Geothermal	–	–	–	–	–	–	..
Solar / Wind / Other	–	–	–	–	–	–	..
Electricity	1.0	1.6	2.0	2.0	2.1	2.3	..
Heat	–	–	–	–	–	0.0	..
Shares (%)							
Coal	*11.6*	*12.6*	*11.0*	*9.7*	*8.4*	*7.0*	..
Oil	*52.3*	*33.2*	*25.7*	*31.2*	*23.0*	*25.5*	..
Gas	*19.2*	*26.5*	*29.2*	*26.1*	*34.9*	*32.0*	..
Comb. Renewables & Wastes	*0.5*	*5.4*	*9.2*	*8.3*	*9.2*	*9.6*	..
Geothermal	–	–	–	–	–	–	..
Solar / Wind / Other	–	–	–	–	–	–	..
Electricity	*16.3*	*22.4*	*24.8*	*24.7*	*24.5*	*25.8*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[6]	**4.0**	**5.5**	**7.2**	**7.2**	**7.3**	**8.1**	**..**
TOTAL OTHER SECTORS[7]	**6.4**	**8.4**	**9.6**	**10.3**	**10.9**	**12.0**	..
Coal[1]	1.1	0.7	0.3	0.3	0.2	0.1	..
Oil	3.1	1.8	2.4	2.8	2.6	2.5	..
Gas	0.6	1.2	1.9	2.0	2.4	2.7	..
Comb. Renewables & Wastes[2]	0.7	2.2	1.7	1.8	1.8	1.9	..
Geothermal	–	–	0.0	0.0	0.0	0.0	..
Solar / Wind / Other	–	–	0.0	0.1	0.1	0.1	..
Electricity	1.0	1.9	2.2	2.5	2.6	3.2	..
Heat	–	0.6	1.0	0.9	1.2	1.5	..
Shares (%)							
Coal	*17.6*	*8.1*	*2.9*	*2.5*	*1.7*	*0.9*	..
Oil	*47.8*	*21.2*	*24.5*	*26.8*	*23.5*	*20.7*	..
Gas	*9.2*	*14.6*	*19.7*	*19.2*	*21.7*	*22.6*	..
Comb. Renewables & Wastes	*10.2*	*25.9*	*18.1*	*17.4*	*16.6*	*16.0*	..
Geothermal	–	–	*0.1*	–	*0.1*	–	..
Solar / Wind / Other	–	–	*0.5*	*0.7*	*1.1*	*1.1*	..
Electricity	*15.3*	*23.0*	*23.3*	*24.4*	*24.2*	*26.4*	..
Heat	–	*7.3*	*10.9*	*9.0*	*11.1*	*12.2*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2000	2001P	2010	2020	2030
ELECTRICITY GENERATION[8]							
INPUT (Mtoe)	**4.9**	**7.3**	**8.1**	**8.5**	**9.3**	**10.7**	**..**
OUTPUT (Mtoe)	**2.7**	**4.2**	**5.2**	**5.4**	**5.7**	**6.6**	**..**
(TWh gross)	**30.9**	**49.4**	**60.3**	**62.8**	**66.7**	**76.5**	**..**
Output Shares (%)							
Coal	*10.3*	*14.8*	*11.1*	*12.1*	*8.0*	*3.7*	..
Oil	*14.1*	*4.4*	*3.3*	*3.3*	*5.2*	*8.7*	..
Gas	*14.3*	*14.8*	*13.0*	*14.2*	*18.4*	*22.4*	..
Comb. Renewables & Wastes	*0.7*	*2.3*	*2.8*	*3.1*	*4.7*	*5.0*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*60.6*	*63.7*	*69.6*	*67.0*	*61.0*	*56.5*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	*0.1*	*0.3*	*2.5*	*3.6*	..
TOTAL LOSSES	**4.7**	**4.2**	**3.8**	**5.2**	**5.4**	**6.0**	**..**
of which:							
Electricity and Heat Generation[9]	2.2	2.4	1.8	1.9	2.2	2.5	..
Other Transformation	1.3	0.3	0.4	1.0	0.8	0.7	..
Own Use and Losses[10]	1.2	1.5	1.6	2.3	2.4	2.8	..
Statistical Differences	**0.1**	**0.1**	**0.1**	**–**	**–**	**–**	**–**

INDICATORS

	1973	1990	2000	2001P	2010	2020	2030
GDP (billion 1995 US$)	138.55	212.47	267.02	275.03	328.69	400.67	..
Population (millions)	7.57	7.72	8.11	8.11	8.20	8.28	..
TPES/GDP[11]	0.16	0.12	0.11	0.11	0.10	0.09	..
Energy Production/TPES	0.37	0.33	0.34	0.32	0.32	0.33	..
Per Capita TPES[12]	2.86	3.27	3.52	3.79	3.94	4.22	..
Oil Supply/GDP[11]	0.09	0.05	0.04	0.05	0.04	0.04	..
TFC/GDP[11]	0.12	0.10	0.09	0.09	0.08	0.07	..
Per Capita TFC[12]	2.22	2.70	3.05	3.15	3.28	3.50	..
Energy–related CO_2 Emissions (Mt CO_2)[13]	54.2	56.9	62.8	..	..	..	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.9	1.7	..	..	..	..

GROWTH RATES (% per year)

	73–79	79–90	90–00	00–01	01–10	10–20	20–30
TPES	1.6	0.5	1.3	7.6	0.5	0.8	..
Coal	–1.1	1.2	–1.4	4.1	–2.5	–3.4	..
Oil	0.7	–1.9	1.3	10.9	–0.5	1.2	..
Gas	4.6	1.7	2.2	7.7	2.8	1.3	..
Comb. Renewables & Wastes	6.3	9.3	1.2	2.4	2.0	1.0	..
Nuclear	–	–	–	–	–	–	..
Hydro	6.7	1.2	2.9	–0.4	–0.3	0.6	..
Geothermal	–	–	–	–	9.6	–	..
Solar/Wind/Other	–	–	–	54.7	14.0	3.5	..
TFC	2.2	0.8	1.7	3.2	0.6	0.7	..
Electricity Consumption	3.9	2.8	2.0	7.1	0.7	1.4	..
Energy Production	0.2	0.3	1.5	0.4	0.8	1.1	..
Net Oil Imports	2.7	–1.6	1.0	9.7	0.1	1.2	..
GDP	3.0	2.3	2.3	3.0	2.0	2.0	..
Growth in the TPES/GDP Ratio	–1.3	–1.8	–1.0	4.4	–1.4	–1.2	..
Growth in the TFC/GDP Ratio	–0.8	–1.5	–0.6	0.2	–1.4	–1.2	..

Please note: Rounding may cause totals to differ from the sum of the elements.

Footnotes to Energy Balances and Key Statistical Data

1. Includes lignite and peat.
2. Comprises solid biomass, biogas, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Total net imports include combustible renewables and waste.
4. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
5. Includes non-energy use.
6. Includes less than 1% non-oil fuels.
7. Includes residential, commercial, public service and agricultural sectors.
8. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
9. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiency of 100% for hydro.
10. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
11. Toe per thousand US dollars at 1995 prices and exchange rates.
12. Toe per person.
13. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. 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 2000 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

B

ANNEX

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The Member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and 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 they 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** is 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 where practicable have regard to the Polluter Pays Principle.

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

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

IEA Members 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 encourage 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 their 4 June 1993 meeting in Paris.)

ANNEX

GLOSSARY AND LIST OF ABBREVIATIONS

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

ACCC	Austrian Council on Climate Change.
AG	Austrian Thermal Power AG (Verbund).
AHP	Austrian Hydro Power AG (Verbund).
APG	Austrian Power Grid AG (Verbund).
APT	Austrian Power Trading GmbH (Verbund).
AWP	Adria-Wien Pipeline.
BMLFUW	Bundesministerium für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft (Ministry of Agriculture, Foresty, Environment and Water Management).
BMWA	Bundesministerium für Wirtschaft und Arbeit (Ministry of Economic Affairs and Labour).
bcm	billion cubic metres.
b/d	barrels per day.
cal	calorie.
CCGT	combined-cycle gas turbine.
CDM	Clean Development Mechanism.
CFCs	chlorofluorocarbons.
CHP	combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used.
CO_2	carbon dioxide.
cm	cubic metre.
DH	district heating.
DSM	Demand-Side Management.
DSO	distribution system operator.
ECT	Energy Charter Treaty.
ELG	Erdöl-lagergesellschaft.
EVA	Austrian Energy Agency.
EC	European Commission.
EU	The European Union, whose members are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Euro	European currency (€).

FCCC	Framework Convention on Climate Change.
FSU	Former Soviet Union.
GDP	gross domestic product.
GHG	greenhouse gas.
GJ	gigajoule, or one joule $\times 10^9$.
GW	gigawatt, or one watt $\times 10^9$.
GWh	gigawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^9$.
IEA	International Energy Agency whose Members are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.
IEP	International Energy Program, one of the founding documents of the IEA.
IMC	the Interministerial Committee to Co-ordinate Measures
IPCC	Intergovernmental Panel on Climate Change.
IPIC	International Petroleum Investment Company.
ISO	independent system operator.
J	joule; a joule is the work done when the point of application of a force of one newton is displaced through a distance of one metre in the direction of the force (a newton is defined as the force needed to accelerate a kilogram by one metre per second). In electrical units, it is the energy dissipated by one watt in a second.
JI	Joint Implementation.
kWh	kilowatt-hour, or one kilowatt $\times$ one hour, or one watt $\times$ one hour $\times 10^3$.
LDC	local distribution company.
LTA	Long-term agreement.
mbo	million barrels of oil.
mcm	million cubic metres.
MBtu	million British thermal units.
MoU	Memorandum of Understanding.
Mt	million tonnes.
Mtoe	millions tonnes of oil equivalent; see toe.
MW	megawatt of electricity, or one watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.
NGL	natural gas liquids.
NO_x	nitrogen oxides.
OECD	Organisation for Economic Co-operation and Development.
PJ	petajoule, or one joule $\times 10^{15}$.
ppm	parts per million.

PPP	purchasing power parity: the rate of currency conversion that equalises the purchasing power of different currencies, i.e. estimates the differences in price levels between different countries.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
SAVE	Specific Actions for Vigorous Energy Efficiency.
SHAC	solar heating and cooling.
SLT	Standing Group on Long-Term Co-operation of the IEA.
SO_2	sulphur dioxide.
TFC	total final consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
TAG	Trans-Austria Gasleitung.
t	tonne.
toe	tonne of oil equivalent, defined as 10^7 kcal.
TOP	take-or-pay contract.
TPA	third-party access.
TPES	total primary energy supply.
TSO	transmission system operator.
TW	terawatt, or one watt $\times 10^{12}$.
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$.
UGS	underground storage (of natural gas).
UN	the United Nations Organization.
UNCCC	the United Nations Council on Climate Change.
UNDP	the United Nations Development Program.
UNFCCC	the United Nations Framework Convention on Climate Change.
VAT	value-added tax.
VOCs	volatile organic compounds.
WIFO	Austrian Institute for Economic Research.

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