INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

AUSTRIA

2007 Review

OECD

INTERNATIONAL ENERGY AGENCY

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It carries out a comprehensive programme of energy co-operation among twenty-seven of the OECD 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 promote international collaboration on energy technology.
- To assist in the integration of environmental and energy policies.

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The OECD is a unique forum where the governments of thirty democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

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

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EXECUTIVE SUMMARY

Austria's energy policy has seen many positive developments since the last in-depth review in 2002. A new green electricity law passed in 2006 reformed the support system for renewables. New and very ambitious climate change and renewables targets were adopted by the government following the 2006 elections; a competition enhancement programme was negotiated between regulators and the electricity industry; and a major new gas discovery has substantially added to Austrian gas reserves. Nevertheless, great challenges remain for the Austrian government in balancing the "3 Es" of energy policy: security of energy supply, economic development, and environmental protection.

Austria revised its climate strategy in early 2007, following the establishment of a new government. The new approach is commendably assuming a more realistic split between domestic action and the use of flexible mechanisms, but there are still doubts about some of the assumptions underlying it, and whether it will be sufficient to cover the very significant gap to meeting Austria's commitment under the Kyoto Protocol and the EU Burden-Sharing Agreement. There are also doubts over the adequacy of the institutional arrangements in co-ordinating climate policy across a number of government departments and offices. It may become necessary for Austria to consider new arrangements to assure that the measures in the climate strategy are implemented in a timely manner. It is also questionable if renewables and energy efficiency policy and ambitions are well balanced within the current national climate policy.

In the absence of nuclear power plants, one possible way of increasing security of supply in Austria is to increase the domestic production of energy. Austria is strongly promoting an increase of the share of renewables in total primary energy supply (TPES), and has adopted highly ambitious targets. Under the target for 2020, the contribution from all renewables will have to more than double, and the contribution from renewables other than large hydro installations will have to triple, even if energy consumption does not grow at all between now and 2020. These targets are extremely challenging, and meeting them will almost certainly lead to significant cost increases for energy. The means to achieve the planned increase of renewables are economic support instruments such as a feed-in tariff, tax exemptions and

direct grants to investors, on both the federal and state levels. While the support system has some positive attributes, such as a reduction of subsidies for future projects compared to current ones, and increased transparency, it is extremely prescriptive regarding which technologies will be supported at what level, and very costly to energy consumers. The support system is designed to promote particular technologies on the basis of their assumed costs, with the aim to make these technologies competitive. It is, therefore, not a system where the aim would be to achieve the planned contribution of 45% renewables in TPES at the lowest possible cost. Support costs under the new system have already increased considerably faster than electricity production, and are likely to increase even further, given the ambitious targets.

In the area of energy efficiency, Austria is one of the leading countries in researching efficient building solutions, and has a well-developed research programme integrating energy efficiency and renewables to take the most advantage of both. There are concerns in the area of implementation, however, where, for example, widely diverging building efficiency codes allow builders to construct houses of varying efficiency depending on which state they are built in. More generally, energy intensity in Austria has increased in recent years, while for most of its neighbours it has continued a long-term trend of decline. In order to achieve the climate change and renewables targets, the Austrian government will have to put a strong focus on reversing this development.

In terms of fossil fuels security of supply, Austria's domestic production of oil and gas is declining rapidly. Nevertheless, significant finds have added considerably to gas reserves in recent years and new finds are still possible. The Austrian government should, therefore, take all the measures required to encourage exploration activity, and apply international best practice to ensure continued production of reserves for as long as possible. Austria did not suffer physical supply shortages from the Russian gas supply interruption in early 2006, but this raised concerns, however, about the adequacy of storage capacity in the country, in particular in the light of rapid increases in gas use for power generation, and reinforced the Austrian government's desire to work on source diversification for gas supply. The options here are the Nabucco pipeline, which would bring Caspian gas to Europe, and/or through an LNG terminal on the Croatian island of Krk, which would open an import route for North African gas into central Europe and Austria. Both of these projects are commendably supported by the Austrian government and the partially state-owned Austrian oil company OMV. Given the very long gestation period they already have experienced, it will be necessary for the Austrian government to continue to fully support them, if they are to achieve completion within the expected time-frame of 2010 to 2012.

In the area of market reform, Austria has laudably implemented the relevant EU directives well ahead of their deadlines in legal terms. Nevertheless, effective

competition has failed to emerge, partially because many smaller measures that enable customers to switch supplier easily have only recently been agreed to, but also because of some systemic weaknesses in Austrian liberalisation. These are, in particular, dominance of the incumbents in electricity and gas, a lack of transparency in price formation, and a weak regulatory system that may lead to conflicts of interest between regulators and owners. It will be important for the Austrian government to address these weaknesses, and to continually observe the development of competition in Austrian energy markets, with a view to taking additional measures to promote it, should this be necessary.

Research and development in energy technology has a long and strong tradition in Austria, and has been successful in creating world-class industries, *e.g.* for small-scale biomass boilers. To ensure that it continues to be successful, the Austrian government is taking a number of excellent initiatives, such as the development of a long-term R&D strategy, and the provision of additional funds for energy R&D.

KEY RECOMMENDATIONS

The government of Austria should:

- *Implement the measures proposed in the 2007 revision of the Climate Change Strategy, with a particular focus on the most cost-effective means of achieving reductions in greenhouse gas (GHG) emissions, and allowing energy users flexibility in deciding how they want to achieve the overall target. Particular care should be taken to ensure effective co-ordination of the government ministries.*
- *Continue to pursue source diversification in gas supply by supporting the multinational projects that will provide Austria with a greater choice of supplies.*
- *Ensure progress in real market opening by fully supporting the regulatory agencies' efforts, such as the 2006 competition enhancement programme in electricity, and by implementing the means to create fully competitive markets.*

Figure 1

Map of Austria

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the IEA.

GENERAL ENERGY POLICY

OVERVIEW

Austria is located right in the centre of Europe between Germany and the Czech Republic in the north, Switzerland in the west, Italy and Slovenia in the south and Hungary and Slovakia in the east. With an area of 83 850 km^2, Austria is one of the smaller EU countries. Its northern and southern neighbours, Germany and Italy, are respectively 4.2 and 3.7 times larger. Its population of about 8 million is also comparatively small within the European Union (EU). Almost two-thirds of Austria's territory are alpine regions. Forests cover about 45% of the country. Lower lying plains are mainly found in the east. Austria's climate is alpine in the mountainous western regions with annual rainfalls of more than 1 000 mm, and continental in the north and east with cold winters and hot, humid summers but overall less rain than in the west. Austria's capital, Vienna, is also a very important industry and business centre. The country is divided into nine states *(Bundesländer)*, which have extensive responsibilities in the energy field.

Austria benefits from a healthy economic environment (see Table 1). In particular, the opening-up of the central European and Balkan economies since 1990, together with the enlargement of the EU in 2004 and 2007, has contributed significantly to its economic development.

ENERGY SUPPLY AND DEMAND

Austria is one of only five countries in the EU that already fulfils the 2020 target of covering at least 20% of their primary energy supply from renewables. In 2005, 21.3% of Austria's TPES was covered by renewables. The primary domestic energy resources in Austria are large-scale hydro for electricity generation, biomass for electricity and heat production, as well as domestic resources of oil and gas. Oil is the most important single energy carrier in Austria's TPES, contributing 42% in 2005. There have been no significant shifts in Austria's breakdown of TPES since 1990, with the exception of a reduction in coal use, which has been replaced by a mix of gas and biomass (see Figure 2).

Austria is producing 40% of its energy needs domestically (see Figure 3). Regarding fossil fuels, almost 7% of oil and 17% of natural gas required in Austria were produced domestically in 2005, but this production is declining rapidly. In the same year, domestic renewables contributed over 63% to

Table 1

Key Economic Indicators for Austria, 1996 to 2008

	1997	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*[1]	*2008*[1]
GDP per capita relative to EU 25 (average = 100)	125	124	125	126	122	120	123	123	123	123	122.7	122.2
Real GDP growth %	1.8	3.6	3.3	3.4	0.8	0.9	1.1	2.4	2.0	3.1	2.6	2.1
Debt as share of GDP in %	67.9	67.6	63.8	64.2	66.5	67.0	67.0	65.8	64.6	63.9	63.5	62.2
Annual government. balance in % of GDP	–5.4	–3.8	–1.7	–2.3	–2.2	–1.5	0.0	–0.5	–1.6	–1.2	–1.6	–1.1
Annual inflation rate in %	n/a	n/a	1.2	0.8	0.5	2.0	2.3	1.7	1.3	2.0	2.1	1.7
Unemploy-ment rate in %	7.1	7.2	6.7	5.8	6.1	6.9	7.0	7.1	7.3	6.8	6.1	5.9

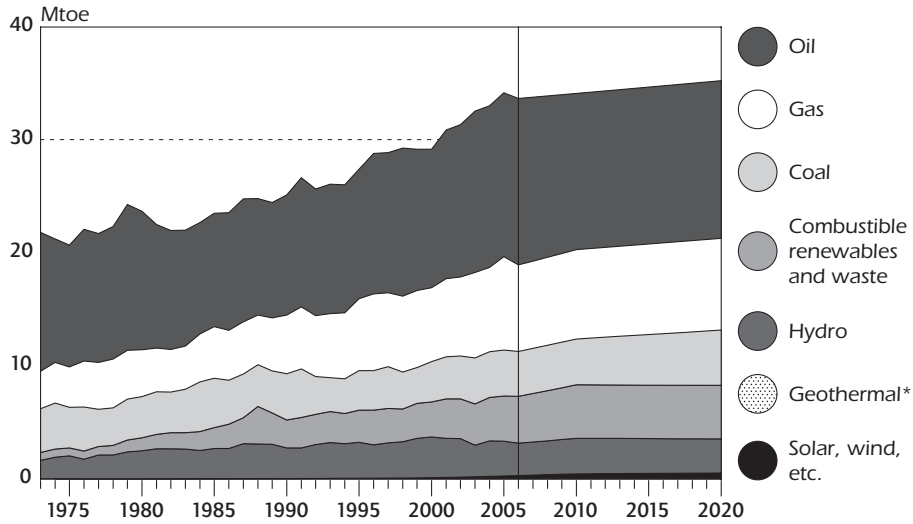
[1.] Estimated.
Source: Statistik Austria, Eurostat.

electricity generation. Renewables also directly contributed over 10% to industrial energy demand and 19% to energy demand in the Other Sectors[1], a very high contribution by comparison to other IEA member countries. The Austrian government is planning to build on this foundation by increasing the share of renewables in all sectors of energy supply.

1. The Other Sectors includes services, agriculture, government/military and the residential sectors.

Figure 2

Total Primary Energy Supply, 1973 to 2020

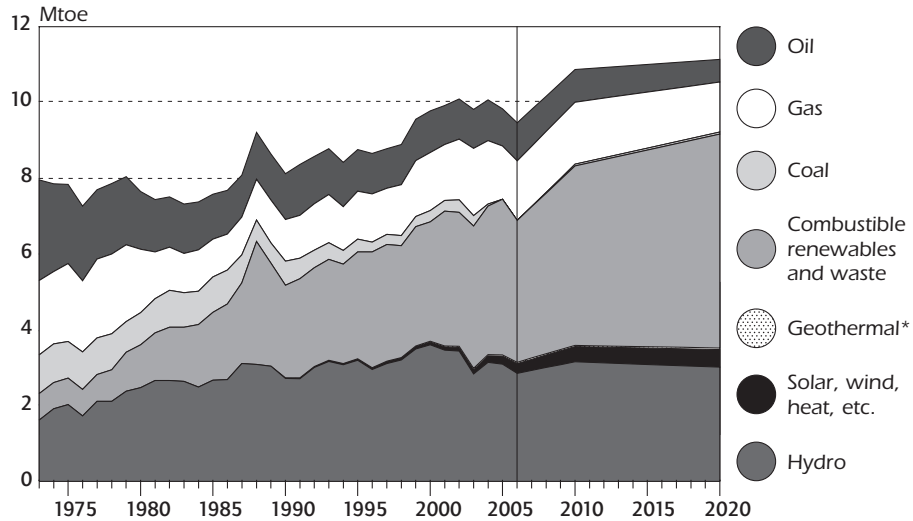


* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Figure 3

Energy Production by Source, 1973 to 2020

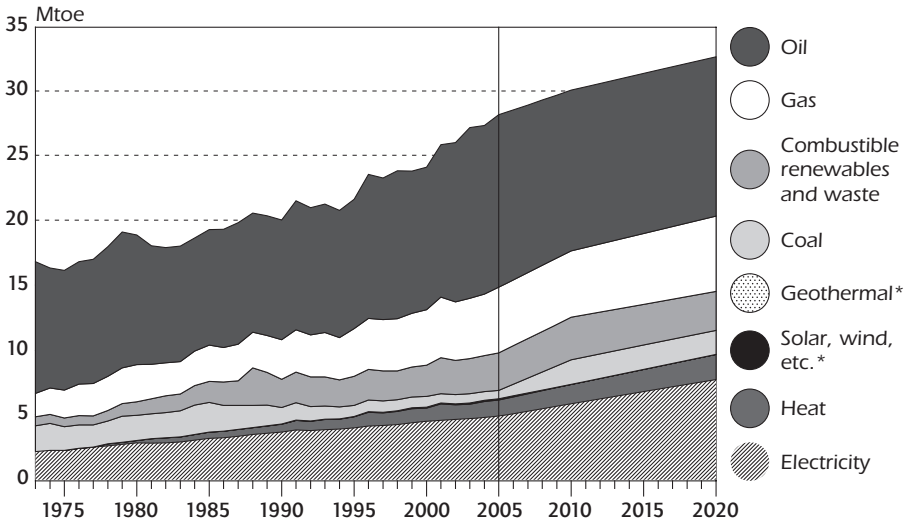


* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Figure 4

Total Final Consumption by Source, 1973 to 2020



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

ENERGY POLICY

Austria's energy policy is simultaneously conducted at two levels, the federal and the joint federal/state levels. The federal Constitution allocates responsibilities either to the federal level or to the joint federal and state level (see Table 2). Energy policy is formulated and implemented in close co-operation with the social partner organisations, which represent important groups of society (employers, employees, agriculture), and in dialogue with non-governmental organisations (NGOs) and the public.

Table 2

Division of Energy Policy Responsibilities in Austria

Federal	*Joint*
Taxation	Supply of electricity, gas and heat
Statistics	Energy conservation
Metering	Subsidies (*e.g.* for renewables)
Emergency supply	Prohibition of nuclear power

Source: Country submission.

Austria's energy policy strives to achieve four distinct objectives, by fostering an energy supply system that assures:

- Security of supply.
- Cost-efficiency and competitiveness.
- Environmental compatibility.
- Social acceptance of the energy supply system.

The Austrian government views these energy policy goals to be fully in line with those outlined by the EU and also with the principles laid down in the *Shared Goals* of the International Energy Agency (see Annex C). In order to achieve these objectives, the federal government's strategy is to promote the rational use of energy through improvements in energy efficiency, and the use of renewable sources of energy. This strategy is complemented by a range of government activities in various areas of energy policy, with the aim, among others, to increase the liberalisation of the energy markets, and the diversification of energy sources and suppliers.

Austria is producing energy forecasts up to 2020. The most recent government programme for 2007 contains high profile commitments in the energy policy sector and has stimulated lively debate, for example regarding the climate change targets and the approach to reaching them. The Austrian public is generally well aware of the issues in energy supply and participates in shaping this policy.

The main environmental challenge facing Austria is the achievement of its Kyoto commitment. In February 2007, the Austrian government published a new Climate Change Strategy, with very ambitious objectives as regards renewables. It sets clear targets for the government to achieve in the area of GHG emissions and commits the Austrian government to the annual purchase of 9 Mt CO_2-equivalent from joint implementation (JI) and clean development mechanism (CDM) schemes over the commitment period 2008-2012. The target for the share of renewables in TPES may mean up to a tripling of the current contribution of new renewables (other than large hydro) to Austrian TPES. The new strategy was adopted by the government in March 2007.

Energy efficiency is also seen as a major element in increasing security of supply, and the Austrian government is supporting efficiency improvements through research and funding programmes in all sectors of the economy. The strategic approach taken towards energy efficiency differs from that taken in renewables by being more reliant on market participants to act, and less prescriptive in terms of choices.

ENERGY INSTITUTIONS

The main energy policy making is taking place at the federal level in a number of government ministries and institutions. The **Federal Ministry of Economics**

and Labour is the main government institution responsible for energy matters at the federal level. The **Federal Ministry of Agriculture, Forestry, Environment and Water Management** is responsible for environmental protection, including climate change and emissions from combustion. The **Federal Ministry of Transport, Innovation and Technology** is responsible for transport policy and energy R&D. The **Federal Ministry of Finance** is responsible for setting energy taxes.

The **Federal Competition Office** is responsible for the safeguarding of competition in energy markets. The **Cartel Advocate** at the Federal Ministry of Justice is responsible for the initiation of legal action against cartels. The **Federal Economic Chamber** and the **Federal Chamber of Labour** are the statutory representatives of Austrian business and labour, and have a right to be heard on important questions of economic decision-making under the system of Social Partnership enshrined in the Austrian Constitution.

The **E-Control Commission** is the federal regulator for electricity and gas in Austria. The **E-Control GmbH** is a government-owned company providing advice on regulation to the commission. The **Austrian Energy Agency** was established by the federal government and states to promote clean energy use in Austria (see Chapter 4 on Energy Efficiency).

At the regional level, the governments of the nine states have responsibility for policy making, setting subsidy levels, and implementing regulatory control of energy companies. Most of the states have energy agencies undertaking activities similar to that of the Austrian Energy Agency.

The energy market in Austria is served by a number of companies. Under a special constitutional law, there is a requirement for a minimum of 51% state ownership of electricity utilities. The most important companies are the following:

- **Verbund** is the largest electricity company, and 51% is owned by the government.
- **EnergieAllianz** is the second-largest electricity company, indirectly owned by two states and the city of Vienna.
- **OMV** is the largest petroleum company, conducting exploration and production (E&P), refining, wholesale and retail sales in Austria and abroad; 31.5% is owned by the government. OMV owns the Baumgarten gas hub operator.
- **EconGas** is the largest gas supplier, controlling the Baumgarten hub and the long-term import contracts. OMV owns 50%, with the remaining 50% owned by five other municipal and state utilities in Vienna, Linz, Upper Austria, Lower Austria, and Burgenland.

- A range of smaller regional and municipal electricity and gas suppliers are active in Austria, mostly in the regions and municipalities which own them.
- Electricity, petroleum, and gas and heat industry associations are part of the energy market.

MARKET REFORM

Austria has implemented all EU market directives, and the Austrian electricity and gas markets are by law fully open to competition. All directives were implemented ahead of the deadlines set by the EU. Austria has also installed an independent regulator, the E-Control Commission (see Box 1).

Despite the early implementation of the directives, the development of real competition and customer switching are lagging in Austria, while both the federal and state governments continue to exercise significant ownership rights in the electricity sector (see Figure 6). Legal requirements for majority government ownership lead to substantial entry barriers for new suppliers who have to compete against integrated incumbents in which the unbundling of the networks has not been effective according to the regulator.

Concentration and dominance issues exist in both the electricity and the gas markets. Over 72% of the gas market is controlled by one supplier (see Table 3), and in electricity over 50% of generation is controlled by one company (Verbund). Although there is sufficient import capacity to develop competitive supply offers, it appears that the capacity is not used to provide competition. In electricity supply, the regional incumbents have not lost their dominant position. This high level of vertical integration and concentration is also creating barriers to entry for new suppliers. In the electricity sector, few suppliers make offers outside the regions in which they dominate the market. Regional market concentration is, therefore, particularly high, and there is no new entry because of not only the lack of access to the market but also a lack of transparency – retail pricing in electricity is not fully transparent, as some incumbents often provide customers with information on prices without separating network charges from the price of the electricity.

The Federal Competition Office conducted inquiries into the development of competition in the electricity and gas markets that were published in 2006. Both reports are very critical:

- The report on the electricity industry concludes that competition in electricity is still weak, primarily because of the dominance of the incumbents, and a lack of effective unbundling. It notes that a range of measures to improve competition were rejected by the electricity industry, and that a particular barrier for competition is a lack of official enforcement. While unbundling laws had been implemented at the federal level, the necessary laws had

Box 1

E-Control

The E-Control Commission is responsible for fundamental decisions on regulation such as the setting of tariffs. The members of the Commission are appointed by the federal government for five years with the possibility of reappointment. The Commission is supported by a private company which acts in carrying out the underlying analysis and in monitoring energy markets on its behalf. A supervisory board made up of representatives from the federal government and industry advisory councils complete the organisation of E-Control, which is detailed in Figure 5.

E-Control GmbH is the company managing regulation on a daily basis. It is responsible for analysis and monitoring to support the decisions by the Commission. It is 100% owned by the Federal Ministry of Economics and Labour, and the managing director is appointed by the Federal Minister for Economics and Labour, who can also give instructions to the company, that would have to be published. To date, no instructions have been given to E-Control. Because of the private company status of E-Control GmbH, it is not possible under the Austrian Constitution to give it judicial decision-making powers over energy utilities. The power to judge whether regulations have been broken rests with the courts, and enforcement powers remain with the state governments.

Figure 5

Organisation of E-Control

Source: E-Control.

In addition to the regulatory work undertaken by E-Control, the company also conducts polls and runs advertising campaigns to promote the idea of competition in energy supply in Austria.

E-Control has a co-operation agreement with the Federal Competition Commission to avoid duplication of effort and the two institutions co-operated closely on the 2006 sector inquiries (see below). In 2005 the total budget for E-Control (commission and company) was EUR 8.7 million, which was financed by a levy on electricity consumption. In 2004, the E-Control GmbH had a full-time equivalent staff of 62.

often not been passed at the state level, blocking the implementation of unbundling completely.

- In the gas sector, the report notes positive developments with the introduction of unbundling between network and supply activities, the restructuring of import contracts, and the improvement of trading at the Baumgarten hub. The report notes that the introduction of unbundling in 2006 has had a positive effect on the wholesale market level. It criticises the lack of competition in the supply markets, and identifies the dominance of the incumbents, and the continued existence of long-term contracts as primary causes.

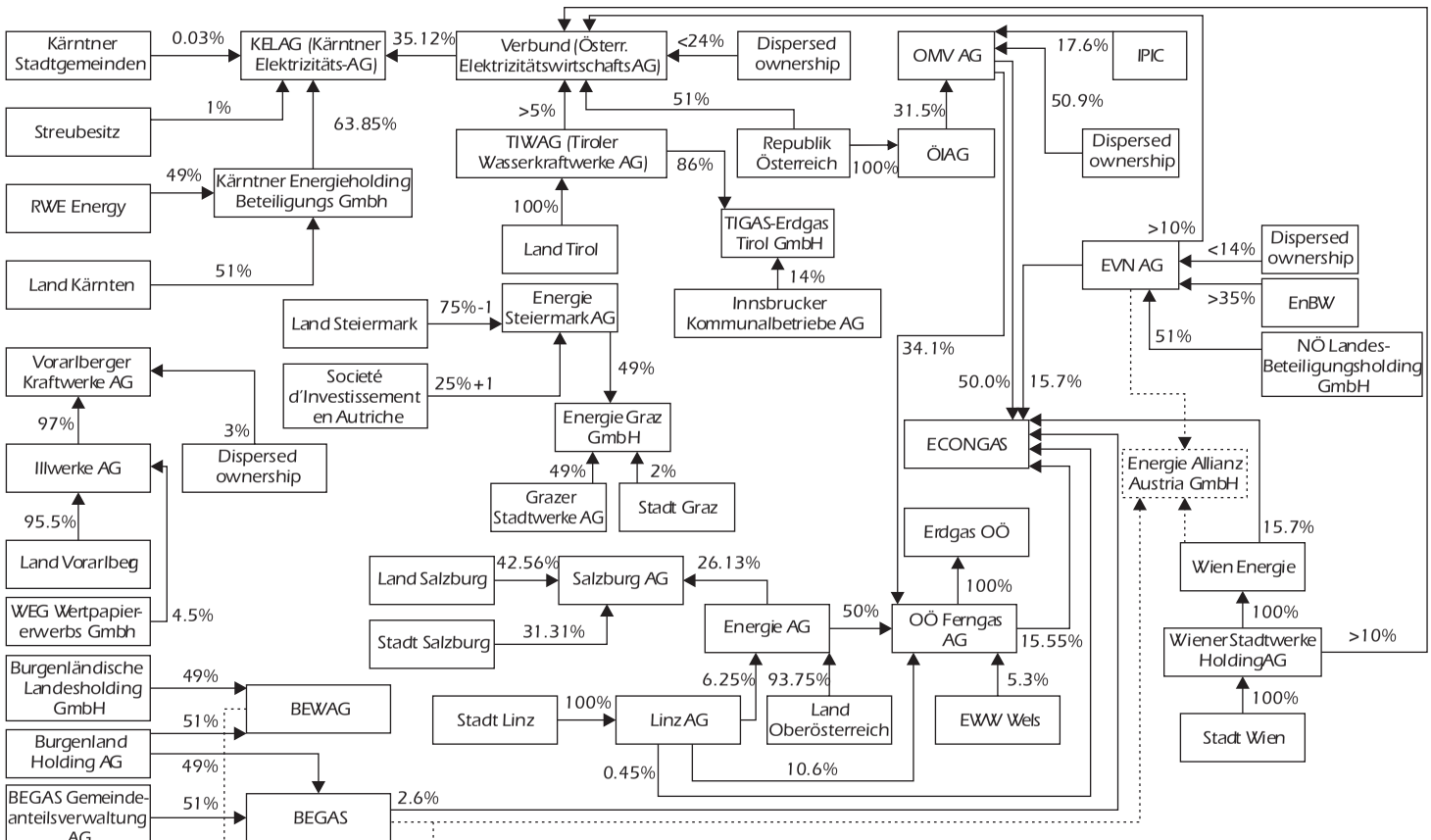
As a consequence of the 2006 report on the electricity industry, the regulatory authorities, the industry itself, and the federal and state governments negotiated and adopted a programme to invigorate competition in the sector. Measures included in the package are:

- The physical provision of an information leaflet regarding their options in the liberalised market to all electricity customers in Austria, as a one-off measure. The leaflet will also be available online and be part of all new connected customers' information package.
- The process of changing supplier will be speeded up from eight to six weeks (October 2006), and the change will be enabled by simply providing customer name and address (January 2007).
- Customers will have the right to choose their supplier, instead of being automatically connected to the local incumbent, even if applications for supply are not made within the correct time frame in the case of new connections.
- To increase transparency, the industry association VEÖ agreed to no longer utilise fixed price conditions whereby reduced network tariffs are automatically balanced by increased electricity unit tariffs.
- A code of conduct for suppliers was developed which all suppliers signed up to.
- From November 2007, all network operators agreed to a uniform electronic standard for customer billing data to eliminate time lags in transferring data.
- The VEÖ will establish a monitoring process, the annual report of which will be sent to the competition authorities.

While this programme addresses several points that, in the view of the regulatory authorities, hindered the development of competition, it still leaves potential for improvement, such as requiring the regulators to continue to observe the market, and be ready to act immediately if market dominance is inhibiting competition. Particular shortcomings are the lack of independent monitoring, repeated provision of the information leaflet to trigger customer action and the establishment of a central electricity metering points database.

Figure 6

Ownership Structure in the Austrian Electricity Sector



Source: The Energy Institute at the Johannes Kepler University of Linz, 2007.

Table 3

Market Shares of Gas Suppliers to Final Customers in 2005

(Eastern Austria)

Company	*%*
EconGas + EnergieAllianz	72.3
STGW	12.5
Terragas	10.0
Salzburg AG	2.5
KELAG	1.7
Total	**99.0**

Source: Government submission.

SECURITY OF SUPPLY

Austria is producing a high share of its energy supply domestically, reducing the risk to its security of supply. It is well interconnected to its neighbouring countries for deliveries of oil, gas and electricity. The western-most part of Austria[2] is fully integrated into the German electricity and gas systems. The Austrian government is pursuing a policy of increasing domestic energy production (primarily from renewables) to further decrease the import dependence of the country.

Particular projects supporting increased domestic energy production from renewables include the production of biogas to feed into the gas grid, the increased use of biomass in CHP and heat production, and the increase of electricity generation from wind.

To increase source diversification of imports and reduce the very heavy dependence on Russian gas, the Austrian government is actively promoting the development of the Nabucco pipeline to bring Caspian gas to Europe. It is also in favour of the construction of an Adriatic LNG terminal on the Croatian island of Krk.

ENERGY TAXATION

Austria is levying taxes on fossil fuels and electricity, their level being set by the Federal Ministry of Finance. Since 2004, the government is attempting to increase the consideration of environmental objectives in taxation. A tax reimbursement scheme for energy-intensive industries is in operation, and approved by the EU. A value-added tax (VAT) is levied at the full rate of 20% on all sales of energy.

2. Western Austria is connected to the German gas grid.

Table 4

Energy Taxes in Austria, 2006

(in euros)

Low sulphur fuel oil	67.7/tonne
Heavy fuel oil for electricity generation	7.7/tonne
Light fuel oil	108.32/1 000 l
Automotive diesel	335/1 000 l
Gasoline	427/1 000 l
Biofuels	0
Natural gas for households	69.34/tonne
Steam coal	50/tonne
Electricity for industry	0.0203/kWh
Electricity for households	0.0219/kWh

Source: *Energy Prices and Taxes Fourth Quarter 2006*, IEA/OECD 2007, Paris.

CRITIQUE

Austria attaches great importance to international co-operation in energy matters, including RD&D and dialogue with major energy-producing countries such as Russia. Austria is an important transit country, and it is generally well connected to its neighbours, even though electricity interconnections, except to Germany, are insufficient. Improvements in energy interconnections are planned, and this is commendable.

Because of the large gap between current emissions and its Kyoto commitment, in 2007 the government updated its Climate Change Strategy of 2002 to correctly reflect the realities of Austria's position. In the area of renewables, the Austrian government has adopted very ambitious targets, and achieving them will be a major challenge for the current and future governments. Great care should be taken to ensure that reaching these climate change and renewables targets does not burden energy consumers and the economy unduly. Contrary to the approach taken in renewables, targets in energy efficiency are more general. Overall, there appears to be an imbalance between the ambitions in energy efficiency and renewables, with less understanding of the benefits and less ambition being displayed in the area of energy efficiency, where great potential remains in Austria, at lower cost.

Austria has liberalised its electricity and gas markets ahead of the implementation timetables foreseen in the relevant EU directives. The special constitutional law requiring regional and major municipal utilities to be owned up to at least 51% by the regional/municipal authority of the territory

in which they are the incumbent operator can create specific problems in regulating these sectors and in achieving sectoral consolidation. Although the relevant EU directives have been applied to the letter and well before the deadlines set for implementation, there is doubt whether the spirit of liberalisation has been fulfilled, and whether Austrian consumers can reap the benefit from full market liberalisation. Customer switching rates are low, and there are only two new entrants in the electricity market, serving a tiny niche of ecological electricity demand, while competition between the incumbents is weak, and further threatened by planned mergers.

Examples of incumbents using their dominant position to block competition from new entrants are documented in the electricity sector. Also, the high degree of public ownership has the potential to create conflicts of interest, for instance where the owner of an electric utility (a state) also has regulatory functions, *e.g.* enforcing a decision against the utility. The enforcement power of the regulator is very weak, and the human resources of the competition authority are insufficient, which exacerbates this problem. Sectoral inquiries in both gas and electricity were held in 2006, and led to a programme aimed to stimulate competition in the electricity sector. The measures introduced by this programme are an indication that government and industry failed to implement many of the policies that are required to give effect to the market opening laws. It is still unclear if this programme will be sufficient, and especially if it will help address specific concerns about potential conflicts of interest in regulation and enforcement by states, and anti-competitive behaviour by some incumbents.

The Austrian government should, therefore, give full support to the regulatory authorities in their attempts to create a well-functioning, competitive market for electricity and gas in Austria, to the benefit of all consumers, and should be prepared to introduce new measures to ensure that effective competition emerges in Austrian energy markets.

Given the rising energy import dependence of Austria and the heavy dependence on a single supplier, the new government remains committed to the goal of enhancing security of energy supply and reducing fossil fuel imports. Therefore, increased domestic production, of both renewables and fossil fuels, diversification of import routes such as the Nabucco pipeline and the Croatian LNG terminal, are proposed, as well as increases in commercial gas storage and a connection to the Druzhba oil pipeline. Domestic energy security is to be strengthened by closing gaps in the electric transmission network.

While the effort to diversify import sources and routes is to be commended, the successful implementation of these projects is highly challenging. Continued monitoring of the energy security situation should help to determine in which sectors investment is needed most. Relevant projects should be facilitated by the government, especially by improvements to, and speeding-up of, the

licensing process for strategic energy projects. Responsibilities should be concentrated as much as possible in the federal government, *e.g.* by the creation of a one-stop shop for developers, in order to reduce the administrative burden on them and to accelerate project development.

RECOMMENDATIONS

The government of Austria should:

- *Continue to develop a cost-effective, affordable, and comprehensive climate change policy.*
- *Further improve competition in the electricity and gas markets by:*
  - *Ensuring that in the electricity sector there is more effective separation of ownership and regulatory functions at all levels in the energy industry and the governmental system, in particular the states.*
  - *Strengthening the role of E-Control and ensuring the implementation and enforcement of regulatory decisions.*
  - *Increasing the staff at the Federal Competition Commission.*
  - *Actively encouraging new entrants in the electricity and gas markets.*
  - *Implementing fully independent electricity and gas transmission system operators with a responsibility for system management, including balancing.*
  - *Ensuring non-discriminatory grid access.*
  - *Considering further measures to increase competition in gas and electricity markets should no effective competition develop.*
- *Continue to monitor security of supply both in terms of imports and internal networks, and streamline licensing procedures to ensure that the required energy projects are accelerated.*

CLIMATE CHANGE

INTERNATIONAL COMMITMENTS

Austria is a signatory to the Kyoto Protocol. It also participates in the European Union's (EU) burden-sharing agreement, with a target of –13% of greenhouse gas (GHG) emissions for the first commitment period 2008-2012, compared to 1990. Austrian climate policy is focusing on the achievement of this target.

GHG EMISSIONS

Since 1990, Austria's GHG emissions have risen rapidly, and they are now significantly above the –13% target. In 2005, total GHG emissions amounted to 93.2 Mt CO_2-eq, 14.2 Mt CO_2-eq more than in the 1990 base year and 26% above the target for the first commitment period of 2008–2012, creating a 39% gap to the target. This is one of the most significant gaps among EU member countries, and it is practically impossible for domestic measures to bridge this gap.

Compared to some other IEA countries, Austria's energy-related CO_2 emissions (see Figure 7) per unit of gross domestic product (GDP) are relatively low, thanks to its high energy efficiency and the very high share of renewables in Austria's TPES. In 2004, CO_2 emissions from fuel combustion were 24% higher than in 1990 (see Table 5), with most of the rise originating in the transport sector, posing a significant problem to policy makers who have so far not found an adequate response to address this problem. The Austrian government assumes that fuel tourism, with vehicles from neighbouring countries taking advantage of the comparatively lower tax rate for transport fuels, accounts for much of this increase in the transport sector. A study commissioned by the Federal Ministry of Agriculture, Forestry, Environment and Water Management has shown that net fuel tourism accounted for roughly 25% to 30% of total diesel and petrol sold in Austria.

POLICY

Austrian climate policy is based on two documents: the Climate Change Strategy and the National Allocation Plan (NAP), submitted to the European Commission (EC) and regulating the allocation of emissions to the trading

Table 5

GHG Emissions in Austria by GHG, 1990 – 2004

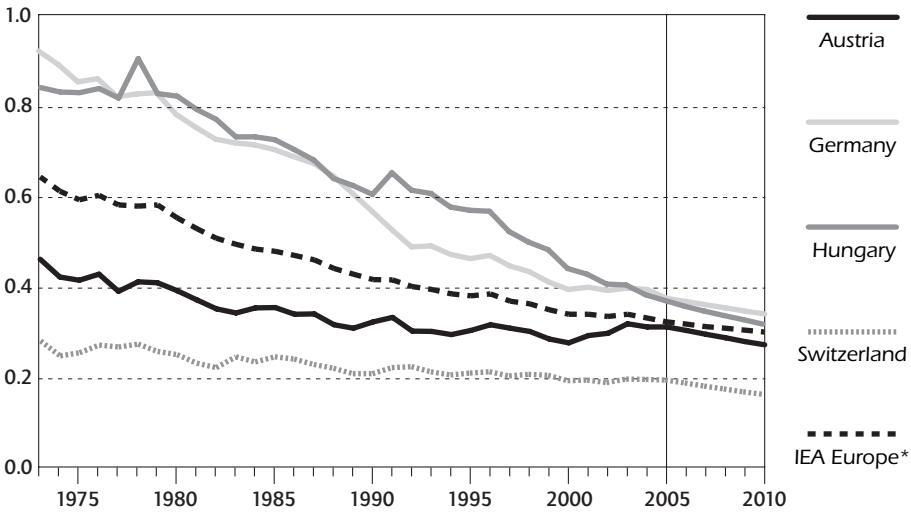
	1990	*2004*	*Share 1990*	*Share 2004*	*Difference 2004/1990*
	Mt Mt CO_2-eq	Mt Mt CO_2-eq	%	%	%
CO_2	61.9	77.1	78	84	24
CH_4	9.2	7.4	12	8	–19
N_2O	6.2	6.1	8	7	–3
Other	1.6	1.5	2	2	–5
Total	**78.9**	**92.1**	**100**	**100**	**17**

Source: *Austria's Annual National Greenhouse Gas Inventory 1990 – 2004.*

Figure 7

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

(tonnes of CO_2 emissions per thousand USD/GDP using 2000 prices and purchasing power parities)



* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007; *National Accounts of OECD Countries,* OECD Paris, 2007 and country submissions.

Table 6

CO_2 Emissions from Fuel Combustion in Austria by Sector, 1990 – 2004

	1990	*2004*	*Share 1990*	*Share 2004*	*Difference 2004/1990*
	Mt CO_2	Mt CO_2	%	%	%
Energy industry	19.76	24.03	34	32	22
Manufacturing/construction	11.67	15.63	20	21	34
Transport	12.89	21.92	22	29	70
Road	*12.26*	*20.8*	21	28	70
Other	13.26	13.56	23	18	2
Residential	*9.91*	*9.61*	17	13	–3
Total	**57.58**	**75.14**	**100**	**100**	**30**

Source: *CO_2 Emissions from Fuel Combustion 1971 – 2004,* OECD/IEA Paris, 2006.

sectors in Austria. Both documents have been prepared as a joint effort by the relevant ministries, regional authorities and non-governmental organisations. This work was co-ordinated by the Federal Ministry of Agriculture, Forestry, Environment and Water Management, the ministry responsible for co-ordinating climate change policy in Austria. Most of the Austrian states have adopted their own regional climate change programmes, taking into account specific regional circumstances, needs and areas of competence.

The overall breakdown of planned emissions reductions under the strategy by sector in Austria is for a 42% purchase of emission allowances and credits abroad; 32% from the non-trading sectors; and 26% from the trading sectors under the European Union Emissions Trading Scheme (EU-ETS). For domestic action alone, non-trading sectors are expected to cover 58% of reductions, while trading sectors under the EU-ETS are expected to cover 42%.

Climate Change Strategy

The Austrian Climate Change Strategy focuses on the first Kyoto commitment period 2008–2012 and covers all sectors, particularly those not included in the EU-ETS. The federal government adopted the current strategy in 2002.[3] The strategy was amended by the acceptance of an update in the Austrian Federal Cabinet on 21 March 2007. This is based on an evaluation of the 2002 strategy, commissioned by the Federal Ministry of Agriculture, Forestry, Environment and Water Management and compiled by the Federal

3. Strategie Österreichs sur Erreichung des Kyoto-Zieles – Klimastrategie 2008-2012.

Environment Agency together with the Austrian Energy Agency.[4] The economy-wide emissions projection was elaborated by the Federal Environment Agency in 2005, while for energy-related sectors it was based on the latest energy scenarios developed by the Austrian Institute of Economic Research and published in 2005.

The evaluation concluded that stronger measures than those foreseen in the 2002 document were needed to reach the Kyoto target, and that increased allowances purchased abroad would be required for meeting the target. The new strategy outlines those measures and estimates an amount of 15.5 Mt CO_2-eq per year to be achieved by domestic measures, while certificates for 9 Mt CO_2-eq would have to be purchased annually, at an estimated total cost of EUR 280 million over the commitment period. The Climate Change Strategy focuses primarily on CO_2-related measures.

In the light of EU level developments, Austria will have to prepare for the negotiations on its post-2012 targets. Those targets are not discussed in the current strategy. The targets will be derived from the EU's overall independent target of –20% by 2020, agreed by the European Council on 9 March 2007, and will be the outcome of the negotiations between the EU countries on how to share the reductions required to achieve the overall target.

Table 7

Summary of the Austrian Climate Change Strategy

Current emissions and projections	*Emissions Mt CO_2 eq*
Target under burden–sharing agreement	68.7
Emissions 2003 [excl. land use change and forestry (LUCF) and removals]	92.5
Difference	**–23.8**
Projection (with measures) 2008-2012	89.9
Difference	**–21.2**
Expected reductions	
EU-ETS	–7.4
Domestic measures not included above but including LUCF	–5.2
Government allowance purchased abroad	9.0
Total expected reductions	**–21.6**

Source: European Commission.

4. Klimastrategie-Umsetzungsbericht, 2005.

National Allocation Plan (NAP)

Preparing a NAP is a legal obligation under the EU Emissions Trading Directive (2003/87/EC). The directive states the total quantity of CO_2 emissions that facilities in the six energy-intensive industries covered by the directive are allowed to emit and specifies how many emission allowances each individual plant will receive free of charge. The government has decided that 1.3 % of total allocation will be auctioned. The NAP is subject to approval by the EC. On 2 April 2007, the European Commission approved Austria's NAP for the years 2008–2012 for the annual amount of 30.7 Mt. This is 6.4% less than what Austria had proposed in its submission to the Commission and 2.3 Mt (7%) less than in the NAP for 2005–2007. Up to 10% of the allowances could come from project-related activities abroad. New entrants are guaranteed free allowances by law.

Table 8

Domestic Emissions Reductions in Austria under the 2007 Climate Change Strategy by Sector, 2005 and 2010

Sector	*1990 Mt CO_2-eq.*	*2005 Mt CO_2-eq.*	*Change 1990/2005 %*	*Climate Strategy (2002 updated 2007) 2010 targets in Mt CO_2-eq.*	*Gap 2005/2010 target in Mt CO_2-eq.*	*Climate Strategy (2002 updated 2007) 2010 targets relative to 1990 emissions in %*
Space heating and other use	14.9	15.6	+4.7	10.7	4.2	-28.1
Energy sector	13.7	15.9	+16.1	11.6	2.1	-14.1
Waste sector	3.6	2.3	-36.1	2.1	0.2	-40.9
Transport	12.8	24.4	+90.6	16.9	7.5	+32.3
Industry (excl. electricity use)	22.3	24.7	+10.8	21.3	3.4	-4.4
F-gases[1]	1.6	1.3	-18.7	1.7	-0.4	+3.4
Other emissions of CO_2, CH_4, N_2O (in particular solubles)	1.0	1.2	+20	0.7	0.5	-27.8
Agriculture	9.1	7.8	-14.3	7.2	0.6	-21.4
Total domestic	**79.0**	**93.2**	**+18.0**	**72.2**	**18.1**	**-9.1**
Kyoto target						**-13.0**

1. HFCs (hydrofluorocarbons); HPFCs (hydroperfluorocarbons); SF_6 (hexasulphurfluoride).

Source: *Bericht zur Anpassung der Klimastrategie 2002.*

Tableau 9

NAP Summary Table (in Mt CO_2)[1]

Installation	*Emission levels*		*2005-7 Allocation NAP I*	*2008-12 Allocation NAP II*	*NAP II as share of NAP I*	*Sector share 2004*	*Sector share NAP II*	*Change 2004/ NAP II*
	2003	2004			%	%	%	%
Combustion installations	13.80	13.07	11.38	9.70	85	40	32	-26
Power generation	*11.72*	*11.03*	*9.03*	*7.60*	*84*	*34*	*25*	*-31*
District heating	*0.56*	*0.55*	*0.6*	*0.54*	*90*	*2*	*2*	*-2*
Chemicals/textile	*0.91*	*0.85*	*1.02*	*0.85*	*83*	*3*	*3*	*0*
Food processing	*0.32*	*0.34*	*0.37*	*0.39*	*103*	*1*	*1*	*15*
Timber	*0.2*	*0.21*	*0.24*	*0.23*	*96*	*1*	*1*	*10*
Construction engineering, automotive	*0.08*	*0.09*	*0.10*	*0.09*	*90*	*0*	*0*	*0*
Other	*0.00*	*0.00*	*0.01*	*0.00*	*0*	*-*	*0*	*n/a*
Oil refining	2.73	2.89	2.77	2.77	100	9	9	-4
Metal/steel	10.08	10.29	11.31	10.61	94	31	35	3
Cement	2.71	2.71	2.57	2.76	107	8	9	2
Lime	0.74	0.77	0.82	0.88	107	2	3	14
Glass	0.20	0.20	0.29	0.21	73	1	1	5
Ceramics	0.83	0.89	1.16	0.88	76	3	3	-1
Pulp & paper	2.13	2.11	2.38	2.22	93	6	7	5
New entrants	n/a	n/a	0.33	0.31	93	n/a	1	n/a
Allowances to be auctioned	n/a	n/a	0.00	0.40	n/a		1	n/a
Total	**33.22**	**32.92**	**33.00**	**30.73**	**98**	100	100	-7

1. Proposed allocation in relation to first period allocation (without additional policies and measures) in the sectors covered by the EU-ETS.

Source: Ministry of the Environment.

The Klima:Aktiv Programme

To support the achievement of the Climate Change Strategy's goals, the Austrian government has established the *Klima:Aktiv* programme, which is overseen by the Ministry of the Environment, and managed by the Austrian Energy Agency. The aim of the programme is to support energy efficiency and increased use of renewables in all sectors of the economy, through direct grant support and accompanying measures, such as information and advice.

The sub-programmes of *Klima:Aktiv* are designed to support the grant, regulation, and fiscal measures foreseen in the climate strategy, to give targeted incentives for the use of climate impact-reducing products. The programme is aimed at technology and service markets. Some programme examples are outlined in Box 2.

Box 2

Three Examples of Klima:Aktiv Sub-Programmes

e5 is a programme conceived to qualify and reward communities that use energy more efficiently and increase the use of renewables. The programme is focusing on supporting the implementation of current best practice in a long-term framework, instead of demonstrating new technologies and approaches. It is tied to the *European Energy Awards* (EEA) programme. A total of 54 communities have so far created 1 500 energy-related projects. Three of them have received the highest level of the programme awards.

Mobility Management is a range of programmes targeted on improving mobility in a sustainable manner in all sectors of the economy. The programme is split on a sectoral basis, with sub-programmes addressing, for example, the business sector, schools, or town planners.

Klima:Aktiv House is a programme under which a catalogue of criteria for a low-energy/high-comfort house was developed. The system is based on achieving a minimum number of points (700 for a *Klima:Aktiv* house, 900 for a *Klima:Aktiv* passive house[5]). Points are awarded for achieving particular minimum standards, or for installing particular technologies. To receive the award, a certificate of compliance has to be issued by a competent authority. The Austrian government has adopted this standard by setting a goal that 50% of all new buildings in Austria should be built to this standard.

5. A passive house is a residential building for either single-family or multiple occupancy that achieves very low rates of energy consumption.

LOCAL AND TRANSBOUNDARY AIR POLLUTION

LEGAL REQUIREMENTS

Austria is signatory to the United Nations Economic Commission for Europe (UNECE) Convention on Transboundary Air Pollution. This and the Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants (the NEC Directive) require annual reports on the emissions of nitrogen oxides (NO_X), sulphur dioxide (SO_2), non-methane volatile organic compounds (NMVOC), ammonia (NH_3) and carbon monoxide (CO), particulate matter (PM), persistent organic pollutants (POPs) and heavy metals (HM). Austria compiles an Air Emissions Inventory which is updated annually[6], and has implemented a European Pollutant Emission Register (EPER) under the Integrated Pollution Prevention and Control (IPPC) Directive 1996/61/EC. The Austrian "Ambient Air Quality Law" requires the reporting of emission data on SO_2, NO_X, NMVOC, CO, HM (lead, cadmium, mercury), benzene and PM.

POLICY

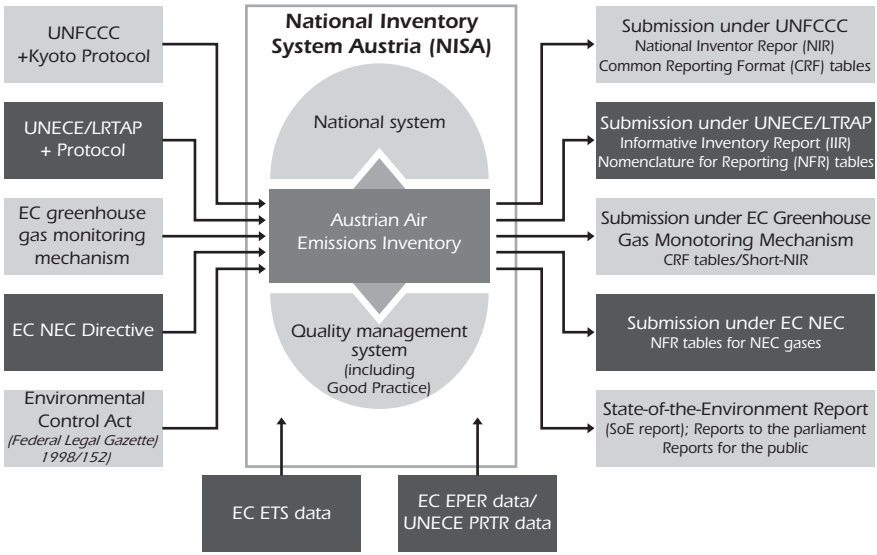
To comply with these regulations, a National Emissions Inventory System (NISA) has been established for Austria, which brings together all the emissions data into a central inventory. It is the basis for reports to the relevant bodies governing the various conventions and laws on air pollution.

The emissions of particulates from transport are a particular challenge for Austria, and the Ministry of the Environment sees this as a task of equal importance to addressing climate change. Increased public anxiety has led to the introduction of policy measures to counteract the rise of this kind of emission. Since 1 July 2005[6], reduced purchase tax *(Normverbrauchsabgabe)* is applied to all diesel passenger cars equipped with a particulate filter, while increased tax levels apply to vehicles without a filter. The net effect of this system is to cover the cost of installing a filter in one year. The system is time-limited to June 2008. In the longer term, the Austrian government aims to reduce vehicle emissions by increasing the penetration of vehicles running on natural or biogas. The Ministry of the Environment and the partially state-owned oil company, OMV, signed an agreement to this end in August 2006. The agreement targets an increase of biogas vehicles from 650 in 2006 to 50 000 in 2010, and an increase in methane filling stations in Austria from 32 in 2005 to at least 200 by 2010.

6. Österreichische Luftschadstoff-Inventur – OLI.

Figure 8

Structure of National Emissions Inventory System Austria (NISA)



Source*: Austria's Informative Inventory Report 2006.*

EMISSION LEVELS

Emissions of SO_2 and NH_3 have reduced in Austria and the target levels for 2010 had been met by 1998 and 2000, respectively. Emissions of NMVOC were still above the 2010 target in 2004, by 8.3%. In 2004, NO_x emission levels were significantly above the 2010 target levels, *i.e.* 112% above the requirements of the UNECE Convention, and 120% above the requirements of the NEC Directive. This is partially due to the calculation of emissions based on fuel sold, not used, in a country. This approach increases emissions in Austria from fuel which is bought, but not used in Austria (fuel tourism), a similar problem to that which exists regarding CO_2 emissions from transport. Particulate emissions of PM_{10} have been stable in recent years, as shown in Figure 9. Transport is the fastest rising source of these emissions. Emission limits for PM_{10} were exceeded at 50 out of 90 Austrian measurement locations in 2005.

CRITIQUE

CLIMATE CHANGE

Environmental compatibility is one of the four main goals of Austrian energy policy. It has been successfully pursued by promoting energy efficiency and the use of renewable energy sources. These two sectors will also form the basis for

Table 10

National Total Emissions and Trends 1990–2004 (in kt)[1]

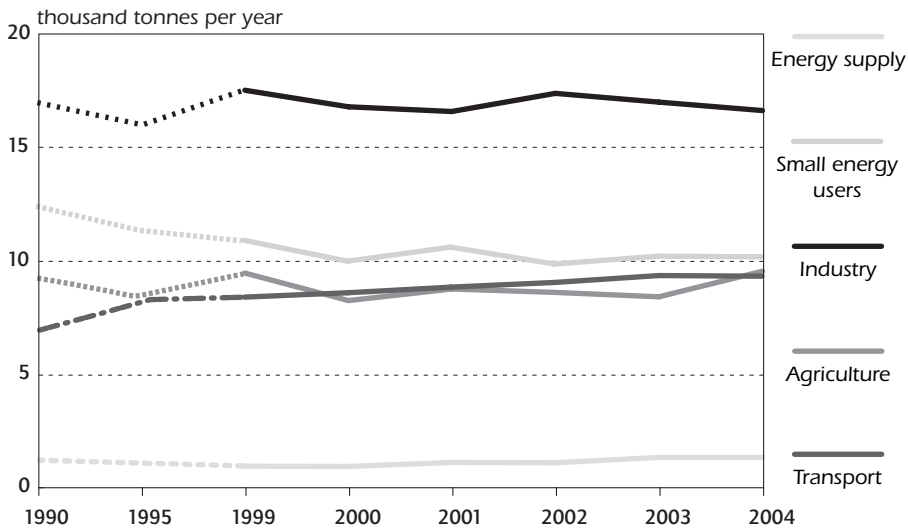
Year/pollutant	*SO_2*	*NO_x*	*NMVOC*	*NH_3*	*CO*
1990	74.23	211.59	284.37	68.65	1 221.85
1995	46.82	192.58	220.66	70.43	1 010.19
2000	31.5	203.9	179.15	65.58	797.5
2004	28.89	226.91	172.2	63.84	742.17
Trend 1990–2004	–61%	7%	–39%	–7%	–39%
Target 2010	39	103	159	66	n/a
2004 distance to target	–10.11	123.91	13.2	–2.16	n/a

1. Also states emission targets for air pollutants covered by the *Multi-Effect Protocol* and CO. The NO_x requirement of the NEC Directive is more stringent than that of the UNECE Convention, with an absolute target of 103 kt by 2010.

Source: Austria's *Informative Inventory Report 2006*.

Figure 9

PM_{10} Emissions by Sector, 1990 to 2004



Source: Federal Environment Agency.

the government's response to the challenge of reducing energy-related GHG emissions. Under the burden-sharing agreement of the EU, Austria's overall target for annual GHG emissions in 2008–2012 is 13% below the 1990 level. Nevertheless, GHG emissions have continued to grow and in 2005, they were 18% above the 1990 level.

The government accepts that it is practically impossible to reach the Kyoto target with domestic measures alone, and in 2007 has updated the Climate Change Strategy of 2002 to correctly reflect the realities of Austria's position. The update contains, *inter alia*, a number of detailed measures in energy supply and demand. According to the first draft of the update, the government wants to increase the use of flexible mechanisms, while reducing the contribution from domestic actions. It is planning to obtain 9 Mt CO_2-eq of emission credits annually through the joint implementation/clean development mechanism (JI/CDM) and has already set up projects to this effect. The government is to be commended for this pragmatism, for its continuing efforts in developing and updating its Climate Change Strategy, and for the preparations it has already undertaken in developing the JI/CDM market.

To support the achievement of the targets in the strategy, the Austrian government has established the *Klima:Aktiv* programme. This is a commendable programme addressing all sectors of the economy and supporting energy efficiency and renewables at the same time. Care should be taken that the programme is established as a long-term programme with stable funding levels.

Nevertheless, there is serious concern that the new measures are still unrealistic in their assumptions about the possible domestic contributions, and it is expected that additional credit purchases beyond the 9 Mt CO_2-eq will be required. To ensure that the Climate Change Strategy can be effective, the government will have to define clear milestones should these be missed, and identify possible remedial actions. In preparing and implementing the strategy, co-ordination will have to be improved significantly to ensure a consistent approach in climate change policy development, as well as the adoption of measures affecting it, across all government departments. To be effective, such co-ordination may have to be implemented at a higher level than is currently the case.

The time that elapsed between the publication of the 2002 strategy and the 2007 update indicates that a lack of monitoring and follow-up actions may be causing delays in implementing corrective policies. The Austrian government should consider institutionalising monitoring and the implementation of corrective actions with less of a time-lag.

For the emissions trading sector, the National Allocation Plan for 2008–2012 will apply, but also the climate strategy suggests measures for this sector. Care

should be taken not to micro-manage the trading sector, instead leaving it up to trading participants to find the most appropriate solution for emissions reductions.

For the non-trading sector, the Climate Change Strategy contains some very ambitious targets, which are likely to be unrealistic. Most of the expected mitigation effects have been quantified only on an aggregate level and there is reason to doubt whether they can actually be reached in just a few years time. Particular concern should be taken regarding the capacity of the industries involved in achieving the target, such as, for example, the building industry.

In transport, the goal is to reduce CO_2 emissions by 22.5% from 2005 to 2010. The bulk of the additional reductions is expected to come from using fiscal incentives to promote biofuels and energy-efficient vehicles. These measures would certainly contribute to reaching the Kyoto target, but they are not yet fully implemented and it is, therefore, hard to see how they could have the expected impact by 2010. The biofuels blending obligation alone would not suffice and the required changes in the car fleet will take more time.

To complicate matters, a large part of the emissions in transport comes from fuel sold to foreigners and actually consumed outside of Austria. Transport fuels are taxed less in Austria than in neighbouring Germany and Italy, and it has been estimated that this fuel tourism accounted for 28% of total transport fuel sales in Austria in 2003 and for roughly three-quarters of the growth in transport sector's emissions from 1990 to 2003.[7] Raising transport fuel taxes would be the obvious solution, and would also encourage more efficient fuel use by Austrians but it would on the other hand reduce the income from fuel taxation. The small raise in fuel taxes in 2007 is not sufficient to cover the increased gap to Germany following the 3% VAT increase there on 1 January 2007. Fiscally, it would be rational for Austria to keep the tax volume and use a small part of it to purchase JI/CDM credits from abroad, as long as the cost for their procurement is lower than the tax income from fuel sales. However, this approach would not provide a solution to achieving the National Emission Ceiling (NEC) NO_X target for 2010, which is equally at risk with fuel tourism, and would not encourage conservation. In the climate strategy, the goal is consequently to keep the volume of fuel tourism at its current level. Changing taxation to eliminate fuel tourism would be politically difficult and a significant part of the emissions would simply occur in other countries, for example those originating from trucks which would continue to transit through Austria. In the medium to longer term, however, gradually raising taxes should encourage more efficient fuel use and modal shift in goods transport in Austria.

7. Klimastrategie-Umsetzungsbericht, 2005.

The impact of individual measures on CO_2 emissions is hard to quantify. Owing to the uncertain contribution of the non-trading sector to reducing emissions, the government may require more JI/CDM credits than currently planned, and it should ensure that sufficient budgetary allocation is made for the purchase of credits.

AIR POLLUTION

While the emissions of some air pollutants have reduced significantly, and in line with the requirements of the international agreements to which Austria is a party, emissions of NH_3 and NO_X are still a matter of concern. Particularly in the case of NO_X emissions, the Austrian government should consider developing stronger measures to reach the 2010 emissions target.

RECOMMENDATIONS

The government of Austria should:

Climate Change

- *Further enhance co-ordination among the Chancellery and the relevant federal ministries, as well as between the federal government and the states.*
- *Assess the cost-effectiveness of the planned measures to reduce GHG emissions in the non-trading sector, especially in transport.*
- *Continue the use of JI/CDM projects to cover any remaining gap, and at the same time pursue a high quality of such projects by ensuring institutional capabilities in developing projects and generating emission savings. The necessary funding should be allocated.*
- *Ensure annual monitoring and discussion of the results of the strategy.*

Air Pollution

- *Consider introducing measures to achieve the 2010 NO_X targets.*

OVERVIEW

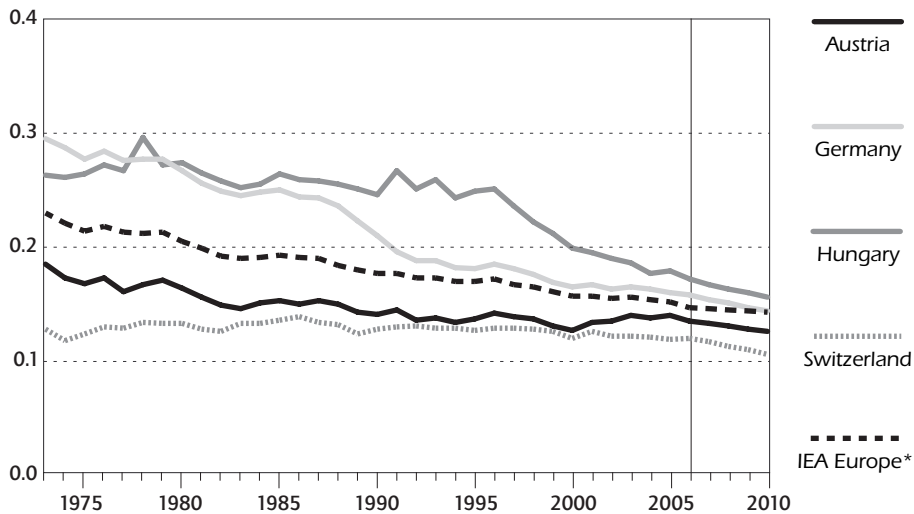
Austria's total final consumption of energy (TFC) has increased by 40.6%, from 20 Mtoe to 28.2 Mtoe between 1990 and 2005. This increase was driven by a number of factors, such as economic growth, the developing links to former COMECON countries on the eastern and north-eastern borders of Austria, and the changes in Austria's vehicle and road-freight transit rules following EU accession in 1995.

Austria has generally improved its energy efficiency since 1990 (see Figure 10). In 2005 total primary energy supply (TPES) per USD 1 000 of GDP (at prices and exchange rates of 2000) was 0.165 toe, a slight decrease of 0.9% from

Figure 10

Energy Intensity in Austria and in Other Selected IEA Countries, 1973 to 2010

(toe per thousand USD at 2000 prices and purchasing power parities)

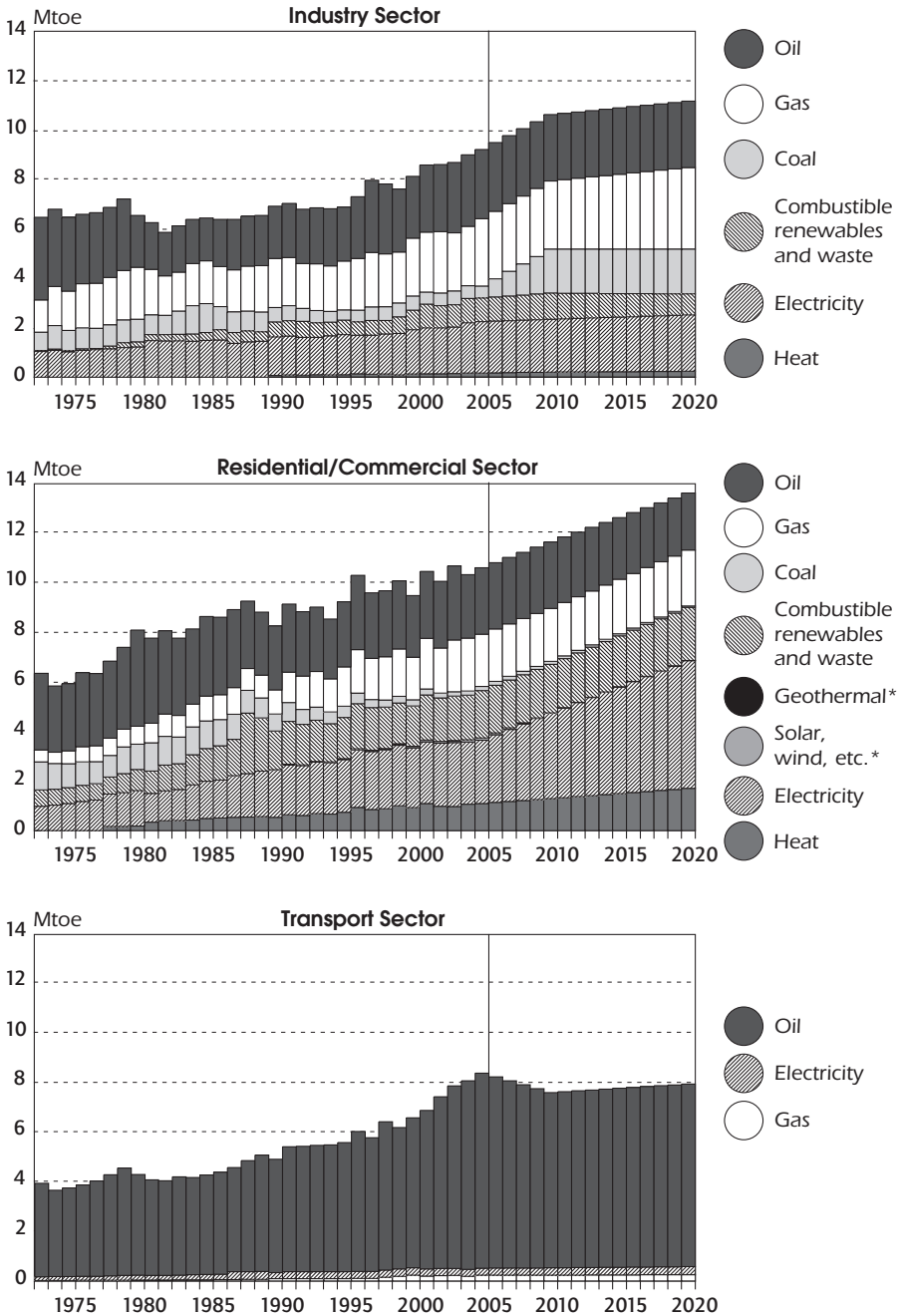


* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007; *National Accounts of OECD Countries*, OECD Paris, 2007 and country submissions.

Figure 11

Total Final Consumption by Sector and by Source, 1973 to 2020



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

the 1990 value of 0.166 toe, but an increase of 10% from the 2000 value of 0.150 toe. This is 14% below the average of European OECD countries which stands at 0.19 toe. During the period from 1973 to 2004, Austria's overall energy intensity decreased by about 26%. The 2005 rate of energy consumption per capita of 4.17 toe is significantly lower than the average rate of the IEA, which stands at 5.14 toe but is 47% above the average of OECD Europe, which stands at 3.50 toe.

Sectoral forecasts predict an increase of energy consumption in stationary uses by 2020, with the most rapid increase expected in the Other Sectors[8], where energy demand is assumed to increase by 28%, primarily driven by electricity demand which is expected to increase by 102%. In the industrial sector, the increase of electricity consumption is predicted to be 9.5% over the same time period. In the transport sector, a small decrease in energy consumption is expected.

ENERGY EFFICIENCY POLICY AND MEASURES

POLICY

Energy efficiency is an integral part of Austria's energy policy. Improvement of energy efficiency is one of the main strategies in pursuing the energy policy objectives, and an *Energy Action Programme* was formulated in 2003 containing a number of elements with direct or indirect relevance to energy efficiency such as:

- General measures with relevance to energy efficiency (*e.g.* harmonisation of energy policy approaches of the various actors – the federal government and the states).
- Measures relating to space and water heating (*e.g.* insulation, transparency of energy demand, calculation of costs according to actual consumption).
- Process heat (*e.g.* improved information on energy flows in companies).
- Mobility.
- Lighting and data processing.
- Biomass use (*e.g.* support of modern combustion technologies, CHP based on biomass).
- Coal use (*e.g.* support of modern combustion technologies).
- Natural gas use (*e.g.* environmentally efficient technologies).
- Electricity (*e.g.* ecologically optimised transmission line system).
- District heat (calculation of costs according to actual heat consumption).

8. The "Other Sectors" comprises all economic activity outside the industry and transport sectors.

Since Austria's accession to the European Union (1995) the country's energy efficiency policy is based primarily on EU policy. The elements of Austria's Energy Action Programme described above are closely connected with the energy efficiency activities of the EU – most recently its Green Paper on Energy Efficiency and the action plan submitted by the European Commission in autumn 2006 and the conclusions of the Council adopted by the Energy Ministers on 23 November 2006.

The Austrian government has a target derived from EU policy to decrease overall intensity by 5% by 2010, and by 20% by 2020, and a detailed list of measures which it expects to achieve by 2010 in support of this target. This target is based on the indicative target mentioned in the Energy End-Use Directive 2006/32/EC. The same applies to the target mentioned in the Council's CHP resolution of 18 December 1997, where the Council sees the indicative target of doubling the share of CHP in the Community as a whole until 2010 as useful guidance for increased efforts at all levels. The Austrian government has committed itself to further support for CHP, without quantifying any targets.

MEASURES

A range of measures is available to the Austrian government in the area of energy efficiency policy, including regulatory measures (such as minimum efficiency standards or energy taxation rules); research, technological development and demonstration, and promotion of market penetration; dissemination of information to energy consumers; and subsidies for the implementation of energy-saving measures.

The relationship between national, state, utility and other energy efficiency programmes is mainly complementary. The various programmes complement each other either geographically (support for energy efficiency measures in households in the context of housing improvement and housing promotion in all states) or regarding the target group. State support is granted to households, while the Kommunalkredit (a special-purpose bank) supports thermal improvement of commercial and office buildings through low-interest loans under the Environmental Support Programme. Regarding programme content, the states can support measures which are not, or in their view insufficiently, covered by federal programmes.

A characteristic of the structure of many programmes that cover energy efficiency is that improving energy efficiency is only one of several objectives pursued. These programmes, therefore, regard energy efficiency improvement as one component within a bundle of policy goals.

While utilities undertake energy efficiency programmes, there is no requirement for them to do so, and there are no targets for their activities. Austria is also not considering an energy-efficiency trading or obligation scheme such as those introduced in other IEA countries.

Box 3

The Austrian Energy Agency

The Austrian Energy Agency is a non-profit energy research and policy institution established in 1977. Its mission is to promote rational use of energy and to stimulate renewable energy sources and innovative technologies. The agency is located in Vienna and is member of the ENR Network of European energy agencies.

It is the institution in which the federal and the provincial administration and some 50 important institutions and corporations from a variety of economic sectors co-operate. The board of directors comprises the federal minister charged with environmental affairs, the federal minister charged with energy affairs and the chairman of the provincial governors.

The agency is the principal partner of the federal government in its effort to attain its energy policy objectives, which aim mainly at achieving a macro-economically efficient production and a rational use of energy, the stimulation of renewable energy sources and innovative technologies. The agency acts, for all of its members, as a clearing house and a co-ordination platform for all associated national and international activities. The overall mandate of the Austrian Energy Agency is to save energy, and to advocate conditions under which market forces can act in favour of renewables and improved energy efficiency.

The agency employs a staff of close to 80 people, including secretarial support. The expertise of the staff members ranges across the technical, economic, statistical and social science disciplines. The internal organisation is based on areas of activity; analyses; consulting and implementation. The list below gives an overview of the type of activities the agency is engaged in:

- Organisation of symposia on energy consulting, energy in public buildings, efficient electric appliances, energy rehabilitation of old buildings, wind energy.
- Studies on biomass, the gas sector, district heating, low energy buildings. The regulation of the electricity sector, energy taxes, Least-Cost-Planning.
- Monitoring of CO_2 abatement policies, and CO_2-saving technological innovation.
- Handbooks on subsidies for energy-saving measures, and energy consulting.
- Co-operation with Central and Eastern European countries in the field of energy efficiency strategies (energy partnerships).
- Management of programmes concerning energy technology and innovation.
- Support for municipalities and regions in developing action-oriented energy plans in a co-operative process.
- Dissemination of information on EU energy programmes.
- Scientific expertise in matters of energy taxation.
- Forum for energy-related co-operation between the Austrian states and regional energy agencies.

Information Provision

More than 40 organisations offer energy efficiency information services for consumers. The most prominent of these is the Austrian Energy Agency (see Box 3). Many organisations are active only at the state or municipal levels. Austrian utilities also run information campaigns to encourage responsible energy use. The most important nation-wide campaign is *Klima:Aktiv* (see Chapter 3), which is the Austrian government's climate change information and grant programme.

Transport

Transport fuel taxation in Austria is low, compared to taxation in neighbouring countries, thus leading to fuel tourism. While a 3% tax rise was introduced in early 2007, this only preserved the differential to Germany, where a 3% VAT increase came into effect on 1st January 2007.

Apart from the taxation of fuels, the taxation of vehicles can be expected to have effects on energy efficiency. In 1992, a tax on the standardised fuel consumption of vehicles (*Normverbrauchsabgabe/*NoVA) was introduced. The NoVA has to be paid when a vehicle is registered the first time in Austria (registration tax). As the tax burden is progressively linked to fuel consumption of the vehicle, NoVA is an incentive to buy more efficient cars regardless of the expected mileage. Another tax instrument for the promotion of energy efficiency is the "engine-related insurance" tax (*motorbezogene Versicherungssteuer*; annual vehicle tax) which favours vehicles with lower horse-power and, therefore, lower fuel consumption, contributing to the improvement of energy efficiency.

Buildings

Requirements concerning the energy performance of buildings are handled through the building codes and complementary regulations of the states, to which the Austrian Constitution allocated responsibility. The basis for a common approach is an agreement between the states and the federal government in which the states undertake to implement strict energy efficiency regulations. Under its programme, the federal government is committed to promote low energy and passive house standards in co-operation with the states. Building-related targets from the programme are:

- 50% of new buildings should meet the *Klima:Aktiv* standard.
- Increase the energetic refurbishment rate to achieve upgrading of all 1950-1980 residential buildings by 2020.
- From 2015, only those residential buildings meeting *Klima:Aktiv* passive house standards should receive government financial support for their construction.

Table 11

Building Efficiency Regulation in Austrian States Using U-values (W/m²K¹)

State	*Burgenland*	*Carinthia*	*Lower Austria*	*Upper Austria*	*Salzburg*	*Styria*	*Tirol*	*Vorarlberg*	*Vienna worst/best*	*Variation*
Valid since	**2002**	**1997**	**1996**	**1999**	**2002**	**1997**	**1998**	**1996**	**2001**	**%**
Outer walls	0.38	0.40	0.40	0.50	0.35	multi: 0.50 single/double: 0.40	0.35	0.35	0.50	+43
Walls to unheated building parts and firewalls	0.50	0.70	0.70	0.70	0.50	0.70	0.50	0.50	0.50	+40
Walls to separate operating units	0.90	1.60	1.60	1.60	0.90	1.60	0.90	1.60	0.90	+78
Outside roofs, lofts, passages, etc.	0.20	0.25	0.22	0.25	0.20	0.20	0.20	0.25	0.25	+25
Roofs to unheated building units	0.35	0.40	0.40	0.45	0.40	0.40	0.40	0.40	0.45	+29
Ceilings to separate residential and other operating units	0.70	0.90	0.90	0.90	0.90	0.90	0.70	0.90	0.90	+29
Windows	1.70	1.80	1.80	1.90	1.70	1.90	1.70	1.80	1.90	+12
External doors	1.70	1.80	1.80	1.90	1.70	1.70/1.90 (glass door)	1.70	1.90	1.90	+12
Walls to ground	0.35	0.50	0.50	0.50	0.40	0.50	0.40	0.50	0.50	+43
Floors to ground	0.35	0.50	0.50	0.50	0.285	0.50	0.40	0.50	0.45	+75

1. K value = Heat loss value.
Source: Austrian Energy Agency.

Table 12

Selected Austrian U-Values and International Best Practice

Fabric element	*Lowest Austrian value*	*Highest Austrian value*	*International best practice*	*Difference best practice in %*	
	W/m²K	*W/m²K*	*W/m²K*	*Lowest Austrian*	*Highest Austrian*
Outer walls	0.35	0.50	0.25	40	100
Roofs	0.20	0.25	0.13	54	92
Ground floor	0.285	0.50	0.20	43	150
Doors	1.7	1.90	1.0	70	90
Glazed doors	1.70	1.90	1.50	13	27

Sources: Austrian Energy Agency and UK Energy Saving Trust.

As Table 11 shows, there are currently significant variations between the stringency of efficiency requirements between the states, and since the last update of the building regulations. Even the lowest Austrian building regulations are not challenging compared to international best practice, as outlined in Table 12, and the differential between the highest accepted values in Austrian regulations and international best practice is significant.

To support building renovation, all nine states run housing improvement programmes offering grants and low-interest loans for the residential sector. These include fabric-related energy efficiency measures such as insulation, or connection to district heating. At the federal level, a number of measures for energy efficiency in the residental sector are promoted via the *Klima:Aktiv* programme of the Austrian federal government. A contracting initiative for buildings owned or used by the Federal Republic is extending support to sectors which are not covered by other programmes such as university buildings, school swimming pools, penal institutions, museums and other historic buildings, and some military buildings. A similar initiative covers energetic improvement of commercial sector buildings.

The implementation of the EU Directive on the Energy Performance of Buildings required regulations at both the federal government and the state levels. The federal *Energy Performance Certificate Presentation Law* was published in August 2006. It mandates that the energy performance certificate is presented upon a change in the ownership or tenancy of a dwelling. The certificate is based on the state-level regulations, and the law will, therefore, be in force as soon as all states have implemented their respective regulations, but not later than 1 January 2008. The states are aiming to harmonise as far as possible their regulations in all areas related to this EU directive.

Appliances

Energy efficiency of household appliances is now driven by the Energy Services and Energy End-Use Directive of the EU (2006/32/EC). While the energy performance of washing machines and tumble dryers is covered in a separate directive at European level, in Austria it will fall within the same law. A variety of new regulations is in the process of development in Austria, most of which will be implemented at the federal level via the *Electro-Technical Law*. Regulations in some other areas are to be implemented by the states. The federal government is supported by the Austrian Energy Agency, which is responsible for information dissemination.

Industry

Klima:Aktiv is offering general and targeted advice, aid in the financing and implementation, and detailed systems analysis in the industrial and SME sectors.

A *Klima:Aktiv* programme for voluntary agreements exists in the industrial and SME sectors, under which the goal is to achieve annual savings in electricity and process heat use of 50 GWh of annual energy savings, equivalent to 20 000 tonnes CO_2-eq per annum. This is to be achieved through co-operation between the states in training energy advisors, including the development of new advice tools and information campaigns. The programme focuses on introducing energy management systems, particularly in the food industry, and on increasing the efficiency of motors for pumps, ventilators and compressors in industrial companies.

Combined Heat and Power (CHP)

The CHP support system was changed in October 2006 by an amendment to the Green Electricity Act. The most important change was that minimum efficiency standards have to be met to qualify for subsidies for existing or new CHP plants. These standards are stricter than the requirements of the EU's CHP Directive (2004/8/EC). A new subsidy scheme with investment aids was introduced for new CHP plants where industrial, as well as utility, CHP plants are supported if they are fulfilling a set of requirements. CHP plants using biomass to produce heat and electricity qualify for "green" electricity support payments under the feed-in tariff system (see Chapter 5).

CRITIQUE

The improvement in energy intensity in Austria since 1973 has been largely along the lines of the expected business-as-usual improvements. This indicates that a considerable potential for efficiency increases remains in all sectors of the economy: buildings, appliances and transport. In the context of reaching

the government's climate change and renewables targets, realising the potential in energy efficiency by going beyond those improvements already targeted by the government is of critical importance. Unlike in the area of renewables, the government programme in the energy efficiency area is not particularly ambitious, and no study for the potential contribution of energy efficiency improvements to the climate change targets in Austria has been undertaken.

The Austrian government has set a general target for efficiency improvements derived from the overall EU indicative targets, which contrasts with the detailed approach taken to target-setting in renewables. There is a risk that in the absence of a detailed understanding about the potential for remaining efficiency improvements in Austria, energy efficiency will be assigned a lower priority than renewables, despite its higher cost-effectiveness in achieving the same goals. It is also not clear how the target relates to, for example, the predictions that foresee a doubling of electricity use in the Other Sectors.

While the government programme outlines some general goals to be reached in support of the target, it is doubtful whether market-based measures, such as, for example, a white certificate scheme, will be considered. The Austrian government should, therefore, first conduct an analysis of the potential for energy efficiency improvements and, from this, develop concrete policies and measures addressing the most important areas for action. Once this has been achieved, the government could consider moving faster on some of the measures outlined in its programme. In particular, the long period until funding for new residential buildings will be tied completely to the achievement of best-practice building standards is an area where faster action could be considered, given the immediate and long-term impact such a move could have.

In the area of energy efficiency in buildings, there are wide variations in regulations across Austria, owing to responsibility for regulations being vested in the states. This is limiting competition in providing architectural and other services across the country or from elsewhere in the EU. Also, even the best Austrian building regulations fall short of the international best practice, indicating that there is significant potential for the improvement of building energy efficiency in Austria. In some states, building regulations have not been updated for over 11 years. The Austrian government should consider taking the initiative and have a stronger role in co-ordinating the development of building regulations, including setting minimum performance standards. Consideration should also be given to moving building codes from fabric item-specific U-values to an overall maximum-design CO_2 emission value, leaving builders freedom on how to achieve the target. Further consideration should be given to a mechanism whereby R&D results from sustainable building research can be translated into building industry practice, either through co-operation with the industry or by forcing it through regulation.

While the consumption of electricity in Austria has risen less fast than economic growth, it is predicted to still grow considerably further in absolute terms in the near future. At the moment, there is no co-ordinated effort to address this predicted rise of consumption, and there are no mandatory targets for electricity companies to contribute to the reduction of use, *e.g.* by supporting energy-saving programmes for households through demand-side management and energy-saving obligations/mandatory saving schemes based on, for example, tradable certificates. Austria could study the experience in other countries which have implemented such schemes, and consider implementing a market-based scheme under which energy suppliers and energy service companies can benefit from increasing the energy efficiency of their clients.

Despite the relatively weak regulations, Austria has done very well in developing energy-efficient technologies in the building sector, and thanks to subsidies, has achieved a relatively high proportion of new buildings constructed with such techniques. To achieve the required energy efficiency improvements in the building sector, the refurbishment of existing housing is a key challenge. Translation of energy R&D results into building practice through regulation as well as capacity increases in the building industry will be needed to achieve this goal. The government will have to co-operate closely with the building industry to ensure that the required capacity becomes available.

Austria is doing comparatively well in ensuring a continued role of efficient and clean modes of transport, such as rail. Nevertheless, low taxes on transport fuels are encouraging demand for road transport. The government is pursuing a policy of indirect consumption-related taxation on vehicle purchase (*Normverbrauchsabgabe* - NoVA).

RECOMMENDATIONS

The government of Austria should:

- *Undertake a study to estimate the cost-effective energy efficiency potential in the Austrian economy.*
- *Take the initiative to co-ordinate state work on building regulations and lead the states to introduce more uniform and stringent building efficiency standards based on international best practice.*
- *Develop a mandatory energy efficiency savings framework for the energy industry, to be implemented in case voluntary efforts are insufficient.*
- *Establish a vehicle taxation system that creates permanent incentives for reduced CO_2 emissions from new vehicles.*

RENEWABLE ENERGY EXCEPT LARGE HYDROPOWER

SUPPLY AND DEMAND

Renewable energy supply measures feature prominently in Austria´s energy policy and are, together with energy efficiency, a main pillar of energy policy. Austria's long-term policy has resulted in a well-balanced mix of energy sources in which renewables account for 21.3% of total primary energy supply (TPES). Renewables contributed 7.3 Mtoe to Austria's energy supply in 2005, an increase of 41% since 1990, when renewable energy supply production stood at 5.2 Mtoe. The share of renewables in TPES has increased by 3% over the same period, from 20.7% in 1990 to 21.3% in 2005. After Norway, Sweden and Finland, Austria's share of renewables in TPES is the fourth-highest among IEA members.

The primary contribution in renewables production is made by biomass combustion for heat and electricity production, either in combined heat-and-power (CHP) or stand-alone applications. The share of CHP in total electricity generation from biomass increased from 54% in 1990 to 67% in 2005, indicating a more efficient use of the resource. Biomass for heat production is at the verge of becoming cost-effective in the market for heat, by benefiting from the high levels of support for electricity production from biomass. Hydropower for electricity generation has been used in Austria for many decades and is able to compete successfully with traditional sources of energy. Hydropower is used for the production of electricity, where it had a share of 57% in 2005, a decline of 11% from the 64% it contributed in 1990. Table 13 shows the development of different forms of renewables between 1990 and 2005.

Biomass is primarily used in industry and Other Sectors[9], where a total of 2.9 Mtoe, or 72.5% of total biomass supply, was consumed in 2005. Use in industry accelerated far more than use in the Other Sectors since 1990, reflecting the effectiveness of support policies by the Austrian government and states. The remainder of Austrian biomass supply, contributes primarily to electricity generation, where biomass had a share of 4.1% in 2005.

Austrian government predictions available at the time of writing were not yet reflecting the policy targets adopted by the new government in January 2007 and are therefore not analysed in this section.

9. Commercial, residential, government, agriculture.

Table 13

Renewables Share in TPES, 1990 and 2005

	Production in Mtoe		*Change in production*	*Share of renewables supply in %*		*Change in share in %*
	1990	*2005*	*1990/2005*	*1990*	*2005*	*1990/2005*
Biomass and waste	2.47	3.84	55%	9.8	11.6	18
Hydro	2.71	3.09	14%	10.8	9.0	–17
Solar/wind/other	0.02	0.21	950%	0.1	0.7	600
Total	**5.20**	**7.14**	**37%**	**20.7**	**21.3**	**3**

Sources: IEA and government submission.

Table 14

Renewables in Austria's Electricity Supply, 1990 to 2010

(in %)

	1990	*2005*	*2010*	*1990/2005*	*2005/2010*
Hydro	63.9	57.0	49.8	–11	–13
Others	0	2.1	6.4	n/a	206
Total	**63.9**	**59.1**	**56.2**	**–8**	**–5**

Sources: IEA and government submission.

Table 15

Biomass Use in Austria, 1990 and 2005

	Consumption in Mtoe		*Change in consumption (%)*	*Share of consumption (%)*		*Change in share in (%)*
	1990	*2005*	*1990/2005*	*1990*	*2005*	*1990/2005*
Industry	0.6	1.0	58	9	10	18
Other	1.6	1.9	22	19	18	–5
Total	**2.2**	**2.9**	**32**	**11**	**10**	**–5**
Share of electricity production	n/a	n/a	n/a	2.4	4.1	71

Sources: IEA and government submission.

GOVERNMENT POLICIES

Since Austria's accession to the European Union in 1995, renewable energy policy is driven to some extent by EU policies, leading Austria to continue and improve the action plan for the support of renewables. In line with the Communication of the European Commission on a Biomass Action Plan (Doc.15741/05) and the Commission Communication on an EU Strategy for Biofuels (Doc. 6153/06), Austria´s energy policy is putting a strong focus on increasing the use of biomass as an energy source. The Austrian government sees increased use of renewables in general and biomass in particular as contributing to the three main objectives of energy policy by:

- Enhancing security of supply through the diversification of energy supply sources and the reduction of dependence on external energy sources.
- Enhancing competitiveness through the development of new and efficient technologies and providing economic growth and employment opportunities in rural areas.
- Promoting environmental sustainability through *inter alia* the reduction of GHG emissions and an increase of the share of renewable energy sources, while respecting other environmental policy objectives.

Austria had adopted or reaffirmed targets for renewables in 2006, which were set as follows:

- To raise the share of renewables in primary energy demand, and in particular to raise biomass utilisation, but without setting a numerical share.
- To raise the share of renewables in electricity production from 70% (1997) to 78.1% (2010) (EU Directive 2001/77/EC).
- To reach a share of renewables in the transport sector of 5.75 % by 2008 (EU Biofuels Directive – national implementation).

The Austrian government has ambitious plans to more than double the contribution of renewables to TPES by 2020, and to increase the share of renewables in electricity generation. Since large-scale hydro is already exploited, this would mean a tripling of the contribution of other renewable sources to Austrian energy supply, while keeping overall demand stable. The new specific targets are set in the government programme 2007-2010 as follows:

- Increase of renewables in TPES to 25% by 2010, and 45% by 2020.
- Increase of the share of electricity production from renewables to 80% by 2010, and 85% by 2020, compared to electricity production of 1997.

- Switch of at least 400 000 households to renewable energy carriers by 2020, of which at least 100 000 by 2010.
- Increase of alternative fuels in the transport sector to 10% by 2010, 20% by 2020.
- Development of a master plan for the optimal use of hydropower.
- Doubling of the use of biomass by 2010.
- Development of a methane-based transport fuel with a share of at least 20% methane by 2010.
- Full coverage of Austria with a network of E85 and methane filling stations by 2010.
- Improvement of the legal framework for feeding biogas into the gas distribution network.

SUPPORT MEASURES

OVERALL MEASURES

In the view of the Austrian government, in order to fully develop renewable energy technologies that are not yet able to compete economically with fossil fuel-based alternatives, promotion by the public will serve the primary aim of mitigating climate effects. The policy is to use a broad portfolio of renewable and efficiency technologies, taking their respective costs into account, and this is reflected in the design of the support programme. Large hydropower for electricity generation has long been able to compete with fossil fuel sources, but the government has recently moved the focus on to small hydro installations. Regarding heat production from biomass, the situation is similar, with larger installations being competitive, while smaller ones are being supported. Wind power, another relatively cost-effective renewable energy source in some regions of Austria, is now reaching the limit of its technical potential in Austria. Since all these resources are limited, more costly technologies are now also taken into consideration by the government. Austria is developing its policies in accordance with European policies by increasing the share of renewables from all sources, including biofuels, photovoltaics and geothermal. A range of support programmes are, therefore, available and listed here, with the most important ones described in more detail below:

- Consumer subsidies for renewables in Austria through for example the Green Electricity Act.
- Domestic Environmental Support.
- Austrian Programme for Rural Development.
- Biofuels regulations.

- Green Electricity Act.
- Ecotaxes.
- Individual subsidy programmes of the states and municipalities.
- Programmes within the Climate Change Strategy.
- *Klima:Aktiv.*

Box 4

The Green Electricity Act Revision of 2006

The original aims of the Green Electricity Act comprised, among others, an increase in the share of green power in total energy generation; the efficient allocation of subsidies; and support for the development of green power generation until market competitiveness has been reached. To achieve these goals, the act stipulates that for electricity from small hydro (<10 MW) and other renewable energy sources a guaranteed feed-in tariff will be available for a period of 13 years from commissioning, with final customers and traders paying the cost. The act set a target of 9% for the share from total electricity production in 2008, with production from small hydro accounting for 5%, and from other sources for 4%. The 2008 target was reached in 2006. For 2010 the act set a target of 10%.

The 2006 revision of the act also supports CHP and fundamentally changes the support system for electricity from other renewable energy sources, which can now receive a guaranteed feed-in tariff for a period of only 12 years, the amount being paid is reduced year by year for new projects. Also, for ten years the feed-in tariff is paid at 100%, in the 11th year at 75%, and in the 12th year at 50%. The tariff is also divided into 14 technology bands, one of which supports biomass CHP, and these are further divided into a total of 29 capacity and fuel type bands.

As in the 2002 act, final customers and traders pay for the support. The act established a special office to handle the financial flows from consumers to producers, and a producer must have a contract with this office in order to benefit from the feed-in tariff. The office is only authorised to contract for a prescribed amount of new capacity per year, and publishes the remaining sum on its website.

A special fund has been set up to give direct support to renewable electricity investments, running from 2007 to 2011 with a total volume of EUR 17 million per year. This is split by technology, with 30% each reserved for wind, biomass and biogas, and 10% for photovoltaics (PV).

For electricity from medium-sized hydropower plants and CHP, a one-off investment grant of 10% of capital cost is available. To ensure that supported plants make efficient use of the biomass feedstock, a 60% fuel efficiency factor for biomass and biogas for all new plants licensed is required.

While increasing the deployment of renewables, the new policies have also added to the cost of supporting them. According to the reports by E-Control, under the pre-2006 support system, EUR 202 million were paid in 2003, of which EUR 53 million went to renewables other than small hydro, while in 2006[10], EUR 435 million were paid to renewables producers, of which EUR 342 million went to renewables other than small hydro. This means an increase of 115% in total support cost and 545% in support cost for non-hydro renewables.

Table 16

Feed-In Tariffs by Technology 2007 and Prior to Green Energy Act Revision 2006 (in EUR/MWh)

Technology	*2007 feed-in tariff*	*Pre-2006 feed-in tariff*
Wind	75.5	78
Solar	300-460	470-600
Geothermal	73	70
Biogas, including fermentation from waste	79.1-169.5	77.25-165
Landfill gas	40.5	60
Sewage gas	59.5	30
Solid biomass	111-156.5	102-160
Co-firing biomass	31.5-64	30-65
Waste with high biomass content	49-117.4	27-128
Liquid biomass	60-125	100-130

Source: E-Control.

During the first quarter of 2007, both the total volume of support and the support paid per kWh have increased significantly, compared to the same period in 2006. The annualised cost per inhabitant for the support of green electricity in Austria for 2007, assuming that there will be no change in quarterly production volume and payments, will reach EUR 59 per capita, for an estimated 7%-7.5% of total electricity generation. To reach the 80% target in 2010, this contribution will have to be doubled. In terms of funding requirements, 2007 marks an increase of 12.5% from the EUR 52.35 per capita in 2006. Table 17 gives further detail.

10. The new system became operational in the fourth quarter of 2006.

Table 17

Green Electricity Feed-In Payments, First Quarter 2006 compared to First Quarter 2007

Energy source		*First quarter 2006*		*First quarter 2007*			*Change*	
		Volume	*Payment*	*Volume*	*Payment*	*Average price*	*Volume*	*Payment*
		GWh	MEUR	GWh	MEUR	EURc/kWh	%	%
Small hydro		350	19.3	221	12.7	5.78	-37%	-34%
Other	*Total*	*728*	*73.4*	*1 180*	*122.4*	*10.37*	*62%*	*67%*
	Wind	445	34.9	649	50.5	7.79	46%	45%
	Solid biomass	175	22.6	393	51.8	13.18	125%	129%
	Biogases	78	10.8	103	14.2	13.84	32%	31%
	Liquid biomass	13	1.8	19	2.7	13.79	46%	50%
	PV	4	2.3	3	2.2 6	3.59	–5%	-4%
	Sewage/ landfill gas	13	1.0	12	0.85	7.45	-8%	-15%
	Geothermal	1	0.1	1	0.05	10.54	0%	-50%
Total		**1 079**	**92.8**	**1 401**	**135**	**9.65**	**30%**	**45%**

Source: E-Control.

The Federal Environment Fund supports projects with a total budget of more than EUR 69 million in 2005, of which more than EUR 35 million were spent for heating and cooling from renewable energy sources (RES). The fund focuses on biomass and biogas district heating, entrepreneurial biogas developments, for example in agriculture, biomass central heating systems, solar panels and energy efficiency measures, small hydro and wind power stations and thermal renovation of commercial buildings.

The Impulse Programme *Klima:Aktiv* aims to support a bundle of environmental protection measures reducing CO_2 emissions. The goal is to achieve the rapid and broad introduction into the market of climate-friendly technologies in the areas of construction, transport, business, energy efficiency and renewables. The area of renewables within the programme comprises solar heating, heat pumps, biogas, firewood procurement, biomass heating of residential

buildings and a quality campaign for local biomass district heating plants, with the programmes lasting 3-5 years.

An example of a non-RES-focused incentive programme which also features renewables support includes the federal housing support sub-programmes which have a total volume of more than EUR 2 billion per annum, not all of which is spent to support renewables. The housing sub-programme spends up to 75% on the construction of new residences, and 25% for the renovation of existing buildings. It is designed to ensure that supported measures such as thermal insulation, use of ecological building materials and low or GHG-neutral energy, water, light and air supply, receive support based on their CO_2 abatement effect.

Additional support is available from the states for the promotion of new technologies for renewable electricity supply. There is also additional financial assistance from states for heat usage of up to 30% of investment costs for the heat part of the application.

Support for innovative technologies is given at different levels, which has significantly contributed to the successful development of renewable energy technology in Austria. At the stage before market implementation, the interests of the national manufacturers of such technologies are the main target of innovation policy. The aim at this stage is to help them increase the maturity of the products, in co-operation with the European Technology Programmes and by using the information available from the European Technology platforms. This will reduce the risk of technology entering the market untried, which could lead to a backlash by consumers.

Under section 25(1) of the Green Electricity Act, E-Control GmbH is to present a report to the Federal Minister of Economics and Labour and the Electricity Advisory Board by the end of June every year. The report has to analyse to what extent the aims of the act have been attained.

WIND POWER

Austria had 965 MW of wind capacity installed at the end of 2006, primarily in the states of Lower Austria and Burgenland, both located in the eastern part of the country. Wind projects are often carried out by co-operatives, which account for 40% of all projects, with the remainder evenly split between commercial investors and utilities. Wind projects established up to 2006 receive a feed-in tariff of EUR 78 per MWh generated, while under the new system (see Table 16), the support for 2007 was EUR 75.5 per MWh produced. Direct investment capital support is also available up to a ceiling of EUR 5.1 million per year for all new projects together from 2007 to 2010.

SOLAR THERMAL HEATING

The market deployment of solar collectors has been successful in Austria. The market ranks second in Europe and third in the world in terms of collector area installed per capita. Solar thermal water heating, in both new and renovated buildings, is a standard measure in Austria today. During the last five years a remarkable increase was achieved in combined solar heating systems. By the end of 2005, 3 million m^2 of solar collectors was installed, equalling an installed thermal power of roughly 2.1 GWth. In 2005, the production of 1.03 TWh of useful heat saved 164 ktoe CO_2. In the same year, 234 000 m^2 of solar collectors was newly installed, and 682 000 m^2 was produced, of which 435 000 m^2 was exported. Austrian manufacturers are among the technological pioneers on today's world markets, boosted by domestic support, R&D programmes, and a challenging home market in technological terms. The largest European manufacturer of glazed collectors is situated in Austria. Around 25% of the market for newly installed solar thermal systems in 2005 was in systems connected to biomass/pellets or ground-coupled heat pump systems.

BIOMASS HEATING

Austria has benefited significantly from its large biomass resource in developing its renewable energy industry. Some drivers for usage of organic matter for heat purposes in Austria are:

- the very good biomass availability (47% of the national area is forest);
- a very long tradition in bioenergy usage and consumer interest because of the positive image of biomass (further increased by active information and promotion activities);
- the wide portfolio of proven technologies that are available;
- political commitment creating attractive framework conditions, such as stable and predictable financial incentives;
- fuel price stability;
- commercially driven and publicly funded R&D that has led to a high quality of appliances, fuels and services; and
- a co-operative, regional approach to solve problems.

Incentives are of high importance in order to change heating-related energy demand towards renewables. A good example of this is biomass district heating of villages and towns, with central heating plants ranging from 500 kWth to

30 MWth installed. In the period 1980 to 2003, 843 plants above 100 kW heat production were constructed with a total heat capacity of 1 005 MW. The development of these plants is based on local initiatives and supported by investment subsidies of 40 to 50% for rural projects with an agricultural background, and a maximum of 30% for commercial developments.

STATIONARY USE

The Austrian Gas Act provides for the feeding in of biogas into the gas network. According to section 25(10) of this act, distribution system operators have to grant network access to producers of biogas if their gas meets the fixed quality criteria. In 2005 the first Austrian biogas installation, feeding purified biogas into the network, started operation. It is a technology-proving installation located in Pucking/Upper Austria that produces 6 m^3 of purified biogas per hour from 10 m^3 of biogas. Apart from this project, all other biogas produced in Austria (about 200 million m^3) is used for direct electricity production.

TRANSPORT

The EU Biofuels Directive provides indicative targets for the use of biofuels in the transport sector. By 2005, 2% of the energy content of fuels consumed nationally should be accounted for by biofuels. By 2010, this should rise to 5.75%. On 4 November 2004, the directive was transposed into Austrian law through an amendment to the Fuel Ordinance. This amendment stipulates that all companies that put fuels in circulation must, from 1 October 2005, replace 2.5% of the total energy quantity put in circulation with biofuels. From 2007, this percentage will increase to 4.3%, and in 2008, the target of 5.75% will have to be achieved, two years in advance with respect to the EU deadline. At present, the share of biofuels amounts to 3.3 % of Austria's automotive fuel consumption. Together with the amendment to the Fuel Ordinance, the Mineral Oil Act has been revised to provide for tax concessions for fuels with a biofuel share of at least 4.4%.To be able to profit from the tax concessions, the fuel must also be sulphur-free (less than 10 mg sulphur per kg of fuel). The use of pure biofuels is completely exempt from tax. Table 18 provides information on the capacity of Austrian biofuels production from 2004 to 2008, including all projects known up to the end of 2006.

CRITIQUE

Austria is among the leading nations in Europe in terms of renewable energy supply. Austria's energy policy is to increase the use of renewable energy sources, and in particular biomass for heating, electricity generation, and transport fuel purposes through direct and consumer financial support, as well as tax exemptions, in support of its Climate Change Strategy. There

Table 18

Biofuels Refining Capacity in Austria, 2004 to 2008[1]

(in tonnes)

	2004	*2005*	*2006*	*2007*	*2008*
Biodiesel Enns GmbH	0	0	0	80 000	100 000
Biodiesel Kärnten GmbH	25 000	25 000	50 000	50 000	50 000
Biodiesel Raffinerie GmbH (Zistersdorf)	20 000	20 000	25 000	25 000	25 000
Biodiesel Technologies GmbH (Güssing)	500	2 400	15 000	15 000	15 000
Biodiesel Vienna GmbH (Lobau)	0	0	40 000	95 000	400 000
Bioenergy GesmbH (Wöllersdorf) energy biodiesel	7 000	7 000	20 000	40 000	40 000
Carbon Cycle Management AG	0	0	0	0	0
F.Leitner Mineralöle GmbH (Graz)	0	0	10 000	10 000	10 000
Novaol Austria GmbH/Ölmühle Bruck GmbH	25 000	25 000	25 000	25 000	25 000
PPM (Asperhofen) Energie aus nachwachsenden Rohstoffen GmbH	2 000	2 000	2 000	2 000	2 000
RME (Starrein)	1 000	1 000	1 000	1 000	1 000
SEEG Mureck	6 000	9 000	9 000	20 000	20 000
Total	**86 500**	**91 400**	**197 000**	**363 000**	**688 000**
Annual Increase	n/a	6%	116%	84%	90%
Total Increase	n/a	6%	128%	320%	695%

[1.] Includes planned new plants and capacity extensions.

Source: Government submission.

has also been a rapid increase of windpower during the last five years, with an installed capacity of 965 MW at the end of 2006, and an increase of 146 MW from 2005, the fifth-highest per capita in the EU. In addition, there is an ongoing programme for the use of solar energy for heating purposes in passive houses as well as some use of solar photovoltaics.

The new government, which came into office in 2007, has set very ambitious targets to increase the share of renewable energy in TPES, from currently 21.3% to 45% by 2020. Since large hydro (which contributes approximately 10% to TPES) is almost fully developed, this will require a tripling in the contribution from other renewable sources. This goal appears extremely challenging, if not unrealistic, and will substantially increase support costs to be paid by the energy consumer and taxpayer. It is also questionable

whether the breakdown into nine very detailed sub-targets before undertaking a proper impact assessment is better than going for a more general high-level target and leaving it to market actors to decide how to achieve it, or introducing more specific targets once an impact assessment has been made. Considering the time frames, and the set of equally ambitious intermediate targets for 2010, it will also be crucial to implement a speedy and efficient licensing process that is well co-ordinated between the relevant authorities. Early results from the revision of the renewable electricity support system indicate that the support cost is growing much faster than the volume of renewable electricity produced. The current support cost is already high by international comparison, for a relatively low share of electricity production. Renewable heat is cross-subsidised by electricity support, and despite this, is not competitive with fossil sources of heat. It is, therefore, doubtful if the intended targets can be achieved at an acceptable cost to Austrian electricity consumers and society.

The aim for renewables in the electricity sector is to achieve an 80% contribution from renewables by 2010, but this is based on the electricity consumption level of 1997, instead of the estimated level in 2010, considerably reducing the distance to target, while at the same time confusing industry and the public. It would be far more transparent to aim for a target that is set in relation to actual consumption at the time when it is supposed to be achieved, in 2010, instead of relating it back to a base year 13 years in the past, not considering consumption increases since then. If 2010 were the base year, a considerable reduction of fossil fuel use through increased energy efficiency would be crucial to achieve this target, since an already planned increase in electricity production from gas would make it more challenging to reach. On the other hand, if 1997 is the base year, relatively little action outside the electricity production sector will be required. It is, however, unclear how this target will then effectively support the achievement of the overall TPES target. The Austrian government should consider expressing the target in a way that relates directly to projected electricity generation in the year that it is to be achieved.

In terms of specific technologies, the upgrading of existing hydropower plants could generate substantial amounts of renewable energy at comparatively low cost, and should, therefore, be further investigated by the government as a potentially cost-effective measure which could be realised with less support than for other technologies. Small hydro plants are already producing around 4 TWh/year, equivalent to approximately 6%-7% of total electricity production. New prospects and technologies could increase the potential for additional small hydro, and the government should ensure that cost-effective support is available for further development of these technologies through R&D, including bridging the gap to market. Negative impacts from the utilisation of bioenergy caused by deforestation, loss of CO_2 sinks, road transport of wood and the health impact of emissions from burning biomass

are serious challenges which the Austrian government has commendably considered carefully in the past, and which it will have to continue to take into account. The Austrian government should therefore take strong account of this in the ongoing work of its National Biomass Action Plan and the relative impact assessment study. The remaining potential for wind power also appears to be limited. This raises serious questions about Austria's ability to reach the challenging targets in a manner that does not cause public support requirements to increase significantly.

To sustainably support the ambitious growth targets for renewables in the electricity sector, the Green Electricity Act was reformed in 2006. Under the new act, the time frame during which a new project can be supported has been reduced, and the support paid for new projects is degressive over time. The act also stipulated publication of support payments by technology, aiding transparency. These are commendable changes. Nevertheless, there are negative elements in the reform. These include the scale of the feed-in tariff per MWh generated for some technologies, as well as the use of very detailed banding, both by technology and by capacity. Tariffs are now based on making technologies competitive, in particular small-scale biomass CHP, which may not be the most appropriate choice for supporting all these technologies at this point. Within the context of the overall climate change goals, a stronger focus should instead be given to providing for efficient production of the required volumes of renewable electricity, using investment in energy efficiency to reduce heat requirements at the same time. Capital grants for investment are also available, increasing the risk of oversubsidisation. Support costs have already increased by 115% between 2003 and 2006 for all supported renewables, and 545% for non-hydro-supported renewables. Considering the ambitious targets and the limits to both small hydro and wind power in Austria, it is almost certain that the cost to the consumer will increase further. While it is clear that the country will have to commit substantial financial support to renewables if the targets are to be reached, it will be necessary to commit this support efficiently in a stable long-term framework, and to ensure that support is focused on achieving the overall climate change and energy security aims at the lowest possible overall cost to the consumer, taking all aspects and alternatives into account. It is questionable whether the 2006 revision of the Green Electricity Act achieves this goal, since it fails to allocate the available support to the most cost-effective projects, without undue bias towards the type of technology. Another problem that may arise is the compatibility of the caps introduced in the revision, which are not consistent with the overall ambitious targets to which the Austrian government has committed itself recently. These caps, together with the "stop-and-go" situation of 2005, are a source of instability and raise the perceived risk for potential investors, adding to the cost for consumers. It would be better to reduce payments on a per-kWh-generated basis, but spread them over the year, instead of having the current situation where high payments are made to those applying early in the year.

In addition to the support given at the national level through a range of programmes, renewables projects are also supported through local and regional mechanisms. While local support is critical to the success of many renewable energy projects, this also has the potential to create oversubsidisation, and has created a cluttered support landscape, possibly confusing developers and consumers. The Austrian government should consider co-ordinating federal- and state-level support programmes to ensure that project developers and consumers are able to easily gain access to support information and grants, and that these grants are outcome-focused and do not oversubsidise projects.

The use of tax reductions combined with mandatory blending has been a significant driver in the development of biofuels, particularly biodiesel production capacity. While this has been successful in moving Austria towards the indicative target set out by the EU, it is questionable whether this level of support is really required, and is not in fact detrimental in developing the capacity for second-generation biofuels. The Austrian government should consider reforming the support framework for biofuels, taking into account the potential oversubsidisation, and the need to push second-generation biofuels development.

In the longer term, Austria's strong focus on RD&D in renewables and the commercialisation of the developed technologies is an important driver towards reaching the targets.

RECOMMENDATIONS

The government of Austria should:

- *Express the 2010 target for the share of renewables in electricity production using 2010 as a basis, instead of 1997, to avoid confusion and uncertainty.*
- *Carefully monitor the cost of its strong commitment to increase the share of renewable energy in TPES, be prepared to consider alternatives to achieve the overall climate change target, and use economic incentives in the most cost-effective way, regardless of the type of renewable energy source.*
- *Carefully monitor technology costs and learning, and increase the degression of incentives over time accordingly.*
- *Balance the predictability and long-term stability of the support system with the need to control the support cost at an acceptable level, while avoiding "stop-and-go" situations in funding.*

EXPLORATION AND PRODUCTION

Austria produces both oil and gas domestically, with production accounting for approximately 7% of domestic consumption in 2005 in the case of oil, and 17% of natural gas consumption in the same year. Two companies, OMV AG and Rohöl-Aufsuchungs AG (RAG) are active in exploration and production in Austria. OMV AG is owned by state-owned Österreichische Industrieholding AG (31.5 %), International Petroleum Investment Company, Abu Dhabi (17.6 %) and a number of smaller national and international investors (50.9 %). RAG is owned by Shell Austria AG (25 %) and RAG Beteiligungs AG (75%). RAG-Beteiligungs AG is owned by one German and four Austrian companies of the energy sector.

Oil and gas are produced from 767 wells in Austria. This number has declined from 867 in 2001. A total of 29 exploration and production-related drilling operations were carried out in 2005. Of these, 14 were for exploration, four for follow-on, and 11 for production wells. RAG conducted 19 of these drilling operations, reflecting the much stronger geographical focus of RAG in Austria, compared to OMV, which has drilling operations around the globe. Oil production in Austria is declining at an increasing rate, and the country is seen as a mature province for oil. The decline rate in oil production has increased from 1.3% in 2001/02 to 4.1% in 2004/05, and is faster for RAG than it is for OMV. In gas production, the decline in 2004/05 was 8.9% for OMV and 40% for RAG. Table 19 shows the total production and relative shares of the two companies. OMV is reporting a very high recovery rate for its domestic oil wells of 66% of total resources.

Proven reserves of oil including natural gas liquids (NGL) are estimated at approximately 11 Mtoe by the Federal Geological Institute. At current production rates, this equals around 11-12 years of production, and the number of production years remaining has been relatively constant since 1997. The proven reserves of natural gas are estimated to be about 32 billion cubic metres (bcm), an increase of 9 bcm over 2004 thanks to two important discoveries by OMV, while production in 2005 was 1.6 bcm. OMV has plans to expand production to about 2 bcm per year in the near future, taking advantage of recent discoveries. Proven gas reserves are equivalent to approximately 16 years of production.

Table 19

Production Shares in the Austrian Petroleum Province, 2005

Company	*Oil production including NGL (tonnes)*	*Share of oil/NGL production (%)*	*Gas production (mcm)*	*Share of gas production (%)*
OMV	857 765	91.20	1 195	73
RAG	75 646	8.80	442	27
Total	**933 411**	**100**	**1 637**	**100**

Source: Government submission, *Fachverband der Mineralölindustrie.*

Box 5

OMV AG

OMV is the Austrian oil company, 31.5% owned by the Austrian government, and the largest integrated oil company in central Europe. OMV is the majority owner of Romanian Petrom, and has an annual production of 1.4 billion barrels of oil equivalent (boe), and a total refining capacity of 26.4 million tonnes (Mt) of oil. Its retail market share in the Danube area of south-east and central Europe stands at 20% of the market. In 2006, OMV, including all its subsidiaries, had close to 41 000 employees, sales of EUR 19 billion, earnings before interest and tax (EBIT) of EUR 2 billion, and a return on capital of 15.1% on a market capitalisation of EUR 15 billion.

OMV is active at all levels of the oil market in Austria, including production of oil and natural gas both in Austria and globally, refining, distribution including pipelines, wholesale and retail. OMV produces over 90% of oil and 70% of natural gas, and has large concession areas. OMV also owns the only Austrian refinery in Schwechat outside Vienna and has a large share in refining capacity in Bavaria, which is relevant for the Austrian market. OMV operates over 400 filling stations in Austria and owns 69.5% of the Vienna-Adria pipeline, as well as 25% of the Trans-Austria pipeline. It owns the product pipeline in west Austria, and was involved in the consortium to build a pipeline from Bratislava to Schwechat to connect Austria to the Druzhba pipeline, a project which is not being pursued at the moment.

In 2006, OMV was involved in an attempt by the Austrian government to create a national energy champion, when a merger between OMV and the electricity company Verbund was supposed to result in a large integrated energy company. This merger failed over constitutional objections by the Austrian states (see Box 6 in Chapter 7). In 2007, OMV attempted to move towards a merger with the Hungarian oil

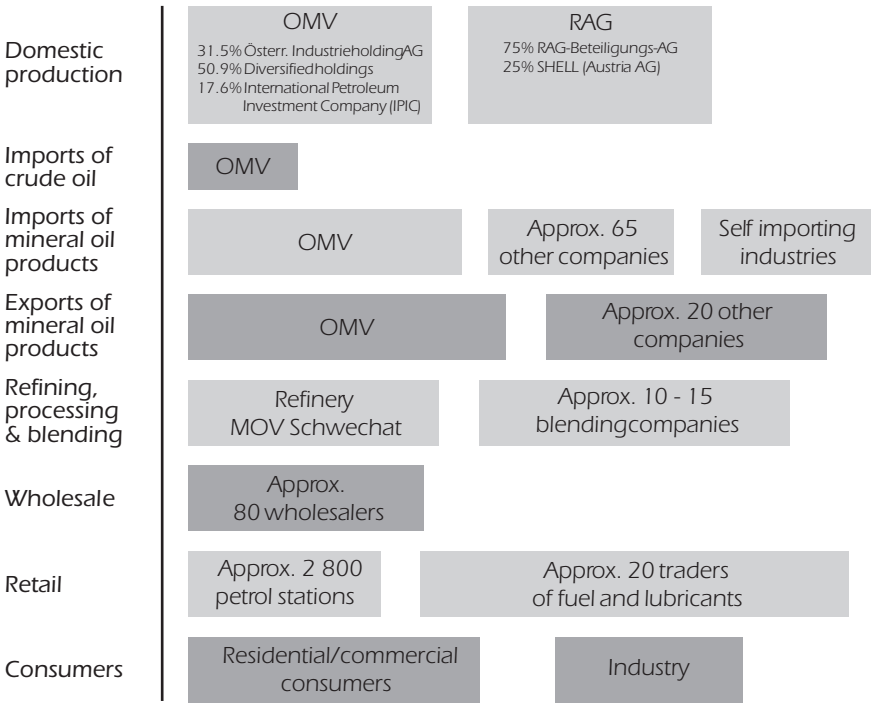
company, MOL, its main competitor in central Europe. At the time of writing, the outcome was not clear.

In the gas market, OMV owns most of EconGas, the main importer of Russian gas into Austria that also controls most of the Austrian gas market, and wholly owns the Baumgarten gas hub operator CEGH GmbH. OMV also owns the only independent network operator, AGGM. Total gas sales of OMV Gas and its 50%-owned subsidiary EconGas ran to almost 9 bcm in 2005.

OMV plays a key role in Austria's attempts to diversify its gas supplies through its involvement in the Nabucco pipeline, for the development of which it continues to provide resources, and through its involvement in the Krk LNG terminal evaluation consortium.

Figure 12

Structure of the Austrian Oil Industry, 2006



Source: Country submission.

SUPPLY AND DEMAND

Even though its share is lower than in many other countries, oil remains the most important source of energy for Austria's energy supply, accounting for over 42% of TPES in 2005 (see Table 20). This high share is mainly due to a lack of cost-efficient alternatives in the transport sector, and to cross-border demand from drivers in Italy and Germany (so-called "fuel tourism"), who take advantage of the comparatively low vehicle fuel taxation rates in Austria. According to long-term forecasts carried out by the Austrian Institute of Economic Research (WIFO) on behalf of the government, total oil demand is expected to increase by 13 % in the period 2000-2020. Because of the increase in overall energy demand, the share of oil in TPES would, however, decrease to 37% by 2020 according to this forecast.

Table 20

Oil in the Austrian Economy, 1990 - 2020

	1990	*2005*	*2020*	*Change*	
				2005/1990	*2020/2005*
TPES	**25.1**	**34.4**	**36.1**	**37%**	**5%**
Total oil supply (Mtoe)	10.6	14.5	14.0	36%	-4%
Oil share in TPES	42.4%	42.2%	38.6%	0%	-9%
TFC	**20.0**	**28.2**	**32.7**	**41%**	**16%**
Total oil use in final consumption (Mtoe)	9.2	13.3	12.3	44%	-7%
Oil use in Industry Sector (Mtoe)	2.1	2.8	2.7	32%	-4%
Oil use in Transport Sector (Mtoe)	4.9	8.4	7.9	72%	-6%
Oil in use Other Sectors (Mtoe)	2.6	2.7	2.3	4%	-14%
Oil share in power generation	**3.8%**	**2.6%**	**0.6%**	**-32%**	**-79%**

Source: *Oil Information 2006*, IEA/OECD Paris, 2007.

In 2005 7.8 Mt of crude oil were imported by OMV for use in Austria's only refinery in Schwechat. The most important suppliers are Russia, Kazakhstan, Nigeria, Saudi Arabia, Iran, Azerbaijan and Libya. Imported crude oil is primarily transported via the Trans-Austria pipeline (TAL), which links Trieste (Italy) with Ingolstadt (Germany). At Würmlach (Austria), the TAL is linked with the Adria-Wien pipeline (AWP), which is connected to the Schwechat refinery. A link to the Druzhba pipeline which currently ends in Bratislava, Slovakia, has been discussed for a long time. This connection will allow Austrian oil

companies to access Russian oil supplies and the Slovak companies to access oil imports from Trieste, Italy. The pipeline is planned to have the capacity to transport 5 million tonnes of crude oil per year.

In 2005 the following amounts of oil products were imported: 1.1 Mt of gasoline, 2.1 Mt of gas/diesel oil, and 0.26 Mt of heavy fuel oil. OMV imports 40 % of the Austrian mineral oil product consumption, with the rest accounted for by Agip Austria, BP Austria, Esso Austria, and Shell Austria as well as by 60 to 70 other comparatively small companies. A product pipeline of 172 km connects Schwechat's product storage with a storage depot in Linz in Upper Austria.

INDUSTRY STRUCTURE

Refining

Austria's only refinery in Schwechat (near Vienna) is operated by OMV AG. This refinery has been under competitive pressure by refineries in neighbouring countries in recent years. The capacity of the Schwechat refinery is 10 Mt per year, and has atmospheric and vacuum distillation, and catalytic and hydro-crackers to process crude. In 2005 the refinery input was 8.68 Mt of crude oil. The output breaks down as follows: 22% gasoline, 36% gas/diesel oil, 11% heavy fuel oil, 10% heating oil, 7% kerosene, 14% other oil products. In 2005. Schwechat covered 60% of the Austrian mineral oil consumption, and 20% of the refinery output was exported. The refinery is co-located with OMV's petrochemical operations.

Austria introduced a new law in 2004 in accordance with the EU Biofuels Directive, which stipulates that all companies providing oil fuels to the market have to replace 2.5% of the total energy quantity with biofuels from October 2005. The percentage will be increased to the level of the EU directive's indicative target of 5.75% in 2008, two years ahead of schedule. At the moment, the government is considering a further increase of the target to 10% by 2010. The Austrian support system differs from those in Germany and Hungary, creating a potential problem to refinery management when it comes to blending requirements and investment in refining.

Distribution and Marketing

Austria's oil product market is generally seen as competitive, with a number of national and multinational companies operating on both the retail and wholesale levels. An investigation into the market by the Federal Competition Office in 2004 found no evidence of a cartel being in operation, or of any problems in the formation of prices. Six companies account for at least 85% of the market, while the rest is shared between 110 small companies. To monitor price developments and to consider the potential for changes in the legal

framework for the operation of fuel stations, two working groups have been established under the chairmanship of the Federal Ministry for Economics and Labour. Specific fuel markets in Austria can suffer from the dominance of OMV, as demonstrated by the Federal Competition Office's action in June 2006 regarding the jet fuel market at Vienna's Schwechat airport.

At the time of the last review, a self-imposed limitation by OMV on its retail prices was seen as a risk to competition in the market and the government was advised that this should be monitored to ensure that it in no way acts to impede the current high level of retail competition by either distorting market prices or discouraging new entrants. As a result of price discussions during the first months of 2004, the commitment made by OMV in April 2000 to establish the average net automotive fuels prices at a level less than EUR 0.029 above the relevant weighted average values – as reported in the weekly *Oil Bulletin* of the European Commission – was suspended in accordance with the Federal Minister of Economics and Labour on 30 April 2004.

In 2006, a total of 2 812 filling stations were in operation in Austria. Since 2000, this number has been relatively stable. Major oil companies operate 1 782, or 63%, of the filling stations, while the remainder is operated by smaller oil companies or by independent operators. The largest companies are BP with 543 (19%) and OMV with 407 (14.5%) filling stations. Additionally, 314 distribution points for agricultural diesel fuel are in operation.

PRICES

For several years, the Federal Chamber of Labour and motorist lobbies have discussed the level of Austrian fuel prices compared to some other EU member countries. The criticism of these organisations has focused on Austrian net prices for gasoline and diesel in comparison to weighted average values within the European Union. In response to this, a study was commissioned by the Federal Ministry of Economics and Labour in 2005 to analyse the Austrian automotive fuel market (comparing it to neighbouring countries and taking into account the developments in the international oil markets). The results were that the prices for automotive fuels at filling stations can be influenced only marginally (approximately 9%) by the Austrian oil industry. This so-called B-factor includes costs for transport within Austria, investments for, and the running of, filling stations, together with the profit margin. Costs for crude oil, transport of crude to the refinery or products to the Austrian borders, refining – the so called A-factor – amount to 36% of the sales price. The main part of the price – C-factor – consists of taxes and duties and accounts for 55% of the price.

EMERGENCY PREPAREDNESS

In November 2001, the Stockholding and Reporting Law was revised to include jet fuel and deliveries of domestic waterway transport bunker fuels in the stockholding obligations of importers, as well as to provide for possible penalties against importers who do not comply with their stockholding or reporting obligations. Also, the Energy Steering Law 1982 was revised on 28 June 2006 to include definitions of steering measures that can be activated by the government if there is the necessity to comply with international legal obligations based on decisions by executive bodies of international organisations. No study on the potential contribution from demand restraint measures has been undertaken by the Austrian government.

Austria meets its international emergency oil reserves obligations by compulsory industry stocks. Importers may hold their stocks at the private, non-profit stockholding company ELG (*Erdöl-Lagergesellschaft*), a licensed stockholding entity which is privately owned by OMV and three international companies. ELG now holds 98% of all compulsory industry stocks for emergency purposes.

NATURAL GAS

SUPPLY AND DEMAND

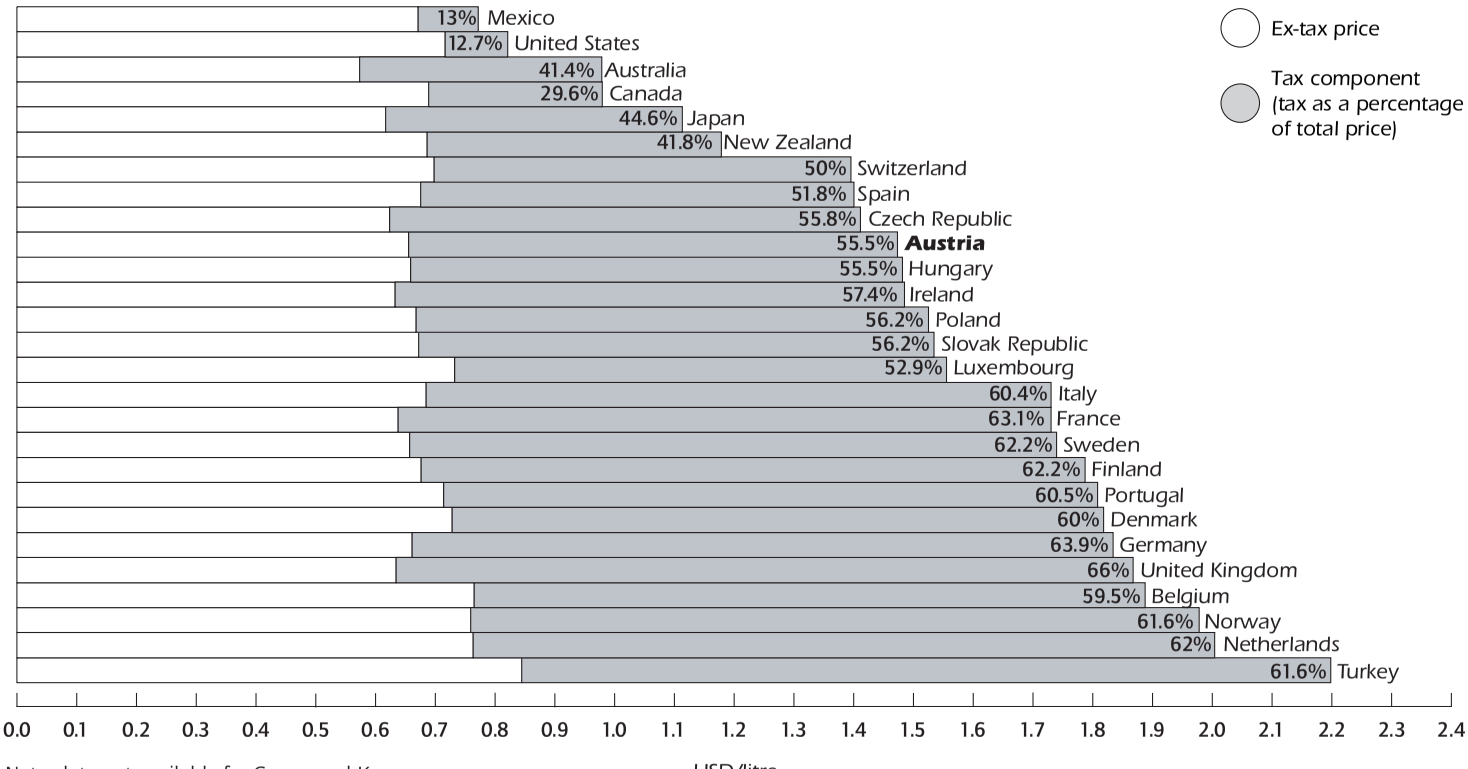
Gas is an important fuel in Austria, accounting for 24% of TPES in 2005. Contrary to many other IEA member countries, the Austrian government expects the share of gas to decrease slightly by 2020, because of a policy focusing on increasing the supply of renewables in both electricity generation and heat production. It is expected that the increase of gas consumption in the residential sector will be covered by a corresponding decrease in gas use in other parts of the tertiary sector.

Almost 85% of gas used in Austria is imported, with Russia being the main source country. Net imports of natural gas in 2005 stood at about 8.0 bcm, of which 6.4 bcm came from Russia or the countries of the former Soviet Union, 1.0 bcm from Norway, and 1.3 bcm from Germany. The major import contract is between Russian Gazexport and Austrian EconGas, accounting for about 5.0 bcm of the total imports. While gas imports on a contractual basis show diversification of suppliers, in terms of physical delivery all gas used in Austria originates in Russia.

Gas use in power generation has increased rapidly in Austria, and was responsible for supplying all net growth in electricity demand between 2004 and 2005, when it increased by 19% year on year. The Austrian government expects that total power production from gas will increase by almost 90% between now and 2020, with over 60% of this increase occurring between 2005 and 2010.

Figure 13

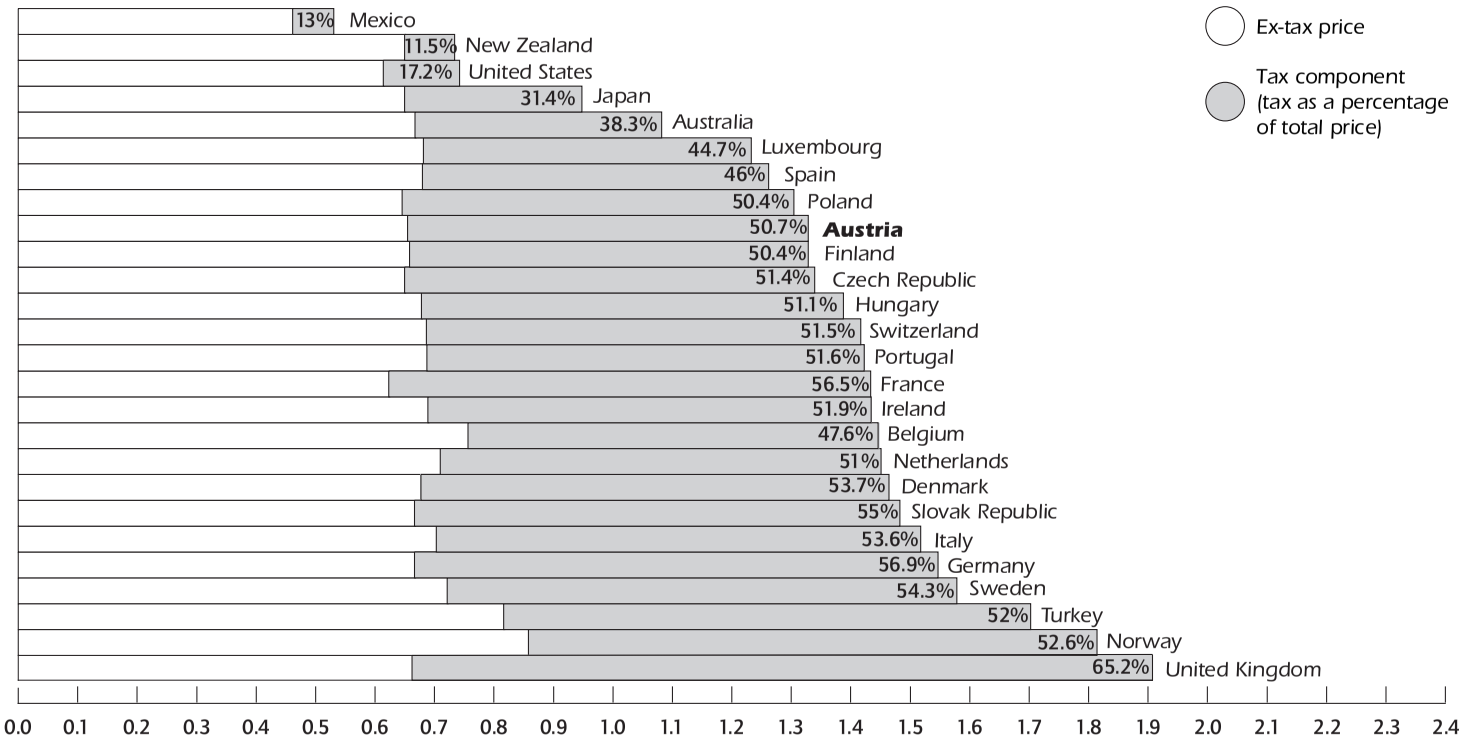
OECD Unleaded Gasoline Prices and Taxes, Second Quarter 2007



Note: data not available for Greece and Korea.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

Figure 14

OECD Automotive Diesel Prices and Taxes, Second Quarter 2007



Note: data not available for Canada, Greece and Korea.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

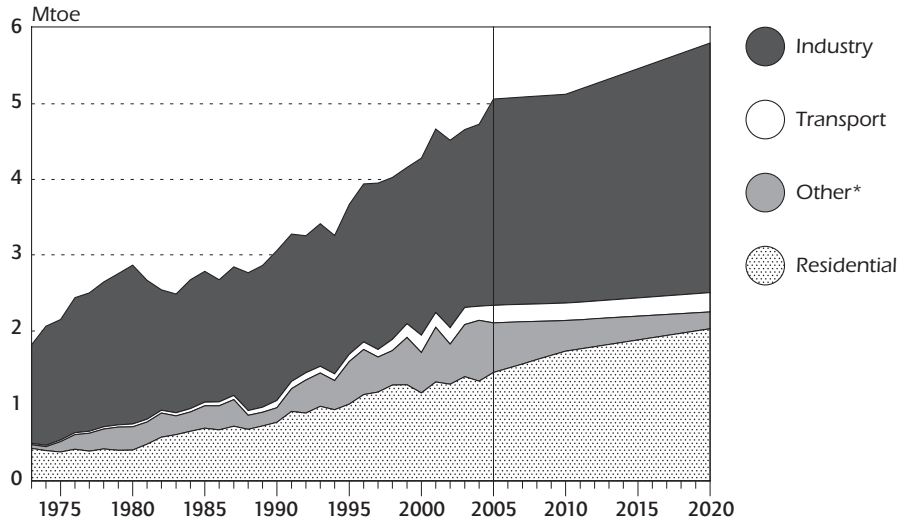
Table 21

Gas in the Austrian Economy, 1990 - 2020

	1990	*2005*	*2020*	*Change*	
				2005/1990	*2020/2005*
TPES	**25.1**	**34.4**	**36.1**	**37 %**	**5 %**
Total gas supply (Mtoe)	5.2	8.3	8.1	59 %	–2 %
Gas share in TPES	20.6 %	24.0 %	22.5 %	16 %	–6 %
TFC	**20**	**28.2**	**32.7**	**41%**	**16 %**
Total gas use in final consumption (Mtoe)	3.1	5.1	5.8	66 %	15 %
Gas use in Industry Sector (Mtoe)	2.0	2.7	3.3	38 %	21 %
Gas use in Other Sectors (Mtoe)	1.0	2.1	2.1	116 %	1 %
Gas-fired power generation (TWh)	7.7	13.0	24.5	69 %	88 %
Gas share in power generation	15.7 %	20.7 %	27.4 %	32 %	32 %

Figure 15

Final Consumption of Natural Gas by Sector, 1980 to 2020



* includes commercial, public service, agricultural, fishing and other non-specified sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

INDUSTRY STRUCTURE

Four companies are importing gas into Austria, OMV-owned EconGas, regional utilities STGW, EIS (Salzburg AG), and Kelag. The first three account for over 90% of all imports.

The Austrian gas grid is operated by seven transmission system operators (TSOs). Of these, 3 Transit TSOs OMV Gas, BOG GmbH and TAG GmbH, 5 domestic TSOs, OÖFG, EVN, Gasnetz Steiermark, Begas and OMV Gas. OMV owns 100% of the only independent system operator, AGGM.

Austria is supplied by 19 distribution companies in total, and of these, 14 are small distribution companies with less than 100 000 customers each. The five major distribution companies are Wienenergie, EVN, Erdgas Oberösterreich (OÖFG), Steirische Gas Wärme (Gasnetz Steiermark as network operator), and Begas. Distribution companies normally own the distribution network in their region.

SECURITY OF SUPPLY

Security of supply is of particular concern in Austria. There is a very strong dependence on Russian gas, which accounts for approximately 80% of imports, and around 70% of total demand. The Austrian government is trying to reduce this dependence by actively supporting the new pipeline project, Nabucco, which is expected to bring Caspian gas into Europe, and by working on the development of an LNG Terminal in Krk in Croatia, both of which are expected to weaken this dependence if they can be realised.

The increasing peak demand is creating a risk in case of a failure of critical import infrastructure during a peak demand period. Austria's storage facilities can cover up to 62% of 2005 peak demand in terms of release capacity for up to 90 days. In case of a total failure of gas import facilities during peak demand, the Austrian government would have to ask some large users to reduce their gas consumption to ensure continued supply of critical facilities and households. In case of a crisis, the Federal Minister of Economics and Labour can issue directives regarding the use of natural gas.

Table 22

Peak Winter Gas Demand in Austria, 2002 - 2005

Year	*Demand (MW)*	*Change year on year*
2002	22 708	n/a
2003	23 068	1.59%
2004	23 073	0.02%
2005	24 456	5.99%

Source: Government submission.

In June 2006, the Austrian Energy Steering Act *(Energielenkungsgesetz)* of 1982 was amended, providing a role for the regulator E-Control in assuring security of gas supply. E-Control is now responsible for the preparation and co-ordination of measures for a possible crisis. Furthermore, an ordinance

regarding the delivery of data from gas suppliers to the regulator for the evaluation of the supply situation was introduced. The Control Area Manager in each of the transmission grids plays an important role as he is responsible for the operational implementation of measures.

INFRASTRUCTURE

Pipelines

Austria is connected to the European gas grid through the Baumgarten hub, where a number of pipelines converge, directly connecting Austria to Germany, Italy and Hungary. Transit pipeline operators are the TAG GmbH, and the BOG GmbH (WAG). The total transit pipeline length is 792 km, consisting of the TAG, WAG, SOL, HAG, and MAB pipelines. The domestic transmission capacity extends to 2 718 km in length, while the length of the distribution grid is 29 240 km.

Austria is an important transit country for gas, with significant gas transits going to Hungary and Italy, and it is hosting the major gas hub in the region, at Baumgarten. Between April 2006 and April 2007, 34.9 bcm of gas flowed through Baumgarten, of which only 8 bcm (23%) were destined for Austria. The hub operator, Central European Gas Hub Baumgarten (CEGH), is currently owned 100% by OMV AG, but Gazprom will acquire a share of the ownership in the future. All gas flowing through Baumgarten is physically supplied by Gazprom. OMV has declared an objective to increase the quantity of gas traded with partners in neighbouring countries to 10 bcm and to strengthen the position of the Gas Hub Baumgarten as the centre for gas trade in Europe. It is uncertain if this ambition can be fulfilled, given the absence of alternative suppliers to Gazprom at the hub.

As part of the regulatory approval for the establishment of EconGas, a gas release programme was requested at the Baumgarten hub, in order to stimulate competition in Austria. Because of the strong demand from Italy, most of the released gas under this programme is usually traded into Italy.

Storage

Austria has four gas storage installations with a maximum storage output capacity standing at 62% of the 2005 maximum daily demand. Table 23 gives details on the individual storage facilities in Austria. In May 2007, the company RAG, together with its partners Wingas and Gazprom, officially inaugurated the gas storage site, Haidach, which is located on the border between Salzburg and Upper Austria. The site now has a working gas volume of 1.2 bcm. After completion of the second construction phase (2008 - 2011) the total working gas volume will be 2.4 bcm.

Table 23

Natural Gas Storage in Austria, 2006

		Input capacity Nm³/h	*Share of total capacity*	*Output capacity Nm³/h*	*Share of total capacity*	*Working gas volume million m³*	*Share of total capacity*
OMV	Schönkirchen	650 000	55 %	740 000	56 %	1 570	56 %
	Tallesbrunn	125 000	10 %	160 000	12 %	300	10 %
	Thann	115 000	10 %	130 000	10 %	250	9 %
	Total	*890 000*	*75 %*	*1 030 000*	*78 %*	*2 120*	*75 %*
RAG	Puchkirchen	290 000	25 %	290 000	22 %	700	25 %
Total		**1 180 000**		**1 320 000**		**2 820**	

Source: Government submission.

MARKET REGULATION AND LIBERALISATION[11]

There are 28 gas suppliers operating in eastern Austria[12], but the Austrian gas market is dominated by the EconGas/EnergieAllianz group, an alliance of six suppliers. The market was fully liberalised in October 2002, but switching rates remain low, and real competition has not emerged. E-Control and the Federal Competition Office jointly provide supervision of competition issues in the sector. An investigation by the Federal Competition Office into potential market abuse in the liquefied gas market is ongoing.

Table 24

Number of Gas Consumers Switching Supplier, 2002 to 2005

Customer category	*2002*	*2002/ 2003*	*2003/ 2004*	*2004/ 2005*	*2005/ 2006*	*Metering points*
Residential customers	0	8 645	11 774	9 198	6 970	1 281 500
Other non-metered customers	0	450	900	608	1 048	31 000
Metered customers	0	12	72	109	148	2 000
Total	**0**	**9 107**	**12 746**	**9 915**	**8 166**	**1 314 500**
Share						
Residential customers	0%	0.7%	0.9%	0.7%	0.6%	97.5%
Other non-metered customers	0%	1.5%	2.9%	2.0%	0.5%	2.4%
Metered customers	0%	0.6%	3.6%	5.5%	7.4%	0.2%
Total	**0%**	**0.7%**	**1.0%**	**0.8%**	**0.6%**	**100%**

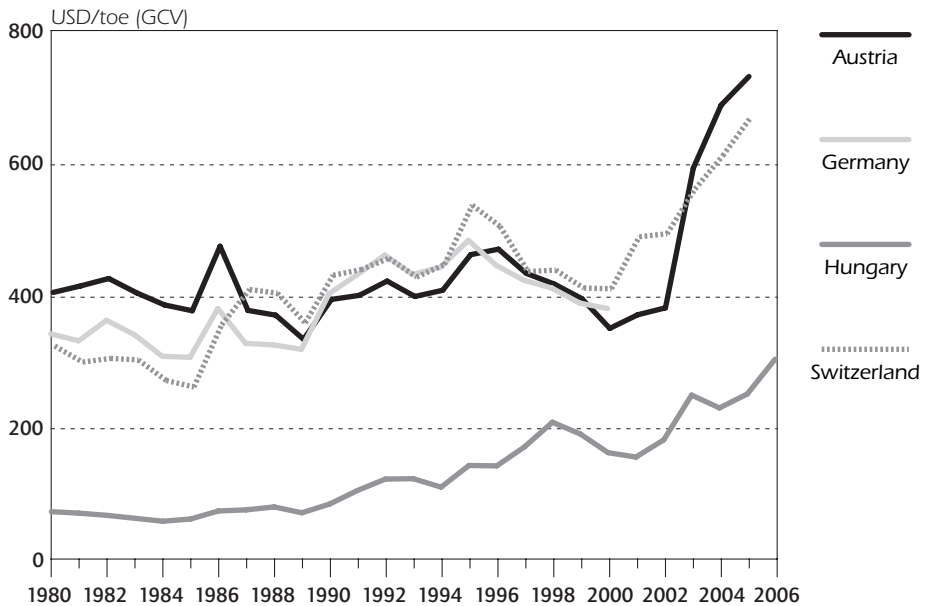
Source: Government submission.

11. See also Chapter 2.
12. Western Austria is connected to the German gas grid.

In the transmission system, non-discriminatory third-party access (TPA) to the entire pipeline system is provided for by the Austrian Gas Act, and legal unbundling of pipeline owners (with more than 50 000 customers) is also provided for by this act. E-Control has the role of following up the implementation of unbundling and of ensuring TPA. E-Control also sets tariffs for TPA, transmission, and distribution networks.

Figure 16

Gas Prices in the Household Sector in Austria and in Other Selected IEA Countries, 1980 to 2006



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

PRICES

The import price for Austrian gas is based on various oil price indices, and the upward trend of oil prices since October 2004 is reflected in the gas import price paid by Austrian importers. As a result of the increase of the import price during the "gas year" (October 2005 to September 2006), suppliers have passed this increase on to retail customers. But in general it appears that the increase in import prices since January 2005 was not passed on immediately and not the whole extent. Prices for industrial customers vary with changes in import prices, since most of the industrial customers have historical sliding price clauses in their contracts.

COAL

SUPPLY AND DEMAND

Coal in Austria is used for electricity generation and steel production, as well as for space heating. Total supply stood at 4 Mtoe in 2005, and while this figure is almost unchanged since 1990, coal's share of TPES has declined from 16.3% to 11.8% over the period. The most important use of coal is in electricity generation where it accounted for 13.5% of power generated in 2005. Coal is also consumed in industry, where it contributes 5.6% to final energy consumption, primarily for steel production. A very small amount of coal (0.1 Mtoe) is consumed in space heating. The government assumes that current consumption levels will remain stable until 2010, and will increase by 20% between 2010 and 2020, primarily driven by an increase of coal's contribution to electricity supply to 19% by 2020.

Most of the demand is met by imports. In 2005, 4.33 Mt of hard coal, 0.11 Mt of brown coal, 0.05 Mt of lignite briquettes and 1.4 Mt of coke were imported into Austria. Re-exports of coal are insignificant. Coal is imported by five large companies and a number of smaller ones. The big importers are also active in the wholesale business. Coal imports come from more than six countries, the most important suppliers being Poland and the Czech Republic.

DOMESTIC PRODUCTION

A small amount of brown coal is produced in Austria. The mining company GKB-Bergbau GmbH (wholly owned by Österreichische Industrieholding AG; 17 employees) stopped production at the end of 2004 after producing 0.23 Mt of lignite during the year. The second lignite mining company is Wolfsegg-Traunthaler Kohlenwerks GmbH (1 employee) which produced 3.6 kt in 2004 and 6.2 kt in 2005. From a dump in Lower Austria, 7.8 kt of hard coal were recovered in 2005. No subsidies are paid for coal production.

CRITIQUE

EXPLORATION AND PRODUCTION

Domestic production of oil in Austria has been declining at an accelerated rate in recent years, and the production of natural gas is declining even more rapidly. The reserves are estimated to last for 11-12 years in the case of oil, and 16 years in the case of gas where important reserves have recently been added, showing that potential remains in the Austrian province.

Two companies, OMV and RAG, produce oil and gas, with OMV by far the dominant producer. It is interesting to observe that RAG has been considerably more active in exploration in Austria than OMV in recent years, probably as a result of the much stronger geographical focus. OMV's recent discoveries show that there is still potential in the Austrian oil province, and the government should ensure that exploration continues at a strong pace so that this potential is realised. The government should consider ways to encourage seismic exploration in Austria, for example through tax measures, as well as introducing a mechanism by which licence-holders are given a clear incentive to work on their licence areas, such as the Norwegian "use it or lose it" approach. Bringing smaller producers into Austria could be of particular interest in developing less important discoveries which may not be of interest to large multinationals.

OIL MARKETS

Oil has been the dominant primary fuel for Austria and this trend will continue in the foreseeable future, even though the share of oil in TPES is smaller than in many other IEA countries.

The Austrian oil market is dominated by the vertically/horizontally-integrated OMV. No signs have been observed that effective competition is jeopardised by this. The government has carefully monitored the market, especially the retail price development of oil products, and this commendable effort should be continued to keep the market competitive. Austria is within easy reach of a number of refineries, ensuring vigorous wholesale market competition. It is particularly commendable that in April 2004 the government took an initiative for the suspension of OMV's self-imposed price limitation on retail sales, which might have become a distorting element in the market.

There are indications that the planned rapid increases in biofuels support may have a negative impact on the regional fuel market if targets are not pursued in co-ordination with neighbouring countries. Considering that the oil consumption as well as the CO_2 emissions in the transport sector have grown significantly since 1990, and since the reduction of oil use directly contributes to the security of supply, the steps taken to promote biofuels are applauded. To reach the ambitious goal of 10% biofuels, however, it will be necessary for the government to establish a pragmatic road map and further measures involving all parties concerned, including co-operation with other governments in the region.

EMERGENCY PREPAREDNESS

Austria contributed 63 000 tonnes of crude oil to the IEA emergency release action in 2005, and this is highly commended. While Austria has made great progress in ensuring timely and accurate data submission, more will have to be

done in this area, and the government is encouraged to continue enhancing the quality of the data and the speed of submission. Demand restraint and fuel switching are important measures in Austria's emergency response and the government is relying heavily on these in planning for an emergency. Yet the potential effects are not well understood, and the government should consider conducting a study into the likely contribution from these measures.

NATURAL GAS

Austria is well located along gas routes from Russia to Italy and southern Germany, and its transit capacity plays an important role in securing the energy supply of its neighbours, in particular Hungary and Italy. The country also has some indigenous gas production covering approximately 17% of gas supply in TPES, but the proven domestic reserves are relatively small and, despite some significant recent finds, are expected to be depleted in the next 20 years. Austria also has a significant storage facility in depleted natural gas fields, and storage facilities continue to be developed on a commercial basis. Some parts of western Austria are not connected to the Austrian grid, but are linked to, and supplied by, the German system.

Regarding security of natural gas supply, Austria is strongly dependent on Russia. Over 80% of net imports, and just short of 70% of consumption, are imported from Russia in terms of contracts; in fact 100% is sourced from Russia in terms of physical delivery. The country managed without interruptions during the Ukrainian gas crisis in January 2006, but if the crisis had been prolonged, the government would have been forced to take emergency actions. It will be important to develop emergency plans that take into account wider regional security and to seek to diversify supply routes.

Austria is directly involved through OMV in the development of two important diversification projects, the Nabucco pipeline and the Krk LNG terminal. These projects have been under debate for a long time, but have not yet moved to a stage where they can be expected to be developed. In order to provide for source diversification in Austrian gas supply, it will be important to move these projects forward. The Austrian government's support for these projects is commendable and should be continued.

Gas-to-power use in Austria is increasing at a rapid pace, and is expected to almost double between now and 2020. This increase will lead to dependence on gas in two critical sectors, power generation and heating. The Austrian government and the regulator should observe this increase and ensure that it is accompanied by the development of new storage and other solutions taking account of the interaction between gas-fired power generation and gas use for heat production in Austria, reducing the potential for cross-over effects, for example if gas-fired power stations are shut down during a gas supply crisis.

The Austrian gas market suffers from strong concentration. The aggregated share of companies supplying at least 5% of natural gas to Austria, either through imports or production, is over 90%, with EconGas by far the dominant supplier. Enforcement of effective TPA in cross-border points is, therefore, critical to guarantee the opening and transparent operation of the gas market in Austria. This is especially important on those gas grids that are not physically connected to the gas grid of eastern Austria.

Austria started to implement a reform programme for its natural gas market at the beginning of this decade, and it has adopted most of the regulations which are a precondition for the proper functioning of liberalised gas markets. The latest improvement was to give E-Control regulatory powers over upstream gas pipelines on Austrian territory in 2006. The Austrian oil and gas major, OMV, has committed itself to developing trading functions in the Austrian gas hub in Baumgarten, but the development of the trading hub is likely to be dependent on the emergence of rival suppliers trading on the hub to compete with Gazprom. One part of these commitments to increase the activity on the hub was a gas release programme run by EconGas. However, the programme has benefited the Austrian market less than expected, because the highest bidders came from Italy in 2003 and 2004, again underlining the important role that Austria plays in supplying its neighbours. Despite the reforms undertaken so far, real competition on the Austrian gas market has developed very slowly, and is in fact regressing. There have also been difficulties in implementing regulatory decisions, mainly due to the complex organisational structure of the government.

RECOMMENDATIONS

The government of Austria should:

Exploration and Production

- *Continue to support the development of domestic oil and gas reserves by encouraging seismic exploration and by giving an incentive to licence-holders to work on their licence area with a view to developing reserves.*

Oil Markets

- *Evaluate measures to reduce fuel consumption by ensuring that taxation levels give adequate signals to oil consumers.*
- *Pursue regional co-operation in the promotion of biofuels to ensure that competition between refineries in the central European region is not affected by the emergence of boutique fuels.*[13]

13. Boutique fuel is a term used for transport fuels produced to local or regional specifications which are not tradable across a wider region.

Emergency Preparedness

- *Implement the recommendations of the 2006 IEA Emergency Response Review, in particular the study on the potential effect of demand restraint measures.*

Natural Gas

- *Develop the services and functioning of the Austrian gas hub and improve its capacity allocation procedures in cross-border points in order to facilitate competition in the Austrian gas market and lower the market entry barriers for new competitors.*
- *Continue to promote the diversification of sources and routes of gas supply to Austria.*
- *Further improve competition by:*
  - *Strengthening the role of E-Control and ensuring the implementation and enforcement of regulatory decisions.*
  - *Increasing the staff at the Federal Competition Office.*
  - *Actively encouraging new entrants into the market.*
  - *Implementing a fully independent transmission system operator.*
  - *Ensuring non-discriminatory grid access.*
  - *Considering further measures to increase competition should effective competition continue to fail to develop.*

DEMAND AND SUPPLY

Electricity consumption in Austria has declined by 5%, relative to the overall growth in the economy (see Table 25). In individual sectors of the economy, however, slight relative growth has occurred. Absolute growth has been most rapid in the industrial sector. Overall, electricity contributes a relatively small amount to TFC in Austria of just over 17%. Growth in electricity consumption in Austria has been slower than in many other IEA member countries.

Table 25

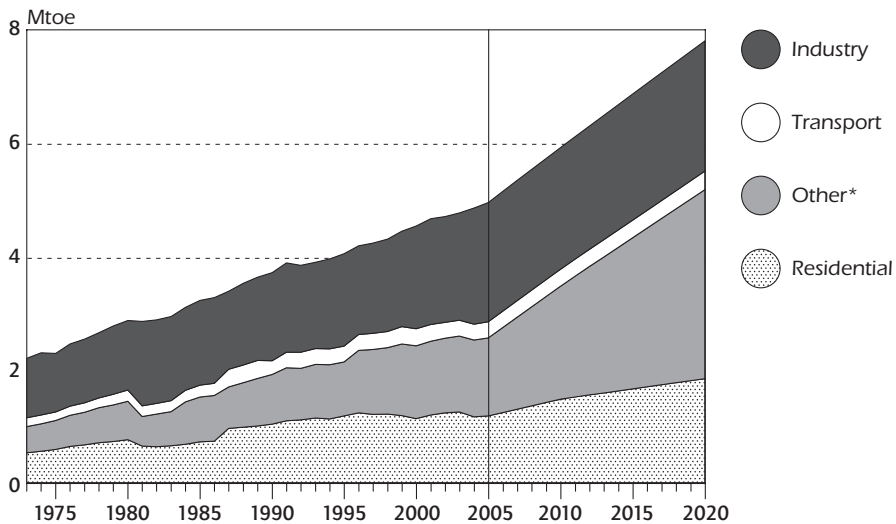
Electricity in the Austrian Economy, 1990 and 2005

	1990		*2005*		*Change 1990/2005*	
	TFC	*Share*	*TFC*	*Share*	*TFC*	*Share*
	Mtoe	*%*	*Mtoe*	*%*	*%*	
Industry	1.5	22.3	2.1	22.6	40	1
Other	1.9	23.0	2.5	24.0	32	4
Total	3.7	18.4	4.9	17.4	32	– 5

Sources: IEA SLT database and country submission.

Figure 17

Final Consumption of Electricity by Sector, 1973 to 2020



* Includes commercial, public service, agricultural, fishing and other non-specified sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Box 6

Verbund

The biggest supplier and generator in Austria is Verbund, which was formed after the Second World War during the nationalisation of the electricity industry. Verbund is owned 51% by the Austrian government, in accordance with the constitutional provisions regarding state ownership (see Chapter 2), with the remainder held by other Austrian utilities (30% together), or in free flotation (20%).

Verbund accounts for approximately 50% of electricity production, operates the largest part of the Austrian transmission network, and has become a driving force for real competition in the Austrian market through its subsidiaries Austrian Power Trading (APT) and Austrian Power Sales (APS), operating in the wholesale and final customer markets, respectively. Verbund also owns subsidiaries or has shares in companies operating in other European countries, such as Italy or France. Like all Austrian electricity generators, Verbund's portfolio is primarily based on large and small hydropower stations, with a share of thermal generation in the form of coal and gas plants.

In 2006, Verbund was the object of an attempt by the Austrian government to create a national energy champion, by merging it with the partially state-owned Austrian oil and gas company, OMV. This project failed because of the resistance to the constitutional change which would have been required to allow the share of the government in the combined entity to fall below 51%.

INDUSTRY STRUCTURE

Austria's electricity industry is highly fractured on both the supply and generation sides. In generation, 53 companies together generate 95% of all electricity. There are five companies generating at least 5% of generating capacity each. The three largest generators account for 52% of total generating capacity, and 56% of generation by volume. Two-thirds of generation by volume are produced by six companies. By far the largest is Verbund (see Box 6), accounting for approximately 50% of power generation.

The transmission network is split into three regions, each owned by a different company, and the networks have been legally unbundled.

On the supply side, there is a total of 125 suppliers. Ownership of integrated electricity companies is often in the hands of the regional or municipal government of the area the company serves. Six of the suppliers sell more than 5% of total Austrian supply volume each. Supply companies normally own the local distribution network.

MARKET REFORM AND REGULATION

MARKET REFORM[14]

Austria liberalised its electricity market ahead of the EU requirements to do so, and all electricity customers have been eligible to change supplier since October 2001. Despite this legal opening, relatively little customer switching has taken place, and incumbent suppliers are continuing to consider market share an important goal. Table 26 gives the number of customers that have switched, in total and as a share of the total number of customers. It is expected that recent efforts by new suppliers, such as APS (see Box 6), or RWE from Germany, will have an impact on the development of competition in the future, even though switching rates have actually declined in all sectors of the market between 2003/04 and 2004/05. A power exchange has been established in Austria, but it is not mandatory, and 95% of trades are in the over-the-counter market, resulting in low transparency within the market.

E-Control is the regulator of the Austrian electricity market. It directly regulates prices for the use of the networks, and the terms of reference for the operation of the network. It also has a reporting function regarding the implementation of unbundling.

In the area of network regulation, only limited progress has been made in Austria to date. There is no independent system operator, and unbundling has been restricted to the level of legal unbundling. Network charges are regulated by E-Control, and have been reduced by an average of 23.3% in all of Austria since regulation was introduced in 2001. Third-party access (TPA) to the networks is regulated, but problems in the connection of wind farms or in the ability of competing suppliers to use the networks have been reported. In the view of the regulator, the newly unbundled network operating companies are generally poorly equipped with personnel, do not own the networks, and in some cases are not the employers of their staff, who are simply seconded to the network operators. The regulator sees these issues, combined with a lack of transparency, as hindering the progress of real unbundling.

14. See also Chapter 2 for a discussion on market reform.

Table 26

Number of Electricity Customers Switching Supplier, 2001 to 2005

Category	*2001*	*2001/ 2002*	*2002/ 2003*	*2003/ 2004*	*2004/ 2005*	*2005/ 2006*	*Metering points*
Residential customers	0	26 077	40 986	34 813	23 250	36 863	3 703 750
Other non-metered customers	181	37 776	20 102	31 314	20 500	24 233	1 391 250
Metered customers	318	1 775	1 701	2 943	1 764	1 516	27 000
Total	**499**	**65 628**	**62 789**	**69 070**	**45 514**	**62 612**	**5 122 000**
Share							
Residential customers	0.0%	0.7%	1.1%	0.9%	0.6%	0.9%	72.3%
Other non-metered customers	0.0%	2.7%	1.4%	2.3%	1.5%	1.6%	27.2%
Metered customers	1.2%	6.6%	6.3%	10.9%	6.5%	7.6%	0.5%
Total	**0.0%**	**1.3%**	**1.2%**	**1.3%**	**0.9%**	**1.1%**	**100.0%**

Source: Government submission.

SECURITY OF SUPPLY

According to the Austrian Energy Steering Act of 1982, E-Control is required to publish an annual medium-term and long-term forecast on security of supply. In co-operation with the representatives of the electricity industry, E-Control conducts annual surveys on security of supply. According to its mandate by the Energy Steering Act, E-Control establishes an annual supply forecast covering a time-span of 10 years. This forecast shall take into account the development of the consumption behaviour and the existing generating capacities and has led to the conclusion that only towards the end of the survey period (2013), larger-scale new generating capacities will be needed in Austria. The following activities are carried out by E-Control to ensure security of supply:

- Long-term forecasts.
- Regular market surveys/monitoring according to Section 4 of Directive 2003/54/EC.
- Ensuring sufficient investment by monitoring unbundling.
- Surveillance of continuity of supply.
- Co-operation with national and international experts for the elaboration of concerted actions.
- Active co-ordinating role for the elaboration of measures for crisis prevention under the Energy Steering Act.

INFRASTRUCTURE

Austria has a relatively well-developed electricity infrastructure, although in recent years, the required investment in transmission has been held back by

permitting procedures. Investment in large-scale generation has not been able to keep up with the growth of demand, turning Austria into a net importer of electricity. Austria is well interconnected, and the western part of the Austrian electricity system is completely integrated into the German system. The government has made energy infrastructure improvements a priority, particularly in the electricity sector.

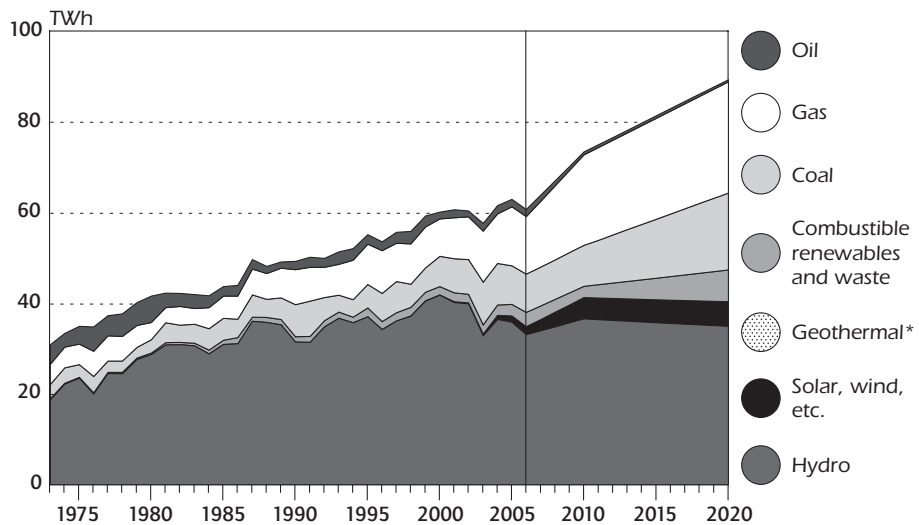
POWER GENERATION

The Austrian power generation system is based primarily on large hydroelectric installations, taking advantage of the geographical conditions of the country. The balance is provided by thermal generation which often operates in CHP mode, and other renewables. In 2006, 372 MW of generating capacity was added, and 127 MW was decommissioned, leaving a net capacity addition of 245 MW. Figure 18 gives an overview of the historic development of power generation capacity in Austria, and a forecast about expected trends in the fuel mix. The figure has not been updated to reflect the current government's policy on increasing the share of renewable power generation from its current 63% to 85%, and it indicates the scale of the challenge to achieve this goal.

The maximum demand load in 2005 was 9 896 MW, well within the capacity of the Austrian power generation park. Table 27 gives an overview of power generation capacity and production in Austria in 2006.

Figure 18

Electricity Generation by Source, 1973 to 2020

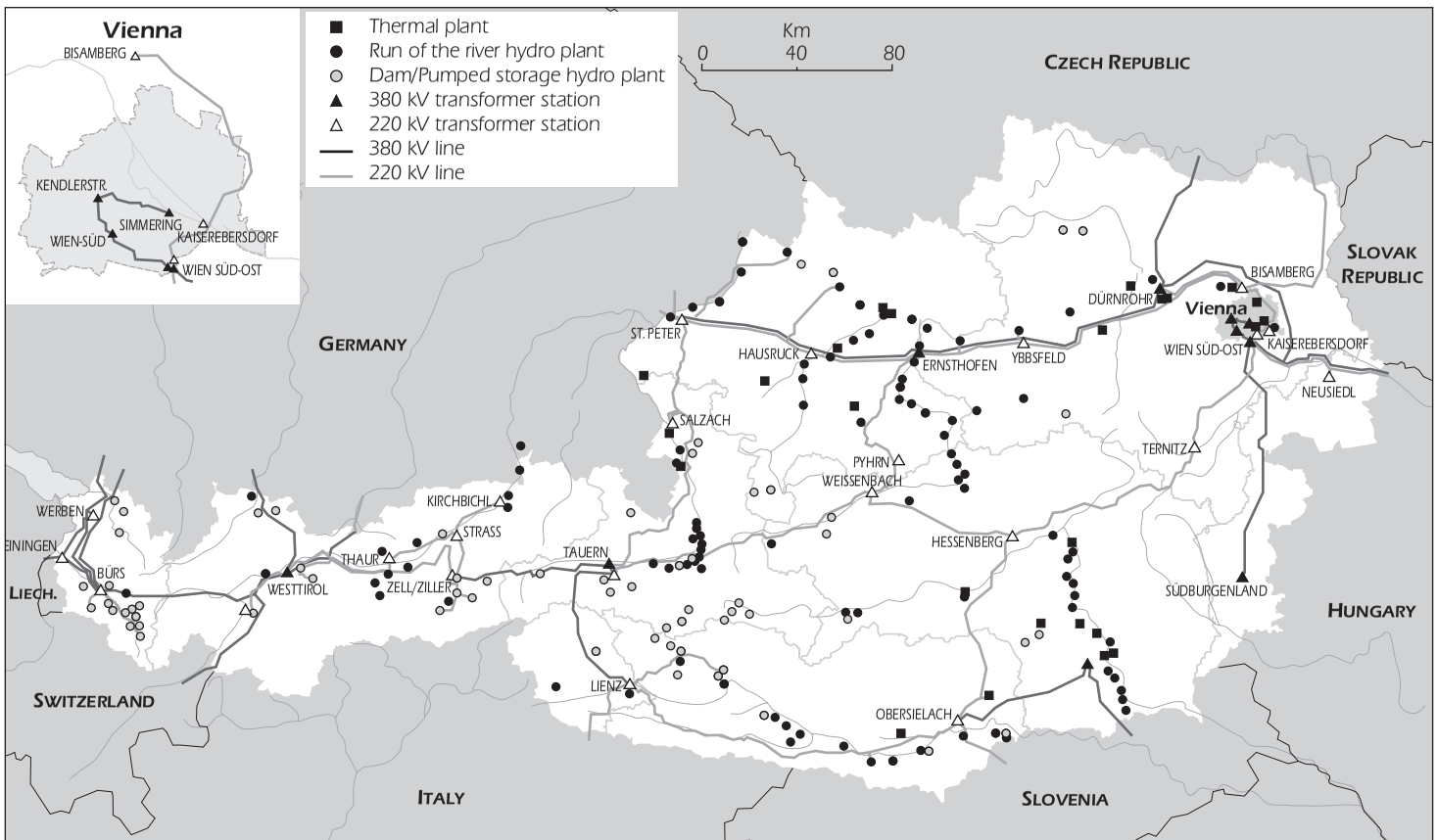


* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2007 and country submission.

Figure 19

Map of the Austrian Electricity System



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the IEA.
Source: E-Control.

Table 27

Power Generation Capacity and Production by Type of Plant, 2006[1]

Type of plant			*Number*	*Capacity MW*	*Production GWh*	*Running hours*	*Load factor*
Hydro	Run of the river	Up to 10 MW	533	732	3 298	4 506	51%
		Above 10 MW	87	4 449	22607	5 081	58%
	Dams	Up to 10 MW	38	149	434	2 912	33%
		Above 10 MW	59	6 305	10 740	1 703	19%
	Small hydro < 10 MW		1 724	218	199	n/a	
	Total hydro 2 441		11 853	37 278	3 145	36%	
Thermal	Fossil and biomass	Hard coal Brown coal Coal-derived	12	1 748	8 165	4 672	36%
		Oil-derived	23	476	1 446	3 034	35%
		Natural gas	67	3 162	9 951	3 147	36%
		Total fossil	*102*	*5 386*	*19 562*	*3 632*	*41%*
	Biomass	Solid Liquid Gaseous Sewage sludge and landfill	77	283	1 242	4 398	36%
		Total biomass	*77*	*283*	*1 242*	*4 398*	*50%*
	Other biomass		2	36	270	7 500	86%
	Other fuels		9	68	416	6 089	70%
	Mixed		12	485	2 612	n/a	
	Other thermal plant		385	87	387	n/a	
	Total thermal plant		**587**	**6 344**	**24 489**	**3 860**	**44%**
	(of these CHP)		(167)	(4 271)	(17 847)	(4 179)	48%
Renewables	Wind, solar, geothermal		141	969	1 722	1 777	20%
	Other renewables		2 013	16	44	n/a	
	Total renewables		**2 154**	**985**	**1 766**	**1 792**	**20%**
Other installations			n/a	n/a	386	n/a	
Total			**5 182**	**19 182**	**63 919**	**3 332**	**38%**

1. Data from July 2007.

Source: E-Control.

TRANSMISSION AND DISTRIBUTION

The Austrian transmission system is broken into three separate control areas, the western-most of which is fully integrated into the southern German system of the energy company EnBW. Transmission networks are owned by integrated electricity companies such as Verbund. Austria has chosen legal unbundling for the transmission and distribution networks and this has been implemented.

An almost complete ring of 380-kV lines exists since approximately 30 years ago, but it has not been possible to complete this because of permitting issues. Table 28 gives detailed information on the Austrian transmission network. Despite this lack of a complete ring main, the reliability of the Austrian network is comparatively high. In 2005, total unplanned outages were 31.35 minutes/customer/year, lower than the level experienced in France, the United Kingdom, or Italy, but higher than in the Netherlands and Germany. Total outage events per customer were 0.85 events/customer/year. Including scheduled outages, the interruptions totalled 52.3 minutes/customer/year.

Table 28

Total Length of the Austrian Transmission System, 2005

Voltage	*Above ground*	*Below ground (est.)*	*Total*	
	km	*km*	*km*	*Share*
110 kV	10 462	573	11 035	64%
220 kV	3 760	5	3 764	22%
380 kV	2 481	54	2 535	15%
Total	**16 703**	**632**	**17 335**	**100%**

Source: E-Control.

INTERCONNECTION AND INTERNATIONAL TRADE

Austria occupies a central position in the European electricity network, and is connected to all of its neighbours. The total capacity of interconnections was equal to 37% of Austrian peak demand in 2005. One new project to strengthen an existing connection between the Czech Republic and Austria is considered for the future.

No congestion exists along the interconnections to Germany in either direction, and the western Austrian system in the state of Vorarlberg is fully integrated into the southern German system. At all other borders (Czech Republic, Hungary, Slovenia, Italy and Switzerland) congestion is restricting the possibilities for trade. Most of these limited cross-border capacities are, therefore, allocated via explicit auctions. Current work of regulators and the TSOs aims to increase the level of co-ordination of these auctions. One important objective in this work is to fulfil the requirements from European

Regulation (EC)1228/2003 to maximise interconnector capacity available for the market. The aim is to achieve this by stronger TSO co-ordination and the use of more accurate capacity calculation methodologies.

Table 29 provides information on Austria's electricity trade in 2005. Imports are mainly from Germany and the Czech Republic, while exports are mainly to Switzerland and Germany. The German electricity trade balance is heavily influenced by the full integration of the Vorarlberg system of western Austria into the German system of EnBW, for which the Vorarlberg system provides peaking capacity from pumped storage plant.

Table 29

International Interconnections and Trade, 2005

	Into Austria (MW)	*From Austria (MW)*	*Imports (GWh)*	*Exports (GWh)*
Germany	1 400	1 600	12 832	4 816
Switzerland	1 200	1 200	65	9 118
Liechtenstein	n/a	n/a	0	128
Italy	220	n.a.	0	1 499
Slovenia	450	450	532	1 349
Hungary	500	400	854	809
Czech Republic	600	200	6 114	12
Total	**4 370**	**3 850**	**20 397**	**17 732**

Source: Government submission.

PRICES

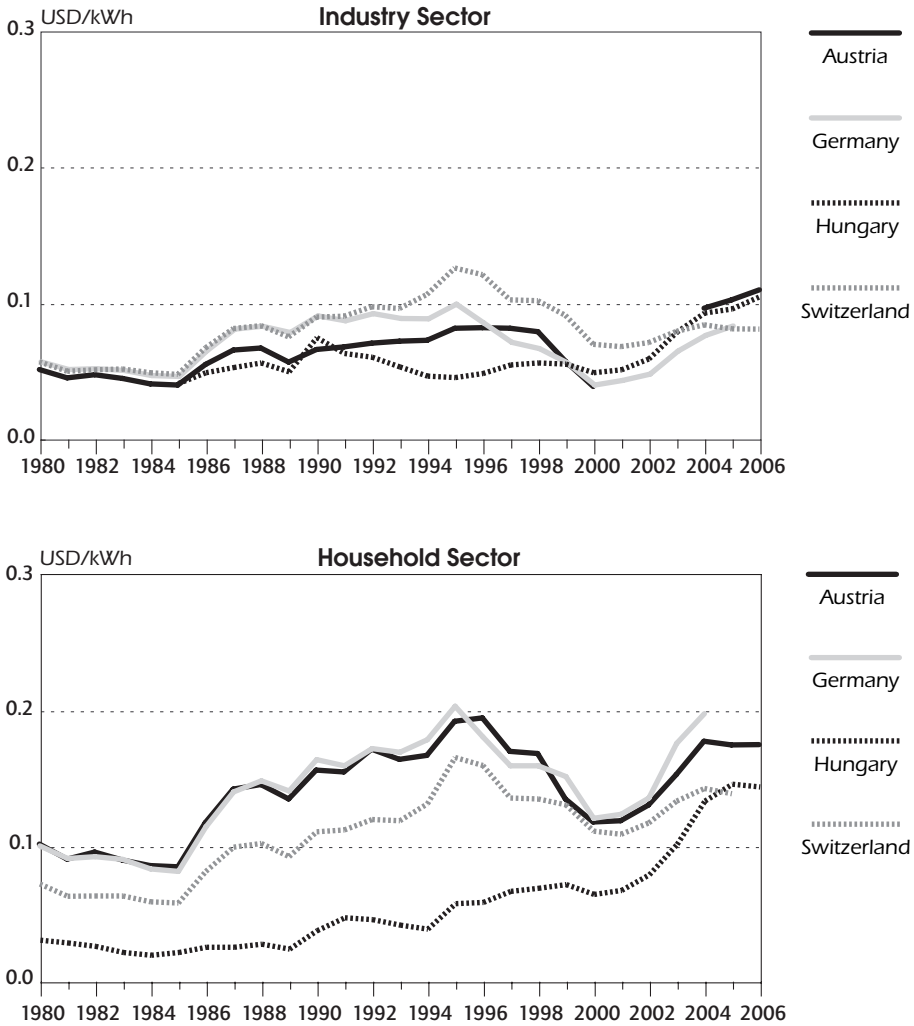
The German and Austrian wholesale markets are closely interlinked, and the spot prices of the Austrian and German power exchange are moving in parallel. Spot prices have generally been trending upwards in recent times. The reasons for this are steadily growing consumption and shrinking surplus generating capacity as well as the introduction of the EU-ETS. The steep rise in primary energy prices, most importantly for oil and gas, has also played a crucial part. More recently, prices have fallen again.

The prices charged to industrial consumers continued to rise over the last years. Pricing in the retail market was largely shaped by two factors: a lack of effective competition in Austria and general market trends in European wholesale markets. Competition has declined since the initial post-liberalisation period, with fewer suppliers being active now. Parallel to market consolidation, a different approach to pricing has taken hold. Industrial consumers are no longer being offered prices below wholesale rates, as was often the case immediately after liberalisation when the aim was to increase market share at the cost of profitability. Instead, suppliers are increasingly basing their offers on forward prices.

After liberalisation, the overall prices for residential customers declined. This development is mainly traced back to two factors: on the one hand, the network tariffs were reduced by the E-Control Commission, and on the other hand, electricity suppliers lowered their energy prices. These gains for consumers were partly offset by the introduction of green power and CHP surcharges. The rise in the price index at the start of 2003 was due both to the surcharges provided for by the Green Electricity Act and to higher wholesale prices. The latter factor has since been behind a number of increases in electricity prices.

Figure 20

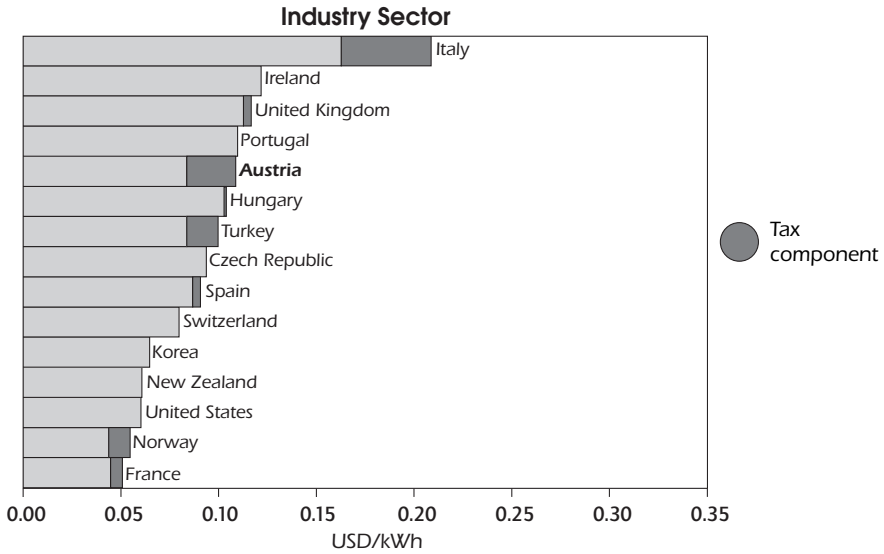
Electricity Prices in Austria and in Other Selected IEA Countries, 1980 to 2006



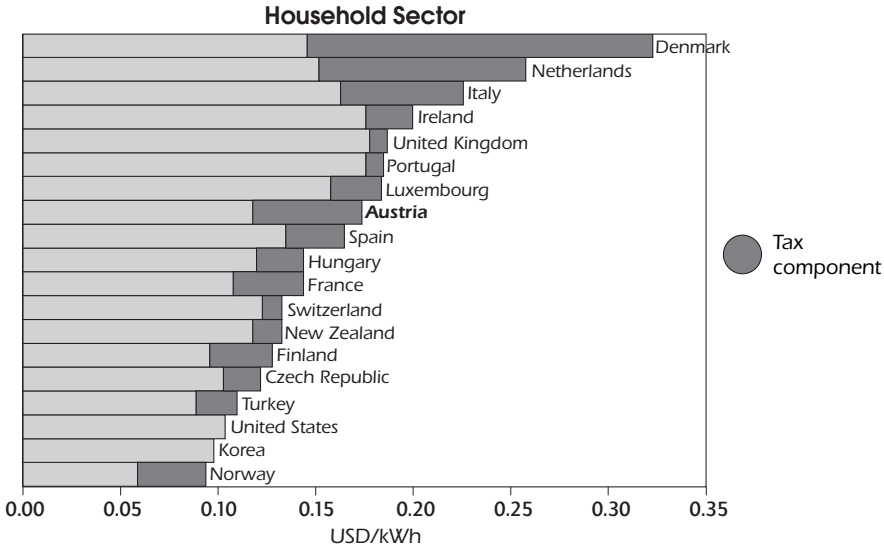
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

Figure 21

Electricity Prices in IEA Countries, 2006



Note: Tax information not available for Korea. Price excluding tax for the United States. Data not available for Australia, Belgium, Canada, Denmark, Finland, Germany, Greece, Japan, Luxembourg, the Netherlands and Sweden.



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

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2007.

CRITIQUE

Electricity use in Austria has grown more slowly than overall energy use since 1990, indicating a reduction in the electricity intensity of the Austrian economy. This is a commendable development, and one which the government will have to reinforce if it wants to achieve the ambitious targets for the growth of electricity generation from renewables. Nevertheless, in absolute terms electricity consumption has grown by almost one-third since 1990, and with the lack of potential for new large hydro stations in Austria, electricity production from other fuels than hydro has had to increase.

Large hydropower is by far the dominant source of electricity supply, contributing approximately 10% to TPES. The remaining potential growth for economically feasible new and refurbished hydro production is estimated to be substantial, of around 12-15 TWh/year. The actual remaining potential for the development of large hydro schemes is, however, close to being exhausted, because the economic potential left is facing strict restrictions owing to lack of social acceptance together with environmental concerns. Old hydro plants do, however, offer enough potential for economic capacity increases by capturing additional water streams and the refurbishment of generating components, to support the achievement of government targets. To realise the potential for further increases from hydro generation, it will be necessary to streamline licensing procedures, and to ensure that water legislation is allowing it to be developed, taking environmental concerns into account. The government should also consider introducing support schemes to give incentives for upgrading and extending existing hydropower schemes where this is cost-effective and required.

In terms of market reform, the Austrian market has some particular characteristics. One is a high degree of state ownership of incumbent electricity companies, and another is the reflection of the federal nature of Austria in the electricity market, since the market is not fully integrated at a national level. Vertical integration of the power system is strong, and benefiting from a lack of transparency, for example in available market information. Information on congestion, balancing prices, and availability is not readily available to new entrants. The Austrian market is coupled to the German market in terms of prices. There is a national power exchange with no mandatory trading, and over-the-counter trading accounts for over 95% of total trading. Austria is split into three control areas. There are 14 distribution areas with different network usage charges, creating further difficulties for new entrants to enter the market, because they will be unable to offer a consistent price across the whole of the country.

Austria has chosen legal unbundling for its network operators, and has no plans to set up an independent system operator for its networks. The regulator has criticised the progress in implementing legal unbundling and

the effectiveness of current arrangements. It has also criticised the lack of transparency in pricing. Reports of abuse of dominant position by network operators, in favour of their affiliated supplier, have been documented. Because of the regulatory arrangements that give enforcement power to the states, which often own shares in the incumbent supplier, effective enforcement appears to be lacking. The Austrian government, the states, and the regulator should consider co-operation with a view to ensuring that abuse of dominant position can be adequately addressed within the regulatory framework.

The reliability of the electricity system is relatively high even though it could be improved, and Austria is facing significant challenges and serious risks to security of supply in terms of network security. Most importantly, the completion of the 380-kV ring line in Austria has been held up in licensing for over 20 years. The government should consider measures to ensure that critical energy infrastructure projects can move through the planning phases more easily, and without undue delay. The explicit commitment by the government in its 2007-2010 programme to improve electricity infrastructure is commendable.

Austria is also affected by high levels of electricity transit, and is contributing to ensure security of supply in neighbouring countries. Austria's interconnections to all its neighbours except Germany are suffering from congestion, leading to management problems in the electricity system. Austria should further consider strengthening interconnections and to develop additional system management capacity, to stabilise domestic and regional supply. E-Control and the government are strongly encouraged to pursue regional solutions to network development and trading to ensure continued security of supply in the Austrian electricity network.

Pumped storage capacity in Austria is sufficient for the country's needs. Further developing it could offer new opportunities in the liberalised European markets, where peak production capacity and the ability to support the increasing share of non-dispatchable renewable capacity can offer high income potential.

Concerns have been raised relating to the operation of the grid with the expected increase of intermittent production of electricity, mainly from wind and small hydro. Already, additional investment has been necessary to accommodate the current level of non-dispatchable renewables. This indicates a need for more peak-load capacity and pumped storage, and for smarter management of the current renewable capacity. For example, at present, all wind power is allocated to a single generation group, regardless of location, making it more difficult to manage output and the grid. The use and enforcement of the regulatory framework in this area should be implemented in a way that secures the participation of small producers of renewable energy.

RECOMMENDATIONS

The government of Austria should:

- *Ensure that Austria's economic potential for hydro, including pumped storage, is realised in the future by:*
  - *Streamlining licensing procedures.*
  - *Considering support schemes where this is appropriate, cost-effective and required.*
- *Increase domestic and regional system stability and prepare the grid system for larger volumes of intermittent electricity by:*
  - *Completing the domestic 380-kV ring line.*
  - *Facilitating interconnector capacity increases.*
  - *Increasing the capacity of pumped storage.*
- *Ensure a good framework for the grid regulation which does not discriminate or set up undue obstacles for small producers of electricity.*
- *Further improve competition in the electricity market by:*
  - *Ensuring that there is more effective separation of ownership and regulatory functions at all levels in the energy industry and the Austrian governmental system, in particular the states.*
  - *Strengthening the role of E-Control and ensuring the implementation and enforcement of regulatory decisions.*
  - *Increasing the staff at the Federal Competition Office.*
  - *Actively encouraging new entrants.*
  - *Implementing independent electricity transmission system operation with a responsibility for system management, including balancing.*
  - *Simplifying transmission grid pricing to encourage new entry into the market.*
  - *Ensuring non-discriminatory grid access.*
  - *Increasing the transparency by making real-time market-relevant information provision mandatory, for example through the internet.*
  - *Consider further measures to increase competition in electricity should effective competition continue to fail to develop.*

RESEARCH AND DEVELOPMENT

OVERVIEW

Energy R&D has in the past produced very good results, the consequence of a strong focus on developing technologies that are well suited to the Austrian energy landscape, such as biomass boilers or solar water heating, with particular concern for improving quality. The result has been the development of world-class industries for these products in Austria.

Research programmes managed by federal ministries, states, and the recently reorganised Austrian Research Promotion Fund support energy R&D at the federal and state levels. The most important research institutions outside the government are the universities, especially the technical universities in Vienna and Graz. In addition, two large publicly-owned research institutes operate in Austria: Joanneum Research, with 14 research centres, owned by the state of Styria, and Arsenal Research, a subsidiary of the public-private partnership Austrian Research Centres (ARC). There are also two energy-focused competence centres, the ABC (Austrian Bioenergy Centre) and RENET, the Renewable Energy Network Austria.

The ministry accountable for the overall co-ordination of energy R&D in Austria is the Ministry of Transport, Technology and Innovation (BMVIT). It oversees the research programmes, and is responsible for the provision of funding to research institutions such as universities. It is also responsible for the Austrian government's ownership share in ARC, and has the lead in co-ordinating research activities within the government. It co-operates closely with the Ministry of Economics and Labour (BMWA) and the Ministry of the Environment, as well as with the states.

Austrian industry is involved in R&D through a range of small and medium-sized enterprises, for example in the bioenergy and solar sectors, as well as through large industrial companies – including Siemens, Andritz, VA Tech Hydro, Magna, and GE Jenbacher – that are actively engaged in researching hydropower generators, power plant engineering, and constructing gas power stations and control centres. Energy utilities are also stakeholders in energy R&D, even though their R&D activities have been reduced in recent years. As for the private sector, it is responsible for the largest portion of Austria's energy-related R&D activities (see section on Funding below), and private R&D activities will generally profit from favourable tax conditions, a mix of tax allowances and tax credits.

In recent years, Austria has begun to experience a shortage of qualified researchers in the energy R&D sector.

POLICY

The Austrian government is assigning a high level of importance to energy R&D, at both the fundamental and demonstration stages. Energy R&D policy is explicitly formulated with regard to its impact on energy, environmental, economic and research policy. It is prominent in the wider policy context and it is, therefore, not just a subset of energy policy, but a combination of R&D elements related to energy, environment, innovation and technology with sustainable development as a guiding principle.

The goals and the framework of Austria's energy R&D policy were laid down in 2002 in the *Austrian Energy Research and Energy Technology Concept* document. This concept was developed by an expert panel and published by the Minister of Transport, Technology and Innovation after consultation with other ministries and an international review. The main objectives of the concept are to:

- Boost existing strengths.
- Promote sustainable development.
- Engage in European energy R&D activities (European Research Area - ERA).
- Focus on results-oriented programmes with a mid-term horizon of 5-10 years.

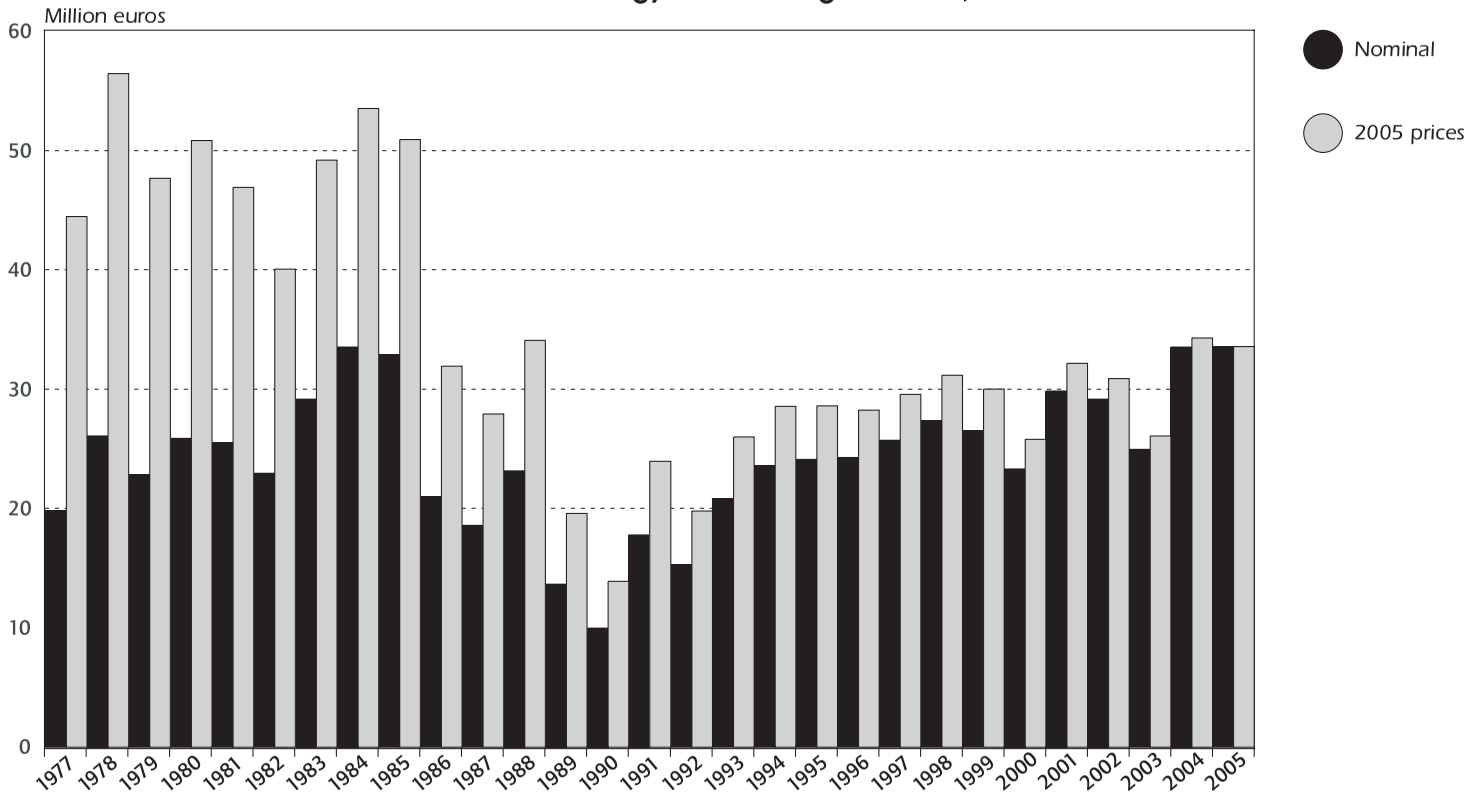
To supplement this framework, in late 2005, a strategy process called "e2050" was launched. e2050 aims to develop a long-term strategy for Austrian research on energy technologies; create R&D programmes in the areas of technology, infrastructure and framework conditions; and align existing funding instruments in the fields of basic research, industrial research, technology development, demonstration and regional implementation. This process resulted in the creation of the Energy for the Future programme in 2007 (see Major Programmes below).

FUNDING

Energy R&D funding has generally increased since 1989, but it is still below real funding levels of the mid-1980s. Total public funding in 2005 stood at EUR 33.6 million, divided among a number of programmes and institutions. Total public and private funding together is estimated to be around EUR 150 to EUR 200 million per year, but no reliable data are available for private-sector R&D funding. Austrian energy R&D has greatly benefited from integration with EU-funded programmes, which enable Austrian institutions to access funding streams other than the domestic ones. Figure 22 shows the development of government funding for energy R&D in both nominal and real terms from 1977 to 2005.

Figure 22

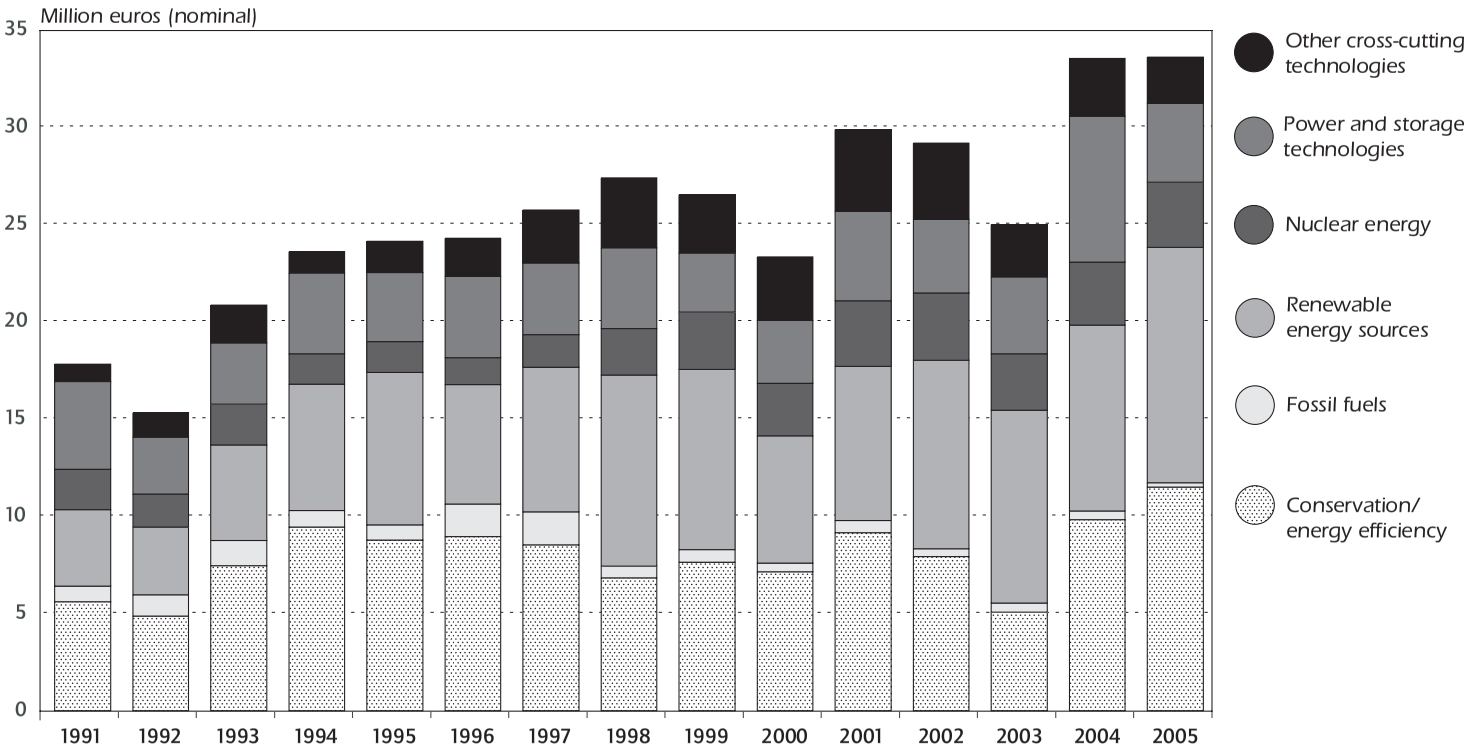
Government Energy R&D Funding in Austria, 1977 to 2005



Source: Country submission.

Figure 23

Changes in Government Energy R&D Funding Composition in Austria, 1991 to 2005



Source: BMVIT.

Table 30

Share of Specific Research Areas' Funding Allocation, 2004 and 2005

	2004	*2005*
Energy Efficiency		
Buildings	41%	47%
Transport[1]	35%	33%
Others	24%	20%
Renewables		
Bioenergy	75%	78%
Solar energy	15%	15%
Others	10%	7%

1. Includes alternative fuels.

Source: Government submission.

Total funding for energy R&D in Austria is not high by comparison to other IEA countries. Austria ranks 14th out of 26 IEA member countries in terms of total spending, and 11th when nuclear energy R&D is not taken into account. The Austrian government is aware of this, and is planning to triple the public funds available for energy R&D between now and 2010.

Approximately 61% of actual public funding is direct funding, while 39% is indirectly funded by government-supported institutions such as universities. The federal government spent EUR 13.3 million directly, 63% of which was spent by the BMVIT, and 13% by the BMWA. The two universities of Vienna and Graz spent EUR 10 million together, while another EUR 3.9 million was spent by the states. The remainder of public spending came from the Austrian Research Support Association (FFG) and similar programmes.

Austria's priorities for public energy R&D are energy efficiency and renewables, both of which receive roughly one-third of available public funding. This is reflected in the breakdown of public funding as explained below. The breakdown indicates that publicly financed energy R&D tends to focus on short- and mid-term R&D areas, with particular importance given to market deployment and opportunities with strong export potential. Table 31 shows how spending breaks down further by specific research areas.

Table 31

Breakdown of Public R&D Funding in Austria, 2004 and 2005

Research areas under the IEA code	*Budget 2004 (million EUR)*	*Budget 2005 (million EUR)*	*Change 2005/2004*
Conservation	9.84	11.50	16.90%
Fossil fuels	0.46	0.23	–50.0 %
Renewables	9.53	12.10	+26.9 %
Nuclear	3.22	3.33	+3.3 %
Generation, transmission, storage	7.51	4.08	–45.7 %
Cross-cutting technologies	2.97	2.37	–20.3 %
Total	**33.53**	**33.61**	**+0.2 %**

Source: Ministry of Transport, Technology and Innovation.

Table 32

Public Funding in Energy R&D by Sector, 2004 and 2005[1]

Year	*Basic research*	*Applied research*	*Experimental development*
2004	16%	61%	23%
2005	15%	65%	20%

1. Based on the definitions in the OECD's *Frascati Manual*.
Source: Government submission.

MAJOR PROGRAMMES

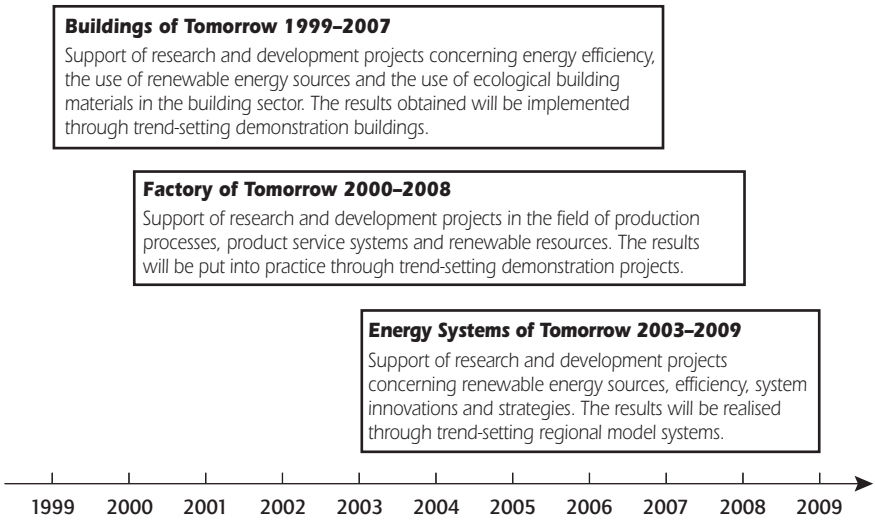
AUSTRIAN PROGRAMME ON TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

This innovative research and technology programme was developed by the BMVIT and the current phase will be concluded in 2008. The programme has now been superseded by *Energy for the Future*, which is a joint programme of BMVIT and BMWA for the years 2007 to 2010. While the ongoing projects will continue to run up to 2010, no new calls for tender will be held after 2008.

The programme is owned and financed by the BMVIT and carried out by FFG. It initiated and supported trend-setting research and development projects and the implementation of exemplary pilot projects. The programme pursued clearly defined emphases, selecting projects by means of tendering procedures and it was characterised by networking between individual research projects and by accompanying project management. All sectors except fossil fuels, transportation and nuclear energy issues were covered

Figure 24

Structure of the Austrian Programme on Technologies for Sustainable Development



Sources: Country submission.

in this programme. The ministry and FFG invited tenders in three sub-programmes, all of which are described in more detail below:

- *Buildings of Tomorrow*
- *Factory of Tomorrow and*
- *Energy Systems of Tomorrow.*

The most important element of the programme in terms of funding and number of projects is the **Buildings of Tomorrow** sub-programme. Under this stream, five calls for proposals were held from 1999 to March 2007, which led to around 200 projects being financed with a total of EUR 25 million. The sub-programme has led to significant innovation and the construction of demonstration projects, including the introduction of façade solar collectors with multiple functions such as thermal absorption, improved insulation, weather protection for the façade, and an attractive design.

The **Energy Systems of Tomorrow** element of the programme had a total budget of EUR 14 million, and funded about 130 projects from 2003 to 2006. On average four partners were involved per project, and the sub-

Box 7

The Schiestlhaus and Sustainable Güssing Selected Results from the Austrian Programme on Technologies for Sustainable Development

Schiestlhaus

One of the most important projects in *Buildings of Tomorrow* is the Schiestlhaus, an ecologically designed Alpine protection hut for up to 70 people, owned by the Austrian Tourist Club. It is located in Styria in the eastern Alps, at 2 154 metres above sea level. The original building was 120 years old and had to be replaced because of deterioration. The area in which the building is located is not connected to any infrastructure, not accessible by road, and ecologically sensitive. The building is in use from May to October. Construction requirements included the ability to withstand extreme wind and snow loads.

The building maintenance is fully independent, collecting rain water from the roof, producing warm water through flat thermal collectors integrated in the façade, and electricity by 70 m^2 of façade integrated photovoltaic panels. Power can be stored to provide electricity during dark hours. Drinking water is provided by rainwater collection and purification.

The development of an overall integrated system to meet this range of specifications required close co-operation between designers, planners, and professionals as well as networking between research and practice. The realisation of the Schiestlhaus created a prototype for solar and ecological building construction in isolated alpine locations, and enabled the project partners to test a range of sustainable technologies as well as a sophisticated concept for the structures to work under extreme conditions. The solutions and findings resulting from this project may be adapted not only for other building projects in alpine conditions, but also more generally for other passive house buildings.

Sustainable Community Model Güssing

One of the most important projects in *Energy Systems of Tomorrow* was the sustainable community model of Güssing, a small town with 4 000 inhabitants in Burgenland. This is a demonstration project focusing on the creation of a fully sustainable energy supply, which will now be extended within the region. The town is the centre of a region with 27 000 inhabitants. It is located in Burgenland, which in 1988 was the poorest region in Austria. The region relied heavily on imports of fossil energy while the resources available in the region (mainly wood and agricultural plants) were underused, leading to neglect of forests and arable land.

In 1993 the municipal council decided to substitute fossil fuels with renewable energy by the end of 2000. The construction of the then largest district heating plant of Austria of a biodiesel (canola) plant and an electric power plant entirely based on renewable energy followed. The driving force behind all of these efforts was the town council of Güssing which participated in the investment. To secure the supply of wood, professional biomass logistics were established which include long-term contracts with the wood association of Burgenland and various farmers. As a result, the two largest parquet producing corporations of Austria and other companies have moved to Güssing and created more than 1 000 new jobs.

Energy supply in Güssing is now achieved exclusively with regional, renewable resources, and the project features the demonstration of polygeneration of heat, power and liquid biofuels, using thermal gasification as base technology. The most challenging technological aspect was the integration of biogas into the natural gas grid, for which highly innovative gas cleaning technologies had to be developed. While the project has been running since the early 1990s, *Energy Systems of Tomorrow* supported the key development of a new biomass steam gasification process invented at the Technical University of Vienna, which allows the production of electricity and synthetic fuels from wood chips.

Today the town is capable of producing 100% of the heat, electricity and biodiesel it consumes. Güssing hosts an important renewable energy research centre where research includes projects relating to hydrogen-rich gas in fuel cells, or the production of methane and other fuels. Large European corporations like VW, Daimler Chrysler, Renault and Volvo are partners in the research programme.

programme had a high participation rate by industry. Its priority was in the area of biomass, with a particular emphasis on biogas, as well as the integration of distributed generation and renewables.

The **Factory of Tomorrow** sub-programme contains some energy-related research areas such as aiming at zero-waste and zero-emission technologies and methods of production, as well as the increased use of renewable energy. The programme was launched in 2001. There have been 120 energy-related projects financed since 2002 with a budget of EUR 15 million. Particularly interesting projects are the development of a new technology for biodiesel production based on an enzymatic process and the use of solar heat for industrial processes. There is strong potential for solar heat in the food and textile processes as well as niche sectors such as electroplating.

The smaller sub-programme, *A3 (Austrian Advanced Automotive)*, finances R&D projects in the field of new propulsion systems, energy-efficient auxiliary devices, and alternative fuel use in vehicles. In four calls, a total of 77 projects were supported out of 152 applications. The total finance volume was

Box 8

Energy for the Future

Based on the results from the programme on Technologies for Sustainable Development and the energy strategy process e2050, run by the BMVIT and the BMWA, the energy and technology research programme, Energy for the Future, was created in 2007. The aim of the programme is to support high-quality technology R&D projects that are in line with the programme goals by conducting regular calls for proposals. The programme is managed by the Austrian Research Support Association FFG. The first call for proposals was held in June 2007 with a budget of EUR 20 million.

Programme Goals

The programme is based on three fundamental pillars: efficient energy use; renewable energy sources; and intelligent energy systems. Priority is given to research areas that address more than one of these pillars. Based on these pillars, two fundamental objectives have been developed:

Increasing Competitiveness

- Protection of the economic base.
- Improvement of R&D quality.

Societal Concerns

- Sustainable energy systems.
- Reduction of climate impacts.

To address these goals, the programme is focusing on the following thematic areas:

- Energy systems and networks.
- Advanced biogenic fuel production (biorefineries).
- Energy use in industry and commerce.
- Energy use in buildings.
- End-use of energy.
- Advanced combustion and conversion technologies.
- Foresight and cross-cutting strategic questions.

Programme Strategy

The experience with the *Buildings of Tomorrow* and *Energy Systems of Tomorrow* programmes underpinned the need for clear direction and continuous development of key technologies in order to achieve noticeable effects. The new programme, therefore, aims at ambitious ideas and

concepts with a long-term perspective, which can be moved towards market readiness through R&D and the establishment of demonstration projects. High-risk and pre-market technologies with strong potential are also included. A particular focus will be on projects which move basic research results towards piloting and demonstration, the so-called "Innovation Lighthouses". In addition, longer-term development from concept to pilot installations is supported through project financing over a long period. This programme is also designed to address broader social issues and to generate knowledge for long-term energy planning. This includes the evaluation of climate effects in the long term, user behaviour, social change, and transparent analysis of costs, in particular for those measures and strategies requiring significant government investment.

Calls for Proposals

Focused and application-oriented calls for proposals are the means by which the programme strategy will be implemented. It is planned to hold these calls twice a year. Project selection will be based on transparent evaluation by an international jury.

Accompanying Measures

The programme will be accompanied by measures to support the development of innovative projects, create networks of R&D activities, and enable efficient transfer of results. Examples include competitions, foundation initiatives to help new companies use research results to establish themselves in the market, together with educational measures, such as training courses. European energy R&D networks such as ERA-Nets will also be taken into account, particularly with the aim of increasing cross-border activities to further link the European energy R&D landscape.

EUR 39.4 million, including programme support of EUR 20.2 million. Additionally, two leader projects were supported, with a project financing volume of EUR 7.4 million, including programme support of EUR 3.4 million.

INTERNATIONAL COLLABORATION

In international R&D, the two key co-operation mechanisms for Austria are the IEA Implementing Agreements (IA) and the EU Framework Programmes for R&D. Austria participates in 15 IAs, including the IAs on bioenergy, clean coal, and advanced fuel cells. The EU programmes also show a growing influence on institutional environment by creating networks of excellence such as ERA-Net which will reinforce R&D for the long term. Austria is active, for example, in the ERA-Net on bioenergy, in the FENCO-ERA-Net on fossil fuels, in the HY-CO

ERA-Net on hydrogen and fuel cells, and in the PV ERA-Net on photovoltaics. Austria is also participating in various EU-Technology Platforms, such as ZEP Zero-Emission Fossil Fuels, Electricity Networks of the Future (Smart Grids), Photovoltaic Technology Platform, Solar Thermal Technology Platform (ESTTP), Biofuels Technology Platform, Hydrogen and Fuel Cells.

EVALUATION AND MONITORING

The government is evaluating R&D activities in two ways, generally through an annual technology report issued by the BMVIT, and programme-specifically, by conducting public seminars and publicising research results. There are also award competitions for the most important projects in terms of their contribution and innovation.

CRITIQUE

Energy R&D in Austria has been very successful in developing and creating sustainable energy technologies that have turned into exporting industries. For example, Austria now actively exports solar water heating and biomass heating technologies; the passive house concept is also taking hold in other countries. Austrian energy R&D is well embedded in international energy research structures, both through the EU Framework Programmes including the ERA-NET scheme, and through the participation in the IEA Implementing Agreements. Austria continues to lead R&D activities in some fields of the sustainable energy sector, for example biomass gasification technologies.

The government has developed a new research strategy for the energy sector called *Energy for the Future*, and has proposed a tripling of the R&D budget in the energy sector by 2010. Also, the government has announced an additional public-private partnership to establish a EUR 500 million "Energy and Climate Protection Fund" to support energy R&D in renewables and energy efficiency, as well as market demonstration and deployment, spread over four years, and split evenly between energy research, transportation research, and implementing measures. Care should be taken that the money available is spent on relevant projects in a cost-effective manner, and that the R&D capacity is built up in a sustainable way to allow the best possible use of increased funding.

Austria is experiencing a shortage of human resources in the energy field, and investment should be expanded to address this problem. Efforts should also be made to ensure sufficient R&D capacity, and this could also be pursued by further international integration, taking advantage of foreign expertise in research areas of interest to Austria. The international aim of the new R&D programme in this area is, therefore, commended.

While Austrian energy RD&D has traditionally been technology-focused, it will be important to consider integrating it to some extent with social science research in future, to ensure continued relevance and ease of deployment of newly developed technologies. The new programme, *Energy for the Future*, is commendably taking this into account. Care should, however, be taken to make sure that such integration is not to the detriment of funding for technological developments. It will also be necessary to regularly review and ensure the correct alignment of Austrian energy R&D with overall policy goals.

Austria is focusing energy R&D strongly on renewables and, consequently, fossil fuel-related technologies are not primary areas for energy RD&D at the moment. This will, however, become more important with the increasing capacity of fossil-fuel power generation, and also as a backup should the renewables targets fail to be achieved. Of particular interest would be the combination with enhanced oil recovery (EOR) in the declining Austrian and Hungarian oil and gas fields, as well as the potential combination with the refinery Schwechat, Austria's largest CO_2 emitter.

Austrian energy R&D is well integrated in the international collaboration efforts shown, for example, by the country's participation in 15 IEA IAs. Austrian institutions also lead many European energy R&D projects. This is highly commendable.

RECOMMENDATIONS

The government of Austria should:

- *Utilise the proposed increase in the RD&D budget to maximise the chances of reaching the goals in the government programme, in particular in energy efficiency and renewables.*
- *Consider aligning the focus of public R&D funding with the projections for future energy mix, keeping in mind the need for diversification.*
- *Ensure continued focus of energy R&D spending on technology research, including bringing technologies to market, and support this through appropriate regulations.*
- *Ensure continued monitoring and evaluation of the effectiveness of energy R&D.*

ORGANISATION OF THE REVIEW

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 C.

REVIEW TEAM

The in-depth review team visited Vienna and the Simmering Biomass CHP Plant from 19 to 23 February 2007. During the visit, the team met with government administrators, energy suppliers and various other organisations and interest groups, and addressed the major issues relating to the country's energy situation.

The team is grateful for the co-operation and assistance of the many people it met during its visit. Thanks to their willingness to share information and their open hospitality, the visit was both highly productive and enjoyable. The team wishes to make special mention of the understanding and courteous professionalism displayed by our colleagues at the Ministry of Economics and Labour in preparing and accompanying the visit.

The members of the team were:

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Andreas Biermann managed the review and drafted the report with the exception of the energy and environment chapter, which was drafted by Miika Tomilla. Monica Petit and Bertrand Sadin prepared the figures. Marilyn Ferris provided editorial assistance.

ORGANISATIONS VISITED

- Association of Austrian Petroleum Industry
- Association of Austrian Electricity Industry
- Austrian Energy Agency
- Association of Gas and District Heating Companies
- Austrian Institute of Economic Research
- Austrian Small Hydro Association
- City of Linz
- E-Control GmbH
- E-Control Council
- Federal Chamber of Labour
- Federal Chancellery
- Federal Competition Commission
- Federal Ministry of Economics and Labour
- Federal Ministry of the Environment
- Federal Ministry of Finance
- Federal Ministry of Transport, Technology and Innovation
- Federation of Trade Unions
- Liaison Office of the Federal States
- Ökostrom AG
- OMV
- Representatives of the Länder
- Statistics Austria
- Verbund

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2004	2005	2010	2020	2030
TOTAL PRODUCTION		**7.9**	**8.1**	**10.0**	**9.8**	**10.8**	**11.1**	**..**
Coal[1]		1.0	0.6	0.1	–	0.0	0.1	..
Oil		2.7	1.2	1.1	1.0	0.9	0.6	..
Gas		2.0	1.1	1.7	1.4	1.6	1.3	..
Comb. Renewables & Waste[2]		0.7	2.4	3.9	4.1	4.7	5.6	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.1	3.1	3.1	3.0	..
Geothermal		–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other[3]		–	0.0	0.2	0.2	0.4	0.5	..
TOTAL NET IMPORTS[4]		**14.0**	**17.3**	**23.6**	**24.8**	**23.5**	**25.0**	**..**
Coal[1]	Exports	0.1	0.0	0.1	0.0	–	–	..
	Imports	3.1	3.2	4.0	4.0	4.0	4.8	..
	Net Imports	3.0	3.2	3.9	4.0	4.0	4.8	..
Oil	Exports	0.1	0.6	1.6	2.2	1.7	1.7	..
	Imports	9.9	10.2	15.2	15.6	14.6	15.1	..
	Bunkers	–	–	–	–	–	–	..
	Net Imports	9.7	9.6	13.6	13.4	13.0	13.4	..
Gas	Exports	–	–	1.3	0.8	0.9	0.9	..
	Imports	1.3	4.4	7.1	8.1	7.1	7.7	..
	Net Imports	1.3	4.4	5.9	7.3	6.3	6.8	..
Electricity	Exports	0.4	0.6	1.2	1.5	1.1	1.1	..
	Imports	0.3	0.6	1.4	1.8	1.4	2.0	..
	Net Imports	–0.1	–0.0	0.3	0.2	0.2	0.9	..
TOTAL STOCK CHANGES		**–0.3**	**–0.3**	**–0.3**	**–0.2**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**21.7**	**25.1**	**33.3**	**34.4**	**34.3**	**36.1**	**..**
Coal[1]		3.9	4.1	4.1	4.1	4.1	4.9	..
Oil		12.3	10.6	14.3	14.5	13.8	14.0	..
Gas		3.3	5.2	7.5	8.3	7.9	8.1	..
Comb. Renewables & Waste[2]		0.7	2.5	3.8	4.0	4.7	4.7	..
Nuclear		–	–	–	–	–	–	..
Hydro		1.6	2.7	3.1	3.1	3.1	3.0	..
Geothermal		–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other[3]		–	0.0	0.2	0.2	0.4	0.5	..
Electricity Trade[5]		–0.1	–0.0	0.3	0.2	0.2	0.9	..
Shares (%)								
Coal		*17.9*	*16.3*	*12.2*	*11.8*	*11.8*	*13.5*	..
Oil		*56.7*	*42.4*	*43.0*	*42.2*	*40.3*	*38.6*	..
Gas		*15.3*	*20.7*	*22.4*	*24.0*	*23.0*	*22.5*	..
Comb. Renewables & Waste		*3.3*	*9.8*	*11.6*	*11.6*	*13.8*	*13.1*	..
Nuclear		–	–	–	–	–	–	..
Hydro		*7.5*	*10.8*	*9.4*	*9.0*	*9.2*	*8.3*	..
Geothermal		–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Solar/Wind/Other		–	*0.1*	*0.5*	*0.6*	*1.2*	*1.3*	..
Electricity Trade		*–0.6*	*–0.2*	*0.8*	*0.7*	*0.7*	*2.5*	..

0 is negligible. – is nil, .. is not available.
All forecasts are based on the 2005 submission.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2004	2005	2010	2020	2030
TFC	**16.8**	**20.0**	**27.3**	**28.2**	**30.1**	**32.7**	..
Coal[1]	2.0	1.3	0.7	0.6	1.9	1.9	..
Oil	10.2	9.2	13.0	13.3	12.4	12.3	..
Gas	1.8	3.1	4.7	5.1	5.1	5.8	..
Comb. Renewables & Waste[2]	0.7	2.2	2.8	2.9	3.3	3.0	..
Geothermal	–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	0.0	0.1	0.1	–	–	..
Electricity	2.2	3.7	4.8	4.9	5.9	7.7	..
Heat	–	0.6	1.2	1.3	1.5	1.9	..
Shares (%)							
Coal	*11.8*	*6.3*	*2.5*	*2.3*	*6.3*	*5.7*	..
Oil	*60.4*	*46.1*	*47.6*	*47.2*	*41.2*	*37.7*	..
Gas	*10.7*	*15.2*	*17.3*	*18.0*	*17.1*	*17.8*	..
Comb. Renewables & Waste	*4.1*	*10.8*	*10.2*	*10.3*	*10.9*	*9.2*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.3*	*0.3*	–	–	..
Electricity	*12.9*	*18.4*	*17.6*	*17.4*	*19.5*	*23.7*	..
Heat	–	*3.1*	*4.5*	*4.5*	*5.0*	*5.9*	..
TOTAL INDUSTRY[6]	**6.5**	**6.9**	**9.0**	**9.2**	**10.6**	**11.2**	..
Coal[1]	0.7	0.6	0.5	0.5	1.8	1.8	..
Oil	3.3	2.1	2.9	2.8	2.7	2.7	..
Gas	1.3	2.0	2.4	2.7	2.8	3.3	..
Comb. Renewables & Waste[2]	0.0	0.6	1.0	1.0	1.1	0.9	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	1.0	1.5	2.0	2.1	2.1	2.3	..
Heat	–	0.1	0.2	0.2	0.2	0.2	..
Shares (%)							
Coal	*11.5*	*8.5*	*5.7*	*5.2*	*16.7*	*16.2*	..
Oil	*51.7*	*30.6*	*32.1*	*30.4*	*25.2*	*24.0*	..
Gas	*20.2*	*28.7*	*26.8*	*29.7*	*26.1*	*29.6*	..
Comb. Renewables & Waste	*0.5*	*8.8*	*10.9*	*10.4*	*9.9*	*7.6*	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	–	–	–	–	–	..
Electricity	*16.1*	*22.3*	*22.6*	*22.6*	*20.0*	*20.4*	..
Heat	–	*1.1*	*1.9*	*1.8*	*2.0*	*2.1*	..
TRANSPORT	**4.0**	**4.9**	**8.0**	**8.4**	**7.8**	**7.9**	..
TOTAL OTHER SECTORS[7]	**6.3**	**8.2**	**10.3**	**10.6**	**11.6**	**13.6**	..
Coal[1]	1.1	0.7	0.2	0.2	0.1	0.1	..
Oil	3.1	2.6	2.5	2.7	2.7	2.3	..
Gas	0.5	1.0	2.1	2.1	2.1	2.2	..
Comb. Renewables & Waste[2]	0.7	1.6	1.8	1.9	2.0	2.1	..
Geothermal	–	0.0	0.0	0.0	0.0	0.0	..
Solar/Wind/Other	–	0.0	0.1	0.1	–	–	..
Electricity	1.0	1.9	2.5	2.5	3.4	5.1	..
Heat	–	0.5	1.1	1.1	1.3	1.7	..
Shares (%)							
Coal	*17.9*	*8.3*	*1.6*	*1.6*	*1.0*	*0.4*	..
Oil	*48.6*	*31.2*	*24.8*	*25.2*	*23.0*	*16.9*	..
Gas	*7.6*	*11.8*	*20.7*	*19.9*	*18.4*	*16.5*	..
Comb. Renewables & Waste	*10.3*	*18.9*	*17.4*	*18.0*	*16.8*	*15.8*	..
Geothermal	–	–	*0.1*	*0.1*	*0.1*	*0.1*	..
Solar/Wind/Other	–	*0.2*	*0.8*	*0.9*	–	–	..
Electricity	*15.6*	*23.0*	*24.3*	*24.0*	*29.7*	*37.8*	..
Heat	–	*6.5*	*10.3*	*10.4*	*11.1*	*12.5*	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2004	2005	2010	2020	2030
ELECTRICITY GENERATION[8]							
INPUT (Mtoe)	**4.9**	**7.1**	**9.3**	**9.5**	**10.5**	**12.6**	**..**
OUTPUT (Mtoe)	**2.7**	**4.2**	**5.3**	**5.4**	**6.3**	**7.7**	**..**
(TWh gross)	30.9	49.3	61.6	63.0	73.4	89.4	..
Output Shares (%)							
Coal	*10.3*	*14.2*	*14.8*	*13.5*	*12.3*	*19.0*	..
Oil	*14.1*	*3.8*	*2.9*	*2.6*	*0.8*	*0.6*	..
Gas	*14.3*	*15.7*	*17.8*	*20.7*	*27.2*	*27.4*	..
Comb. Renewables & Waste	*0.7*	*2.4*	*3.8*	*4.1*	*3.4*	*7.8*	..
Nuclear	–	–	–	–	–	–	..
Hydro	*60.6*	*63.9*	*59.1*	*57.0*	*49.8*	*39.1*	..
Geothermal	–	–	*0.0*	*0.0*	*0.0*	*0.0*	..
Solar/Wind/Other	–	–	*1.5*	*2.1*	*6.4*	*6.0*	..
TOTAL LOSSES	**4.7**	**5.0**	**5.8**	**6.1**	**5.1**	**6.1**	**..**
of which:							
Electricity and Heat Generation[9]	2.2	2.2	2.7	2.7	2.6	2.9	..
Other Transformation	1.3	0.6	0.8	0.9	0.1	0.1	..
Own Use and Losses[10]	1.2	2.2	2.4	2.6	2.4	3.0	..
Statistical Differences	**0.1**	**0.0**	**0.1**	**0.1**	**–0.9**	**–2.6**	**..**

INDICATORS

	1973	1990	2004	2005	2010	2020	2030
GDP (billion 2000 USD)	98.97	150.67	204.14	208.31	229.99	280.36	..
Population (millions)	7.59	7.68	8.18	8.23	8.25	8.34	..
TPES/GDP[11]	0.22	0.17	0.16	0.16	0.15	0.13	..
Energy Production/TPES	0.37	0.32	0.30	0.29	0.32	0.31	..
Per Capita TPES[12]	2.85	3.27	4.07	4.17	4.16	4.33	..
Oil Supply/GDP[11]	0.12	0.07	0.07	0.07	0.06	0.05	..
TFC/GDP[11]	0.17	0.13	0.13	0.14	0.13	0.12	..
Per Capita TFC[12]	2.22	2.61	3.34	3.42	3.64	3.92	..
Energy-related CO_2 Emissions (Mt CO2)[13]	54.3	57.8	75.5	77.2	74.8	78.9	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.3	0.9	1.5	1.7	1.9	2.3	..

GROWTH RATES (% per year)

	73-79	79-90	90-04	04-05	05-10	10-20	20-30
TPES	1.7	0.4	2.0	3.3	-0.0	0.5	..
Coal	-1.1	1.1	-0.1	0.3	-0.0	1.9	..
Oil	0.8	-1.7	2.1	1.4	-0.9	0.1	..
Gas	4.6	1.7	2.6	10.7	-0.9	0.3	..
Comb. Renewables & Waste	6.3	8.2	3.2	3.6	3.5	0.0	..
Nuclear	–	–	–	–	–	–	..
Hydro	6.7	1.2	1.0	-1.5	0.4	-0.5	..
Geothermal	–	–	16.8	–	-4.4	3.9	..
Solar/Wind/Other	–	–	18.7	24.7	14.4	1.3	..
TFC	2.2	0.4	2.2	3.0	1.3	0.8	..
Electricity Consumption	3.9	2.7	1.9	2.0	3.7	2.8	..
Energy Production	0.2	0.1	1.5	-2.3	2.0	0.2	..
Net Oil Imports	2.7	-1.5	2.5	-1.4	-0.6	0.3	..
GDP	3.0	2.2	2.2	2.0	2.0	2.0	..
Growth in the TPES/GDP Ratio	-1.3	-1.8	-0.2	1.3	-2.0	-1.5	..
Growth in the TFC/GDP Ratio	-0.8	-1.8	0.0	1.0	-0.7	-1.1	..

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

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

1. Coal includes lignite and peat.
2. Combustible renewables and waste comprises solid biomass, liquid biomass, biogas, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Other includes ambient heat used in heat pumps.
4. Total net imports include combustible renewables and waste.
5. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
6. Industry includes non-energy use.
7. Other Sectors includes residential, commercial, public service, agricultural, fishing and other non-specified 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 main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 10% for geothermal and 100% for hydro and photovoltaic.
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 2000 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 2005 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.

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 27 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 hydropower, 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 IEA members wish to retain and improve

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, the Slovak Republic (since November 2007), Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

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.

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.)

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.

AHP	Austrian Hydro Power AG (Verbund).
APG	Austrian Power Grid AG (Verbund).
APT	Austrian Power Trading GmbH (Verbund).
APS	Austrian Power Sales.
AWP	Adria-Wien pipeline.
BMLFUW	Ministry of Agriculture, Forestry, Environment and Water Management.
BMVIT	Ministry of Transport, Technology and Innovation.
BMWA	Ministry of Economics 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.
EC	European Commission.
ECT	Energy Charter Treaty.

EEA	European Energy Agency.
ELG	Erdöl-Lagergesellschaft.
EOR	enhanced oil recovery.
EPER	European Pollutant Emission Register.
Euro	European currency (€). On average in 2006, one euro = USD 1.255.
FFG	Austrian Research Support Association.
FSU	Former Soviet Union.
GDP	gross domestic product.
GHG	greenhouse gas.
GJ	gigajoule, or 1 joule $\times 10^9$.
GW	gigawatt, or 1 watt $\times 10^9$.
GWh	gigawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^9$.
HM	heavy metals.
IA	Implementing Agreement.
IEA	International Energy Agency whose members are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, the Slovak Republic (since November 2007), 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	International 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.

kt	kilotonnes
kt CO_{2-eq}.	kilotonnes CO_2 equivalent
kV	kilovolts
kWh	kilowatt-hour, or one kilowatt x one hour, or one watt $\times$ one hour $\times 10^3$.
LDC	local distribution company.
LTA	long-term agreement.
mcm	million cubic metres.
MBtu	million British thermal units.
MoU	Memorandum of Understanding.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
Mt $CO_{2-eq.}$	million tonnes of carbon dioxide equivalent.
MW	megawatt of electricity, or 1 Watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.
NAP	National Allocation Plan.
NEC	National Emissions Ceiling.
NISA	National Emissions Inventory System.
NO_x	nitrogen oxides.
OECD	Organisation for Economic Co-operation and Develpment.
PJ	petajoule, or 1 Joule $\times 10^{15}$.
PM	particulate matter.
POPs	persistent organic pollutants
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.
RES	renewable energy sources.
SAVE	European Union Energy Efficiency Programme.

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 gas pipeline.
TAL	Trans-Austria oil pipeline.
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 1 watt $\times$ 10^{12}.
TWh	terawatt $\times$ one hour, or one watt x one hour $\times$ 10^{12}.
UGS	underground storage (of natural gas).
UN	the United Nations Organisation.
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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