AUSTRIAN ENERGY AGENCY

Energy efficiency trends and policies in Austria

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TABLE OF CONTENT

LIST OF FIGURES

List of tables

EXECUTIVE SUMMARY

In 2016, Austria's final energy consumption amounted to 1,145.9 PJ – a 18.3% increase compared to 2000. The main drivers for the increase are a rise in final energy consumption in the transport sector (+31.7%) and consumption in the industry sector (+25.9%) over this period. Final consumption also rose in the residential sector (+3.0%). However, final consumption of households, which is adjusted for climatic influences, remained stable in the period under review (-0.6%).

In 2016, the transport sector had the highest share of total final consumption with 33.6%, slightly followed by the industry sector with a share of 30.9% in final energy consumption. Private households recorded a share of 23.7%, services 9.9% and agriculture 1.9%.

In Austria fossil fuels are the main energy source: oil is number one with a share of 36.2% of gross domestic consumption, followed by gas (20.9%) and coal (8.8%). The obligation to add more biofuels to fossil fuels and the increased generation of district heating from biomass have resulted in a record high use of renewable energy sources in Austria. Renewable energy sources account for 29.9% gross domestic consumption, with solid biomass being the most important renewable energy source (39%), followed by hydro power (33%). Other renewable energy sources include solar, wind, geothermal energy, biogas and biofuels with a share lower than 5% each. Austria has adopted a policy that rules out the use of nuclear energy in its energy mix. Electricity consumption continues to rise. In 2016 final electricity consumption amounted to 61,851 GWh, an increase by 21.5% compared with 2000.

The energy intensities (climate corrected) do not show very substantial changes in the period 2000-2016: Primary energy intensity fell by 7.5%, while final energy intensity decreased by 6.9%.

Overall energy efficiency (ODEX indicator) improved by 20% between 2000 and 2016. Most of the efficiency improvements were achieved in the households (32%) and tertiary (30%) sectors. Energy efficiency in the industry sector rose by 16%, and by 9% in the transport sector.

In general, it can be stated that improvements in energy efficiency have been partly offset or even exceeded by higher levels of activity. For example, the transport performance of passenger transport in cars (pkm) has risen by 21%. The transport performance of freight transport (road + rail + river) has increased by 34%. The stock of cars increased by 26% and freight traffic on road (tkm) increased by 37% between 2000 and 2016. Thus, the enhanced engine technology of vehicles is offset by an increase in transport performance. Furthermore, the stock of permanently occupied dwellings (+18%), the average floor area of dwellings (+10%) and the saturation rate of electrical household appliances (dish-washers: +73%, dryers: +190%) and new technical features such as air conditioning (+336%) counteract the positive effects of more efficient buildings.

The Austrian government assumes that fuel tourism with vehicles from neighboring countries taking advantage of the comparatively lower tax rate for transport fuels, accounts for much of this increase in the transport sector. It is estimated that net fuel tourism accounted for roughly 23% of total diesel and petrol sold in Austria in 2016.

1. ECONOMIC AND ENERGY EFFICIENCY CONTEXT

1.1. ECONOMIC CONTEXT

Chart 2.1 shows the long-term trends of the main macroeconomic indicators GDP, private consumption and value added of industry.

In 2016, Austria's GDP in current national currency amounted to 353.3 thousand million euros. The average growth rate of the GDP has been 3.2% per year since 2000, with the years of highest growth being 2007 (6.0%) and 2006 (5.4%). The average growth rate in the 1990s was considerably higher with 4.6%.

In 2009, the global economy suffered shrinkage for the first time in many decades, caused by the international financial crisis. The Austrian economy did not escape the downward trend and experienced a negative growth rate of -1.9% in 2009. This was the only decrease in GDP in current national currency in a year-on-year comparison since 1976. As a small open economy, Austria had entered a recession caused primarily by falling exports, reflecting the collapse of world trade and shrinking investment.

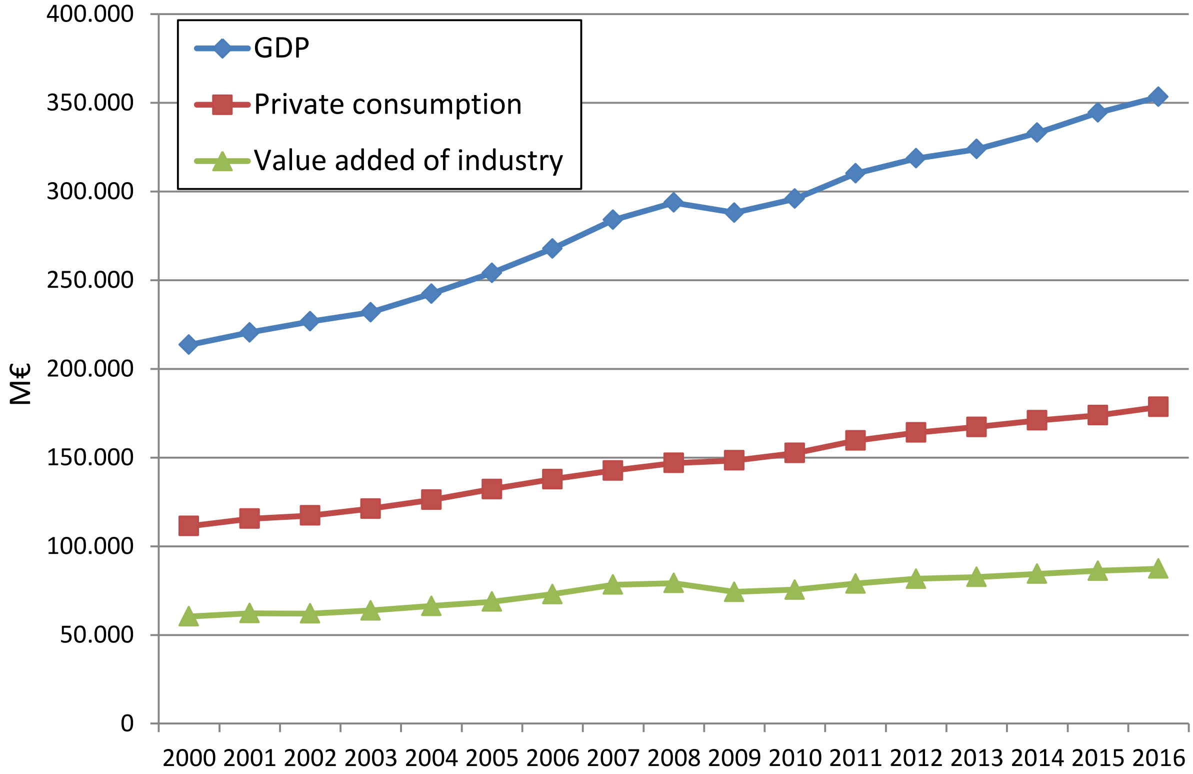
In 2010, the world economy had overcome the cyclical downturn. The Austrian economy, led by a dynamic export growth, recovered modestly with a GDP growth rate of 2.7%. However, the fiscal consolidation in the euro area and weak competitiveness of the southern European economies began to weigh on aggregate demand since 2011.

A similar development as for the total economy was observed in the industry sector: Value added at current market prices of industry increased by an average growth rate of around 2.4% per year in the period 2000-2016. The record growth rate was recorded in 2007 with 7.2%. In 2009, industry had to face a significant recession with a decrease of the value added at a rate of -6.2%. The collapse in the prices for raw materials and weak demand for some time has depressed the general price level. By 2016, the value added has grown again at 17.5% compared to 2009. a. In the year 2016, growth stood at 1.3%.

The private consumption of households (in current national currency) saw an average annual growth of 3.0% per year in the period from 2000 to 2016. In the recession (2009), private consumption rose by 1.0%.

Figure 1: Macroeconomic development (M€ 2010)

Source: Statistics Austria



1.2. TOTAL ENERGY CONSUMPTION AND INTENSITIES

Energy Consumption

Final energy consumption (climate corrected) rose by 16.2% in the period from 2000 to 2016. Figure 2 displays the steady growth trend until 2008. In the period 2000 – 2008 the mean annual growth of total final consumption was 1.6%. In the recession year 2009, total final energy consumption decreased by 3.6%. At 4.4%, the largest reduction for the year 2009 is observed for industry consumption. An average annual growth rate for final consumption of 0.9% is observed for the period 2010-2016.

Figure 2: Final energy consumption by sector 2000 – 2016. The figures for residential consumption are adjusted for climatic influences

Source: ODYSSEE

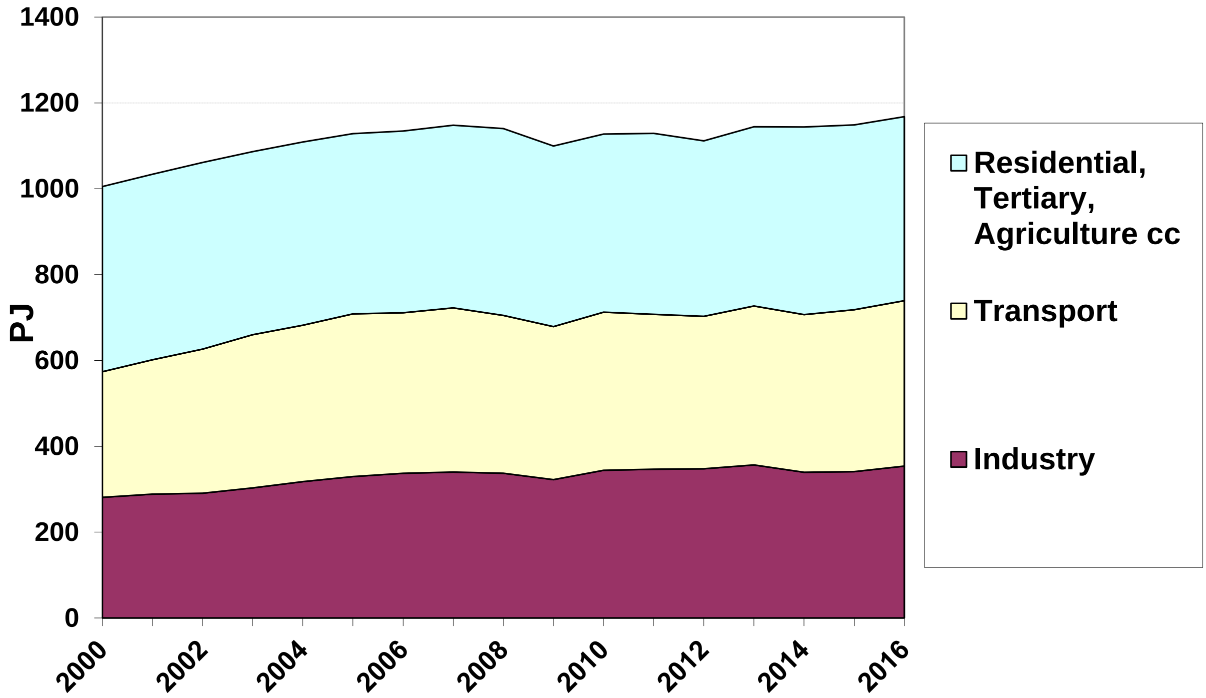
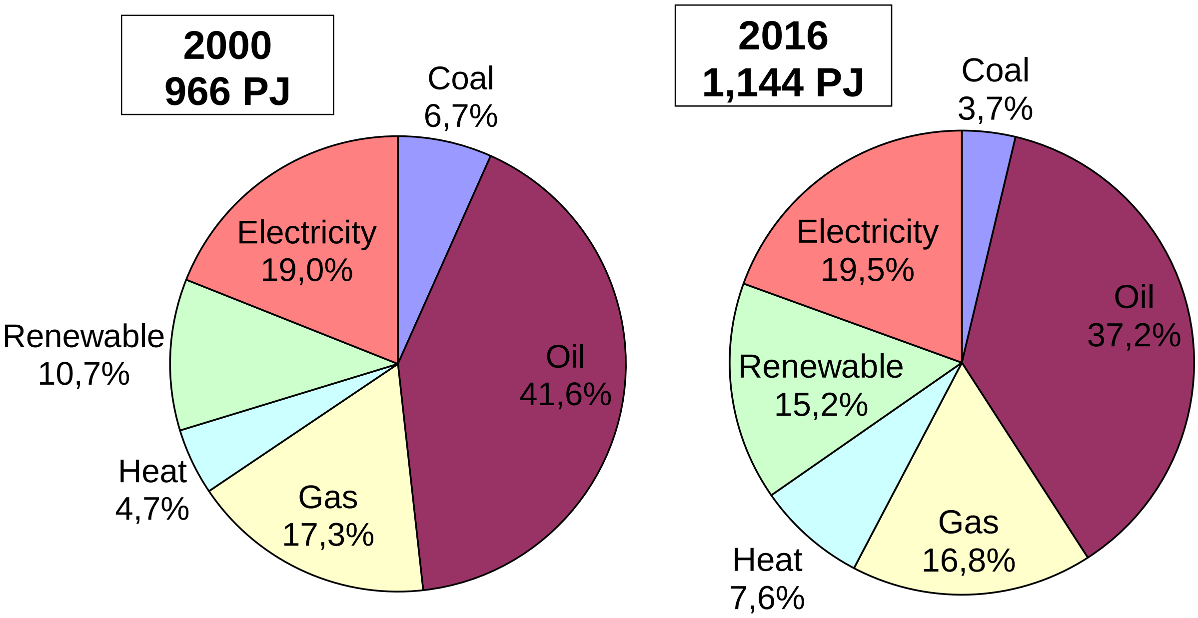


Figure 3 displays the share of the different energy sources in 2000 and 2016 (final consumption which is not climate corrected). Oil products decreased moderately, from 41.6% in 2000 to 37.2% in 2016. The share of electricity in final consumption edged up from 18.8% in 2000 to 19.5% in 2016. The share of natural gas decreased slightly from 19.0% to 19.5%. The drop of coal has continued with a share of 3.7% of the final consumption in 2016 compared to 6.7% in 2000. The share of renewable energy sources for final energy consumption (mainly wood) grew from 10.7% to 15.2%, whereas the share of heat increased to reach 7.6% in 2016 compared to 4.7% in 2000.

Figure 3: Final energy consumption by energy: 2000 and 2016

Source: ODYSSEE



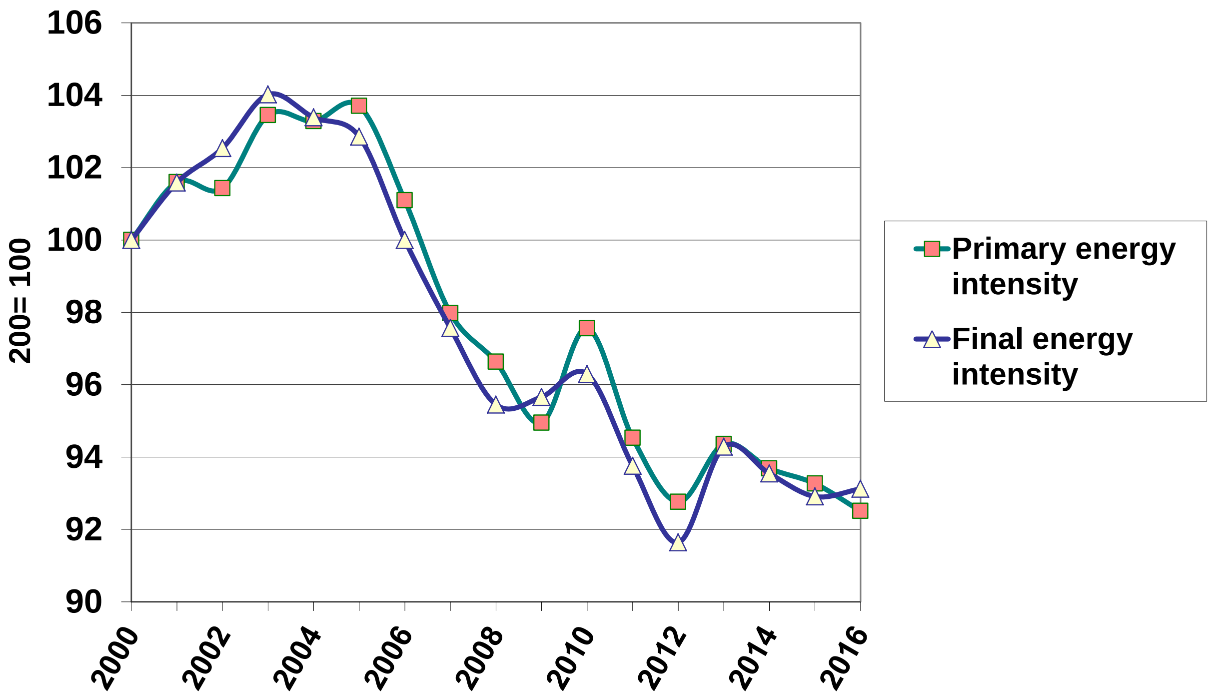
Energy Intensities

The climate corrected primary energy intensity of the Austrian economy decreased during the period from 2000 to 2016 by 7.5%, while the climate corrected final energy intensity decreased by 6.9% in the same period. Both primary and final energy intensity fluctuated, reaching highs in 2003 and 2005 and lows in 2012 (see Figure 4).

In 2016, primary energy intensity with climatic corrections amounted to 0.110 koe/€2010 and final energy intensity with climatic corrections was 0.088 koe/€2010.

Figure 4: Index of primary and final energy intensity of the Austrian economy (climate corrected)

Source: ODYSSEE



It can be observed that between 2000 and 2003 Austria has been one of the countries developing a more energy intensive structure. However, since 2005 energy intensity has shown a strong decrease, a trend which was partly reverted in recent years.

It can be stated that structural changes did not significantly influence final energy intensity – the development of both graphs is more or less parallel, with the exception of the recession years 2008 and 2009 (Figure 5).

Figure 5: Final energy intensity (structural effect)

Source: ODYSSEE

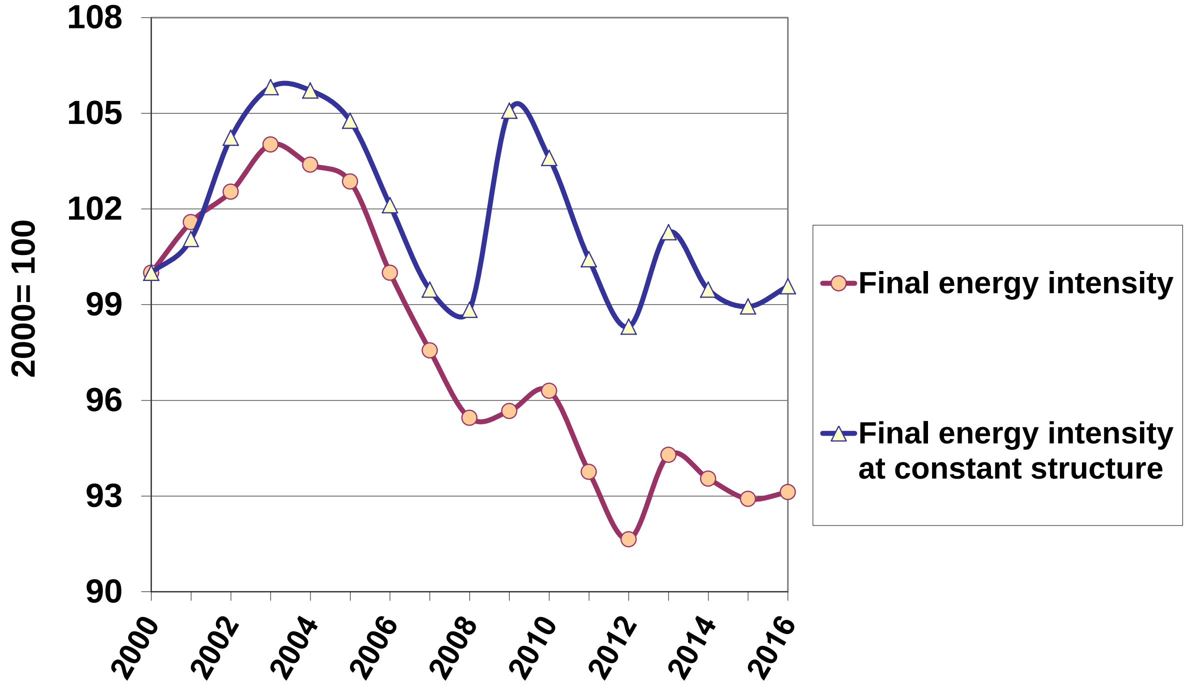
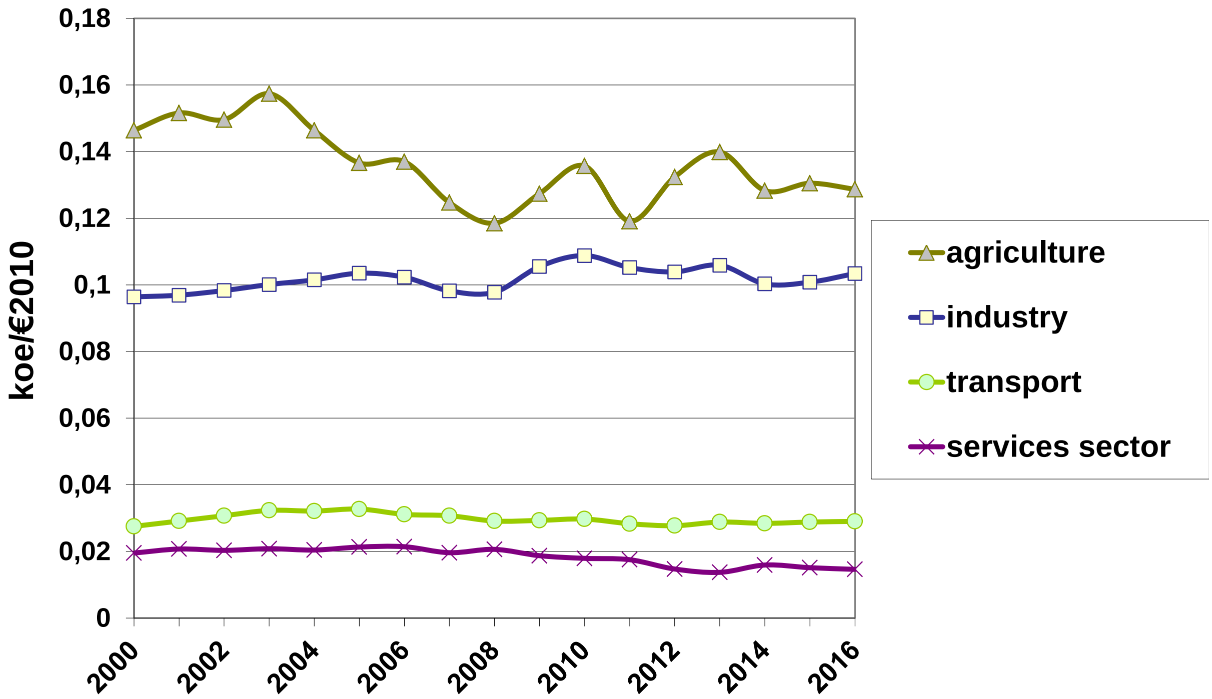


Figure 6: Energy intensity in selected sectors from 2000 to 2016

Source: ODYSSEE



Energy intensity is measured differently in the various sectors. Energy consumption is related to the value added of agriculture, industry and the services sector, while energy intensity for the transport sector is measured by the ratio of final energy usage to total GDP. This means that energy intensity for transport is underrepresented in comparison to the other sectors. Figure 6 shows that final energy intensity in industry (at exchange rate) fluctuated and was higher (+7.3%) at the end of the period observed compared to the beginning. The development of intensity in the transport sector increased by 5.5% over the period under consideration. Intensity in the services sector strongly decreased (-25.1) in the period under review while energy intensity of agriculture decreased by 12.1% between 2000 and 2016.

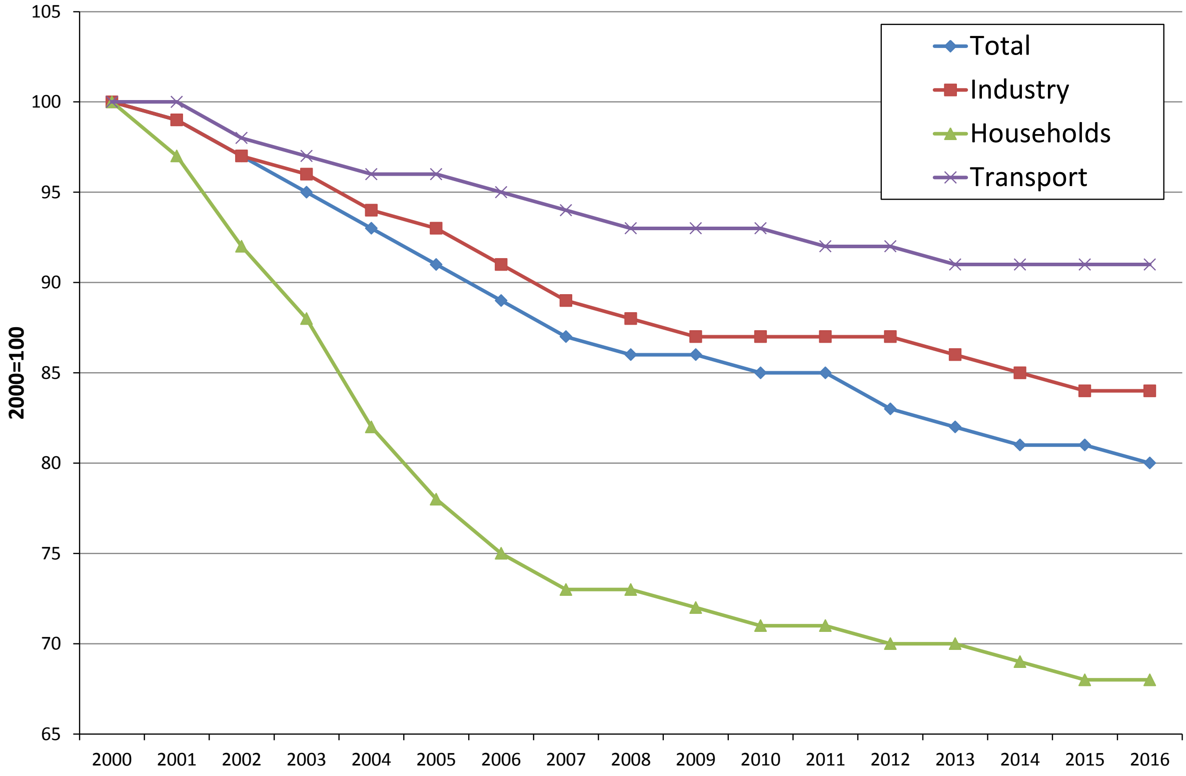
Energy efficiency indicators

Energy efficiency indicators can be used to provide an overall perspective of energy efficiency trends by sector. Such global indicators, which combine the trends of indicators by end-use or sub-sector, are also called “aggregate bottom-up energy efficiency indicators”. They represent a better option to evaluate energy efficiency trends at an aggregate level (e.g. overall economy, industry) than the usual energy intensities, as they are adjusted for structural changes and other factors not related to energy efficiency. The bottom-up approach used for the ODEX indicator first looks at the energy efficiency achievements observed for the main types of energy end-use and appliances, and compiles them into an aggregate bottom-up energy efficiency index (each end-use and appliance being weighted based on their weight in total final consumption). It thus provides a substitute indicator to energy intensities (industry and transport) or unit consumption (per dwelling or per square metre) to describe the overall trends by sector.

As shown in Figure 7, the ODEX indicator for overall energy efficiency improved by 20% between 2000 and 2016, which is a mean annual improvement of 1.4%. Most of the efficiency improvements were achieved in the households sector, which recorded an improvement by 32% within the period from 2000 to 2016. The ODEX indicator for industry shows an overall progress by 16% in the period under review. However, most of the improvement in industry efficiency was recorded in the years until 2007 with an annual average of 1.6% improvement. In the years following the economic crisis, i.e. 2010-2016, the average annual improvement was 0.5%. Efficiency in the transport sector improved rather steadily by 9%.

Figure 7: ODEX Energy efficiency indices by sector from 2000 to 2016

Source: ODYSSEE



1.3. ENERGY EFFICIENCY POLICY BACKGROUND

Austria's energy policy is simultaneously conducted at two levels, the federal level and level of Austria's nine federal provinces. The federal constitution allocates responsibilities either to the federal level (e.g. taxation, metering and emergency supply) or to the joint federal and province level (e.g. energy supply, energy conservation and subsidies). Energy policy is formulated and implemented in close co-operation with the social partner organisations, which represent important groups of society (employers, employees, agriculture).

The main energy policy making is taking place at the federal level in a number of government ministries and institutions. The **Federal Ministry for Sustainability and Tourism** is the main government institution responsible for energy matters at the federal level. This Ministry is also responsible for environmental protection, including climate change and emissions from combustion. The **Federal Ministry for Transport, Innovation and Technology** is responsible for transport policy and energy R&D. The **Federal Ministry of Finance** is responsible for setting energy taxes.

At the regional level, the **governments of the nine federal provinces** have responsibility for policy making, setting subsidy levels, and implementing regulatory control of energy companies.

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 energy institute for Austrian businesses was initiated by the Austrian chamber of commerce and established in 2008.

Two official bodies – the **National Climate Protection Committee** (Nationales Klimaschutzkomitee, NKK) and the **National Climate Protection Advisory Board** (Nationaler Klimaschutzbeirat, NKB) – accompany the implementation of the Austrian Climate Change Act on a continuous basis. The NKK is composed of top representatives of the Federal Government and Provinces and the social partners. The members of the NKB, which has the duty to advise the NKK, include representatives of the parliamentary parties, environmental organisations and science.

The **Austrian Energy Agency** was established by the federal government and states to promote clean energy use in Austria. Besides the Austrian Energy Agency, which acts as a national energy agency, regional institutions performing the tasks of an energy agency exist in all Austrian federal provinces. This corresponds to the important role the federal provinces play in energy policy. In some federal provinces these institutions are incorporated into the administration, in others energy agencies have been formed as legal bodies.

More than 40 Austrian organisations offer energy efficiency information services for consumers. The most prominent of these is the Austrian Energy Agency. 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 and innovative nation-wide campaign is **klimaaktiv**, which is the Austrian government's climate change information and grant programme. The programme is overseen by the Ministry of Sustainability and Tourism, 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 klimaaktiv are designed to support Austria's grant, regulation, and fiscal measures and to give targeted incentives for the use of climate impact-reducing products. klimaaktiv is an innovative add-on to common instruments, introducing target-group oriented programmes in the areas construction and living, mobility, company policies, electricity saving and renewable energy sources. By following a systematic approach, klimaaktiv is determined to effect a breakthrough in the use of climate-friendly technologies and services for increased energy-efficiency and of renewable energy sources, as well as to accrue their market shares. klimaaktiv programmes develop technological and organisational solutions able to compete on the market, take care of innovative quality standards and promote training of all relevant groups. Implementation of the klimaaktiv programmes must be accomplished within set time limits and results in concrete measurable targets. The aim is to widely introduce energy efficient and climate-friendly technologies and services in the fields of construction and living, mobility, company policies, electricity saving and renewable energy sources.

In 2007, the Austrian government funded the **Climate and Energy Fund** (Klima und Energiefonds – KLIEN), which has since its inception delivered clearly visible impetuses for the Austrian Climate Policy and the restructuring of the Austrian Energy System. The Climate and Energy Fund supports R&D in renewable energy and energy efficiency as well as market demonstration and deployment.

Among the best known original programmes of the fund include, among others the model region programme (Climate and Energy Model Regions, Electromobility Model Regions), the model refurbishment programme, the smart cities initiative and the Austrian Climate Research Programme (ACRP). The objective of the Fund is to help Austria reach its climate mitigation targets through the funding of climate- and energy-related projects.

1.3.1. ENERGY EFFICIENCY TARGETS

In Austria, the European Energy Efficiency Directive Act is implemented by the **Austrian Energy Efficiency Act**. Within this act, Austria is increasing its energy efficiency efforts aiming to a final energy consumption of 1050 PJ by 2020. Furthermore, till 2020 cumulative energy savings of 310 PJ have to be achieved. These targets have to be reached by an obligation scheme for energy distributors (with a sales volume > 25 GWh to final energy consumers) contributing with energy efficiency measures up to (cumulative) 159 PJ and by so-called strategic measures by public authorities with up to (cumulative) 151 PJ till 2020. Strategic measures include energy taxes, corporate environmental protection subsidy schemes, refurbishment activities/vouchers, housing and energy subsidies. The Energy Efficiency Act implemented, among others, an energy efficiency obligation system for energy suppliers, mandatory energy management systems or regular energy audits for large companies and renovation of federal buildings. Within the reporting procedures of the EU, Austria reported cumulated total energy efficiency measures of 167 PJ for the years 2014-2016. Austria notified in its reports that energy efficiency measures up to 80 PJ will be achieved till 2020. At this stage, these savings seem to be achievable.

The targets shall be reached by implementation of the following measures (list not exhaustive):

- Energy efficiency obligation system for energy suppliers: energy suppliers selling 25 GWh or more to final customers in Austria have to set energy efficiency measures at their own company or at their own or other final customers between 2015 and 2020. These energy efficiency measures have to lead to energy savings of 0.6% of their energy sales in the previous year to final customers in Austria.
- Energy management in companies that are non-SMEs have to (1) implement an energy management system (according to ISO 16001 or ISO 50001) or an environmental management system (according to ISO 14000) or (2) have to carry out an external energy audit every four years;
- Renovation of federal buildings: energy efficiency measures have to be implemented between 2014 and 2020 in buildings which are owned and used by the federal state, leading to savings of 48.2 GWh. This corresponds to a refurbishment rate of 3% per year. The savings target should especially be achieved through (1) energy performance contracting, (2) measures related to energy management and (3) refurbishment measures.
- Quality standards: minimum criteria for energy auditors and energy service providers: qualified people fulfilling the minimum criteria are listed in the registry for energy service providers.

The **Austrian Climate Change Act**, enacted in 2011, adapted in 2013, sets a maximum threshold for greenhouse gas emissions for the period 2008 – 2012 and 2013 – 2020 on a yearly as well as sectoral basis. It applies to the six sectors agriculture, buildings, energy and industry (excluding those undertakings falling under the Emission Trading Scheme), fluorinated greenhouse gases, transport and waste.

The law defines rules on the development and implementation of effective climate mitigation measures outside the EU emissions trading scheme. This makes it one of the major pillars of Austria's climate change policy up to 2020.

To meet the sector targets, the Federal Government, represented by the relevant Federal Ministries, together with the Federal Provinces are required to devise measures. The action programme for the years 2013 and 2014 will now be followed by the action programme for the period 2015 to 2018, which was agreed by the Federal and Provincial Governments.

The measures focus on the following areas:

- Increase of energy efficiency;
- Increase of the share of renewables in final energy consumption;
- Increase of energy efficiency in the building sector;
- Consideration of climate protection aspects in spatial planning;
- Mobility management;
- Waste prevention;
- Protection and expansion of carbon sinks;
- Economic incentives to boost actions in the area of climate protection.

Austria developed the **Energy Strategy for Austria** which describes how the country wants to achieve the climate and energy targets provided by the EU 2020 Climate & Energy Package in order to contribute to the 20-20-20 targets of the European Union.

The targets for Austria for 2020 are as follows:

- 20% increase in energy efficiency as opposed to a business-as-usual scenario;
- 34% share of renewable energy;
- 16% reduction of greenhouse gas emissions in non-ETS sectors;
- A reduction in greenhouse gas emissions of at least 20% below 1990 levels.

As a first step, Austria decided to stabilize its final energy consumption at the level of 2005, i.e. the final energy consumption in 2020 shall not exceed 1.100 PJ. As a next step, a wide range of measures were proposed to ensure meeting this energy consumption level.

The Energy Strategy for Austria was developed in a broad stakeholder process representing more than 150 people from federal ministries, federal provinces, social partners, science, NGOs, business and special interest groups. In early 2010, the Energy Strategy Austria was completed and notified to the European Commission. In 2013, the progress of the implementation of the 42 agreed measures was assessed. By the end of 2012, about half of the measures were implemented or under implementation.

The new **Austrian Climate and Energy Strategy (#mission2030)** was adopted by the Austrian Federal Government on 28 May 2018 and is intended to provide the framework for the Integrated Energy and Climate Plan for Austria, in which concrete implementation measures for decarbonisation will finally be implemented.

The strategy sets the following goals for a climate-friendly economic system in 2030:

- Reduce greenhouse gas emissions (CO_2eq) by 36% by 2030 compared to 2005. All sectors not covered by EU emissions trading will contribute to achieving this goal. The focus is on the sectors of transport and buildings, where the greatest reduction potential exists. This reduction is to be achieved through measures in Austria and thus represents an important step towards decarbonisation.
- Reduction of transport emissions by around 7.2 million t CO_2eq to around 15.7 million t CO_2eq (currently: 22.9 million t CO_2eq). This will enable Austria to position itself as a pioneer in electromobility and alternative drives and provide strong impetus at federal and state level for further expansion of public transport. In addition, a path is being taken that is compatible with the government's goal of fossil-free mobility by 2050.
- Socially and economically compatible reduction of emissions in the building sector by around 3 million t CO_2eq to around 5 million t CO_2eq (currently: 8 million t CO_2eq). The potential for reduction in the building sector shall particularly be achieved through thermal refurbishment, the abandonment of fossil fuels in new construction and the conversion to renewable energy sources and highly efficient district heating in existing buildings.
- Greenhouse gas emissions from companies subject to EU emissions trading must be reduced by 43% across the EU by 2030, compared to 2005 and thus also contribute to the overall European target. This corresponds to an annual reduction path of 2.2%. Austria aims to phase out the fossil energy industry – decarbonisation – by 2050.

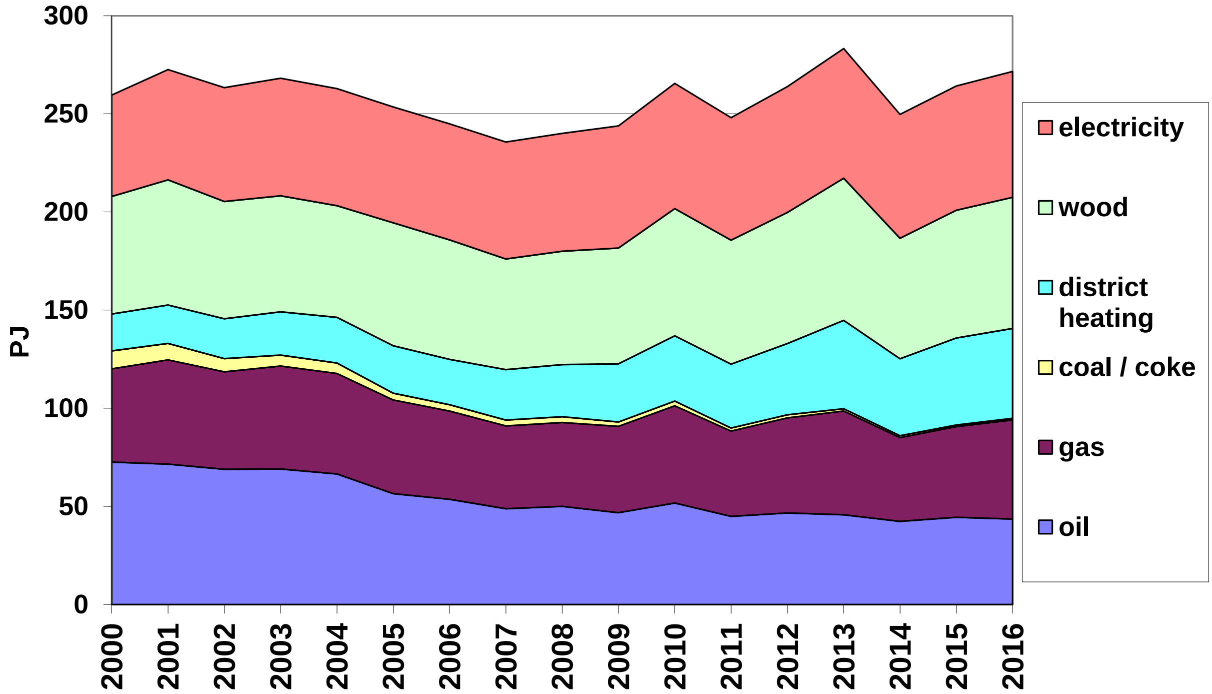
In the field of renewable energy, Austria sets itself the target of increasing the share of renewable energy in gross final energy consumption to 45 - 50% by 2030. At present, the share is 33.5%; the interim target of 34% for 2020 has thus already been almost reached. In addition, the aim is to cover 100% of total electricity consumption in 2030 (on the national balance sheet) from renewable energy sources in the country.

1.4. ENERGY EFFICIENCY TRENDS

The structure of residential energy consumption in Austria underwent a few changes between 2000 and 2016. Figure 8 shows the development of the different fuel types in absolute terms. The corresponding figures are listed in Table 1.

Figure 8: Total residential energy demand by fuel type from 2000 to 2016

Source: Statistics Austria



Energy consumption in the residential sector (without climate corrections) amounted to 272.6 PJ in 2016, which was an increase by 4.6% compared to 2000 (259.6 PJ). A peak of energy consumption of households was observed in 2013 (283.3 PJ).

As displayed in detail in Table 1, the most significant trends in the period 2000-2016 are the increase in district heating by 144%, the decrease in coal and coke consumption by 91% and the decrease in oil consumption by 40%. Wood increased by 12%, while the consumption of natural gas increased by 6% over the period under consideration. An increase by 24% can be observed for electricity consumption in households.

Table 1: Residential energy demand by fuel type: 2000 and 2016

Source: Statistics Austria

Consumption	2000	2016	Change 2000-2016
	PJ	PJ	%
Oil	72,60	43,55	-40,0%
Gas	47,49	50,49	6,3%
Coal / coke	9,15	0,83	-91,0%
Electricity	51,65	64,12	24,2%
District heating	18,80	45,81	143,6%
Wood	59,88	66,80	11,6%
Total	**259,57**	**271,60**	**4,6%**

The associated shares of the various fuel types in residential energy demand for the years 2000 and 2016 are displayed in Figure 9. Major changes include the decrease in the share of coal and coke (by 91%) and in the share of oil (-43%) as well as the increase in the share of district heating (+133%). The shares of electricity (+19%), wood (+7%), and gas (+2%) show minor changes.

Figure 9: Percentage of residential energy demand by fuel type: 2000 and 2016

Source: Statistics Austria

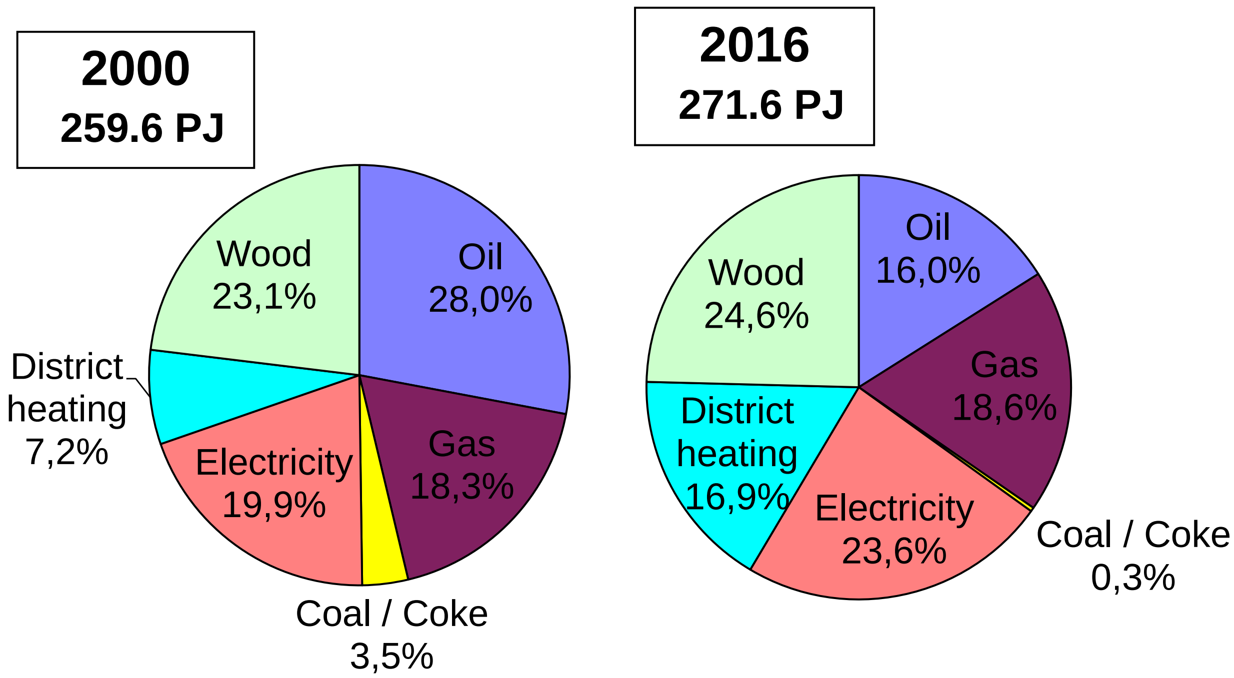


Figure 10 shows the change in the shares of different types of end-use in energy consumption in the households sector between 2000 and 2016. The share of space heating (climate corrected), which is by far the most important end use, fell from 74.4% in 2000 to 70.7% in 2016, mainly due to better insulation. However, this effect is weakened by more dwellings, larger surface areas and higher room temperatures (see Figure 11). The share of electric appliances increased from 9.6% to 13.1% in the period under consideration. In this context, the effect of the growing saturation rate of major household appliances exceeds the effects of more efficient appliances by far. The share of consumption of water heating remained on a similar level (12% and 12.3% respectively). Energy consumption for air cooling is still very low in Austria compared to other end uses, with a share of 0.1%.

Figure 10: Energy consumption by types of end-use: 2000 and 2016

Source: ODYSSEE / Technical University Vienna

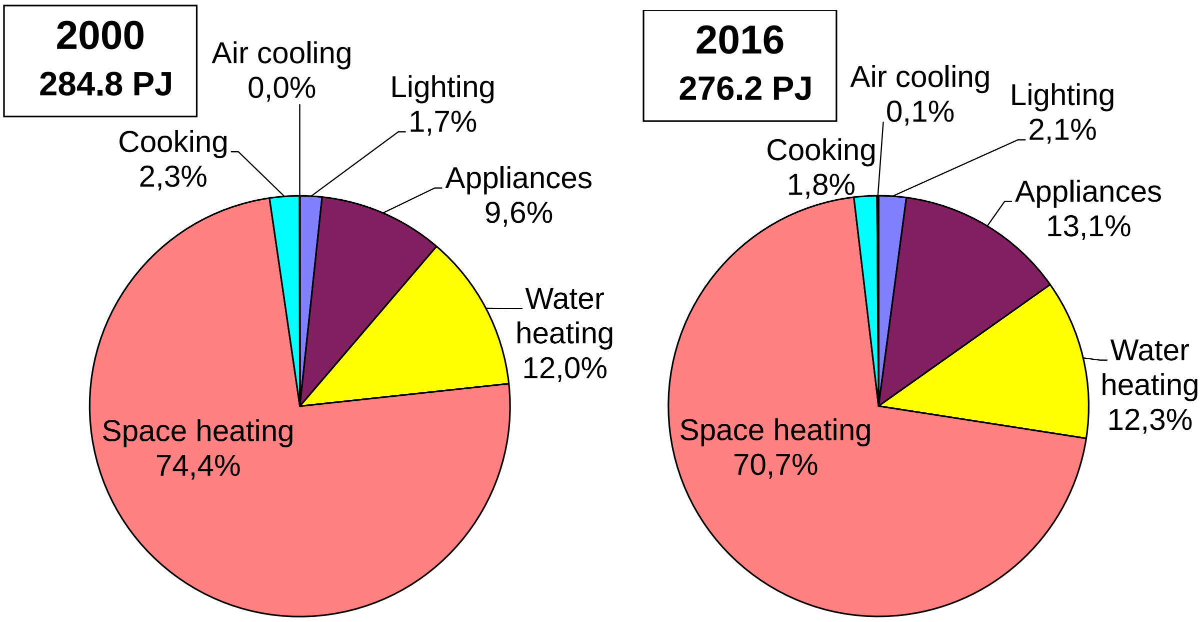


Figure 11 decomposes the variation of the households consumption for space heating in Austria for the period 2000 to 2016. The observed variation is low, because the effects of higher energy efficiency (e.g. insulation, heating systems) (-46.5% of fuel consumption) and heating behaviour (-1.3%) is outweighed by climatic effects (+5.4%), the higher number of occupied dwellings (+17.3%), the higher average floor area of dwellings (+11.4) and a higher penetration of central heating.

Figure 11: Variation households consumption for space heating - Austria - Mtoe (2000-2016)

Source: ODYSSEE

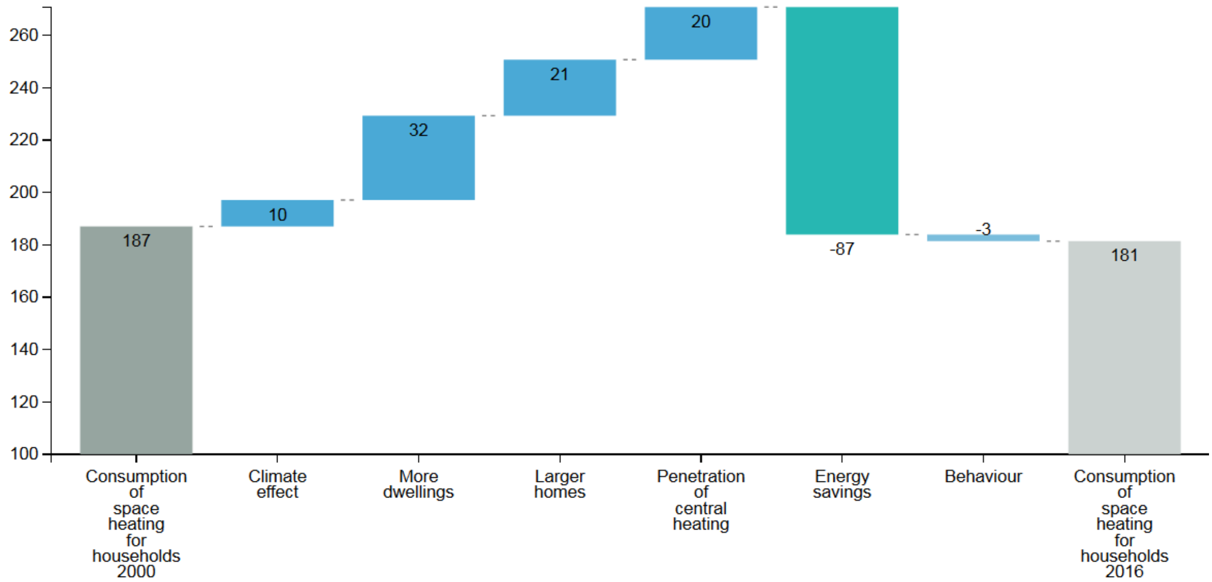
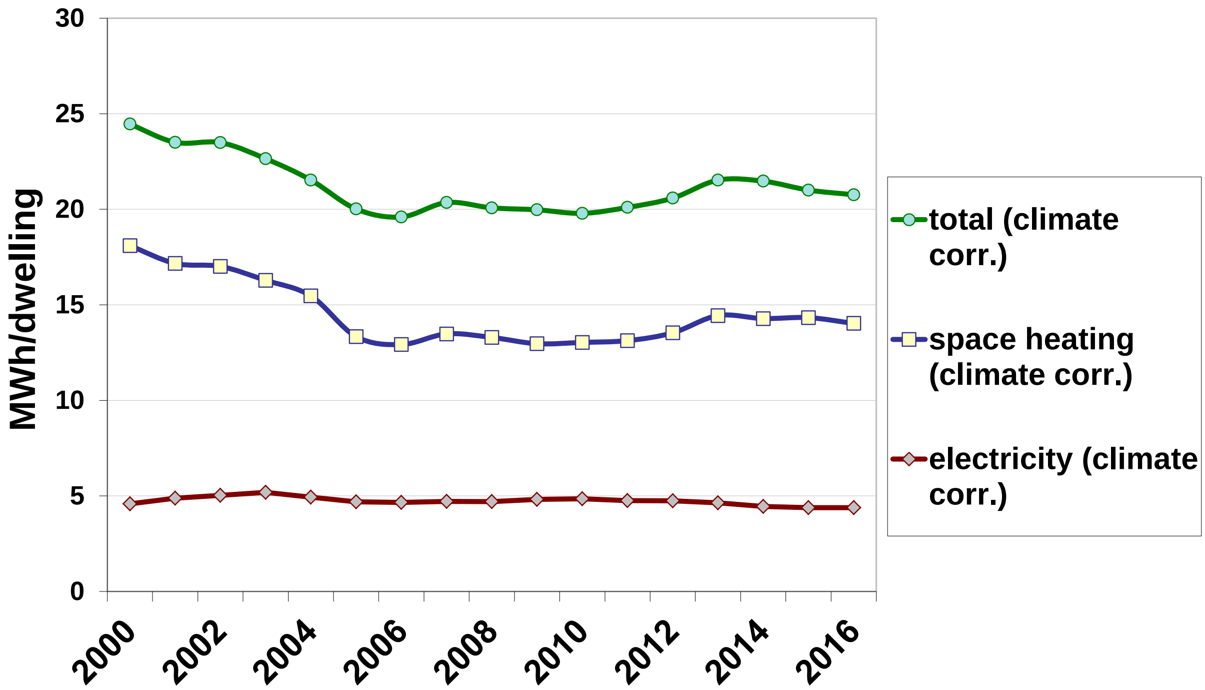


Figure 12 illustrates the development of residential energy usage per dwelling, energy usage for space heating per dwelling and for electricity per dwelling[1] (all climate corrected) between 2000 and 2016. There is a reduction in total energy usage per dwelling (- 15.1%). However, the entire decrease was recorded in the period 2000-2006, after which consumption fluctuated but overall rose again until 2016. Energy usage for space heating per dwelling decreased even more (- 22.5%), showing the same development over the period. The usage of space heating decreased due to improved thermal insulation standards, which compensated for the increase in heated floor area. The total energy usage per dwelling amounts to 20.76 MWh in 2016, in 2000 the respective value has been 24.45 MWh (both climate corrected). Electricity usage per dwelling decreased from 4.58 MWh in 2000 to 4.38 MWh in 2016 (- 4.3%).

[1] Electricity consumption per dwelling has been calculated by dividing the total electricity consumption within the residential sector by the number of dwellings. For this reason electricity consumption in context with space heating (climate corrected) is included in this graph, too.

Figure 12: Development of total energy usage, energy usage for space heating and electricity usage per dwelling (all climate corrected) in the residential sector from 2000 to 2016

Source: ODYSSEE



1.5. ENERGY EFFICIENCY POLICIES

The **building refurbishment programme**, first implemented in 2009 and ongoing, aims at the thermal refurbishment of residential and commercial buildings that were built more than 20 years ago. Budget for granting subsidies is made available for the following measures:

- Insulation of outer walls
- Insulation of the upper ceiling and roof
- Insulation of the lower ceiling and the basement floor
- Refurbishment or replacement of windows and outer doors
- Replacement of fossil heating systems: installation of solar thermal plants, biomass boilers, heat pumps, connection to the district heating grid or local heating grid (residential buildings only)
- Installation of heat recovery systems (commercial buildings only)
- Installation of shading systems (commercial buildings only)

In the Austrian federal states, the enhancement of thermal quality of residential buildings and the expansion of efficient heating systems are supported by the funds earmarked for residential building subsidies. The level of subsidy is dependent on the achieved thermal quality and the efficiency of the heating system. In addition to requirements relating to final energy, new construction subsidies are subject to increased requirements on primary energy demand and CO_2 emissions. The nature of the support differs among the federal states and is provided in the form of loans, grants and/or subsidies. The renovation offensive of the Austrian government ("Sanierungsscheck") is the most important incentive system for households and businesses for the reduction of energy consumption. The subsidy is a unique and non-repayable grant. In 2016, 10,100 private renovation projects and 310 projects in the business sector were submitted.

The Austrian Government offered € 43.5 Mio. for the thermal refurbishment of buildings. According to the responsible ministries, from 2009 to 2015 investments of 4.2 billion Euro could be triggered with subsidies of approx. € 590 million. The average subsidy amounted to approximately 4,200 € over the last years.

Final energy savings amounted to 1,9 PJ in 2014 and to 1,76 PJ in 2015. The cumulative contribution shall amount to 24 PJ between 2014 – 2020. This calculation is based on data in the annual reports by the provinces in the context of energy efficiency monitoring.

A further **investment subsidy** is available for the **new installation of wood-pellet and wood-chip fired central heating systems** as well as **wood-burning fireplace inserts**, replacing one or more existing fossil fired boilers or electrical night storage heaters or electrical direct storage heaters.

The investment subsidy may also be granted when replacing biomass fired heating systems (installed before 2001) with wood-pellet and wood-chip fired central heating systems or when the fuel demand of the existing biomass fired heating system is reduced through the installation of wood-burning fireplace inserts. The amount of the investment subsidy is as follows:

- Wood-pellet and wood-chip fired central heating systems: 2,000 EUR
- Replacement of old biomass fired heating systems (year of construction before 2004): 800 EUR
- Wood-burning fireplace inserts: 500 EUR

Energy audits for households are offered either by dedicated institutions such as energy suppliers, regional energy agencies or other information centres or by commercial consultants. A standardised training as qualification for energy auditors is available in Austria: A-course (basic training), F-course (advanced training).

Energy audits for households started already in the 1990s and have become more in demand over the latest years. The effect of energy audits in households is difficult to assess. The maximum savings reported in literature amount up to 20%. However, it needs to be noted that the savings achieved very much depend on how the intervention in the households was designed and they can therefore not be generalised.

Smart meters and informative billing were introduced in Austria on the basis of the Electricity Industry and Organisation Act (EIWOG) adopted in 2010. In April 2012 the Austrian Ministry of Economy has issued a decree which determines the mandatory timetable for the rollout of smart metering services in Austria. This decree accelerates the rollout of smart meters. The electricity network operators have to equip at least 95% of all metering points by the end of 2019.

As of December 2015, approximately 456 000 metering points were equipped with a smart meter (there are approximately 6 million metering points in total). This corresponds to a degree of coverage of approximately 7.4% (in 2014 it was 4.9%).

According to the NEEAP 2014, savings of 3,800 TJ/a are expected until 2020.

2. ENERGY EFFIENCY IN TRANSPORT

2.1. ENERGY EFFICIENCY TRENDS

Figure 13 illustrates that all means of transport have shown an upward trend since 2000. The passenger kilometres travelled by car in Austria increased steadily in the period under consideration (+21%), while rail travel increased even higher (+44%), however at a lower level. Travel with buses rose by 11%. Air travel (measured in numbers of passengers) skyrocketed in the period under consideration (+78%). With a plus of 59%, the number of air passengers in particular increased considerably in the first eight years of the period (2000 – 2008). However, in the recession year 2009 air transport decreased by 9% compared to the previous year. In comparison, the decrease of car, bus and rail transport from 2008 to 2009 was less than 2%. By 2011, all transport modes reached or exceeded the 2008 levels again.

Figure 13: Passenger travel by transport modes

Source: ODYSSEE / Technical University Graz

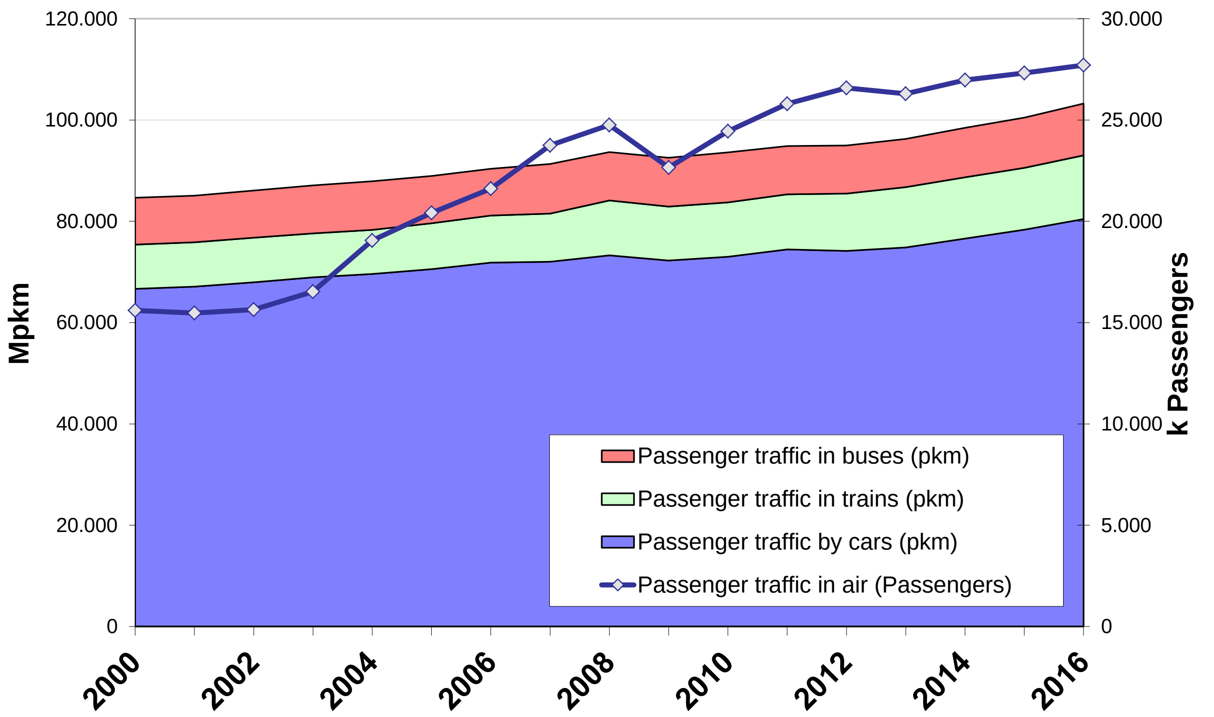


Figure 14 shows that freight traffic (measured in tkm) also recorded a large increase over the period of 2000 to 2016. This trend is driven both by the growth of road freight transport (+37%) and rail freight traffic (+36%). River freight traffic decreased by 20% at a significantly lower level compared to the other modes of freight transport. Overall, freight transport increased by 34% in the period under review.

A peak is observed in the year 2007 for both freight traffic on roads and in trains. By 2007, freight transport was 34% higher compared to the 2000 figure. In the two subsequent years marked by economic crisis, freight traffic decreased by 16%. The largest effect of recession is observed for freight transport in trains, which dropped by one quarter (25%) between 2007 and 2009. Freight transport on roads decreased by 11% and freight transport on rivers by 23% within the two years of recession. The respective figures are displayed in Table 2. In the years after 2009, freight traffic continued to show the long-term growth trend. In 2016, the last year of the period under review, freight transport eventually reached again the peak of 2007.

Figure 14: Freight traffic by transport mode

Source: ODYSSEE / Technical University Graz

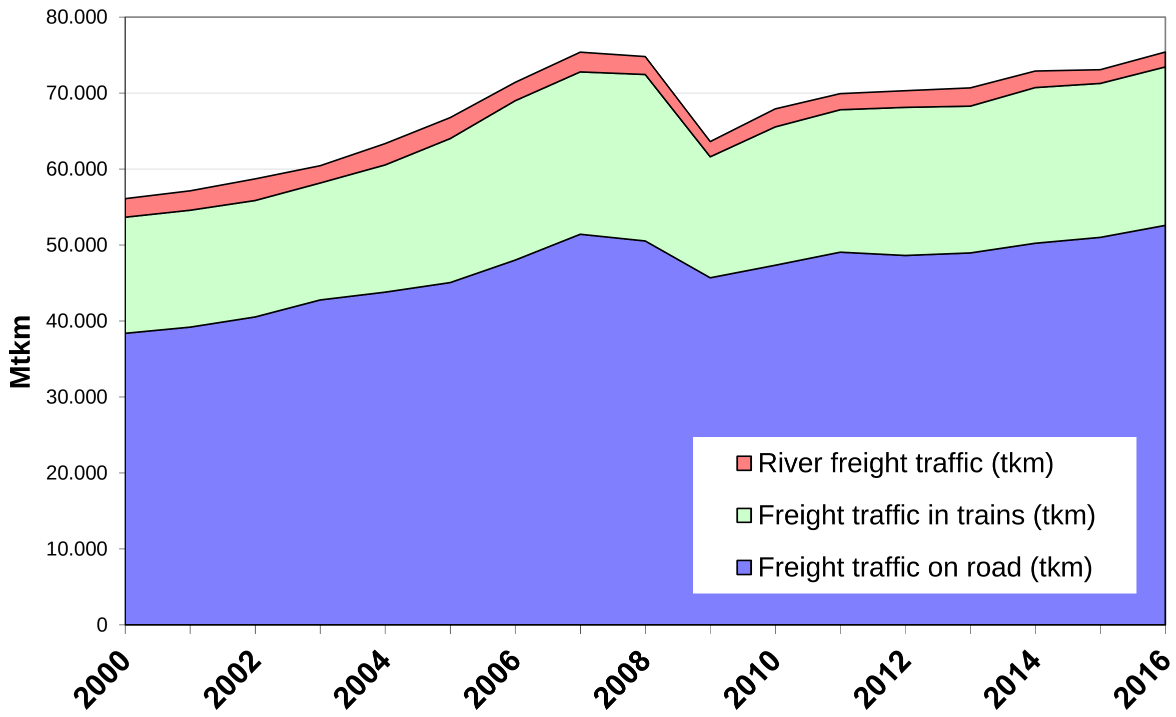


Table 2: Freight traffic by modes of transport: 2000, 2007 (peak year until 2015) and 2016

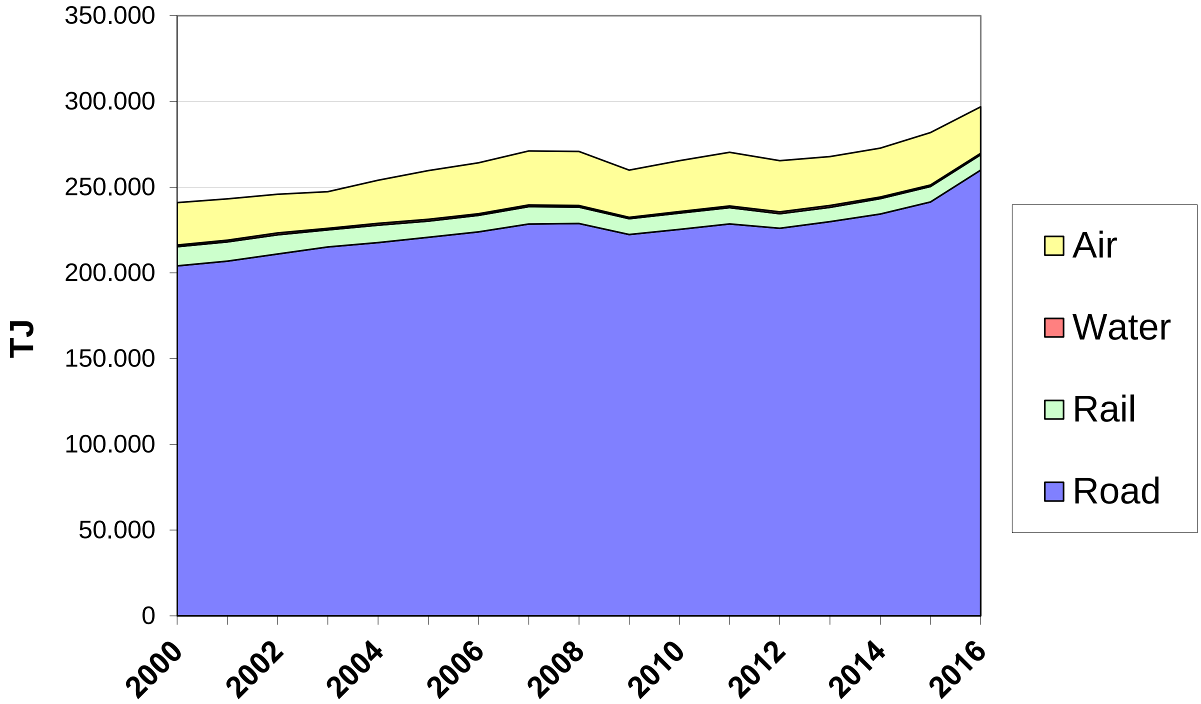
Source: ODYSSEE / Technical University Graz

Consumption	2000	2007 (peak)	2016	Change 2000-2016	Change 2000-2007	Change 2007-2009
	Mtkm	Mtkm	Mtkm	%	%	%
Road	38,380	51,421	52,588	37.0%	34.0%	-11.1%
Trains	15,281	21,371	20,856	36.5%	39.9%	-25.5%
River	2,444	2,597	1,962	-19.7%	6.3%	-22.9%
Total	**56,105**	**75,389**	**75,406**	**34.4%**	**34.4%**	**-15.6%**

Figure 15 shows the development of energy consumption by the modes of transport. The energy consumption of road (excluding border trade) increased by 27% and consumption for air transport increased by 10% from 2000 to 2016. Consumption of rail transport decreased by 20% in the period under review and consumption for water transport decreased by 15% in the period under review.

Figure 15: Transport: energy consumption by mode 2000-2016

Source: ODYSSEE / Technical University Graz



Total energy consumption of the transport sector (excluding border trade) rose by 23% over the period from 2000 to 2016. Road transport counts by far for the highest share with 88% in 2016 (see Figure 16), a slight increase compared to the year 2000, in which road transport recorded a share of 85%. The share of consumption of air transport gained relatively stable in this period (around 10%). Air transport takes account domestic consumption as well as consumption of international flights. The share of rail transport decreased from 5% to 3% while the share of river transport stayed at a very low level in the period under consideration.

Figure 16: Transport: Percentage of energy consumption by mode 2000 and 2016

Source: ODYSSEE / Technical University Graz

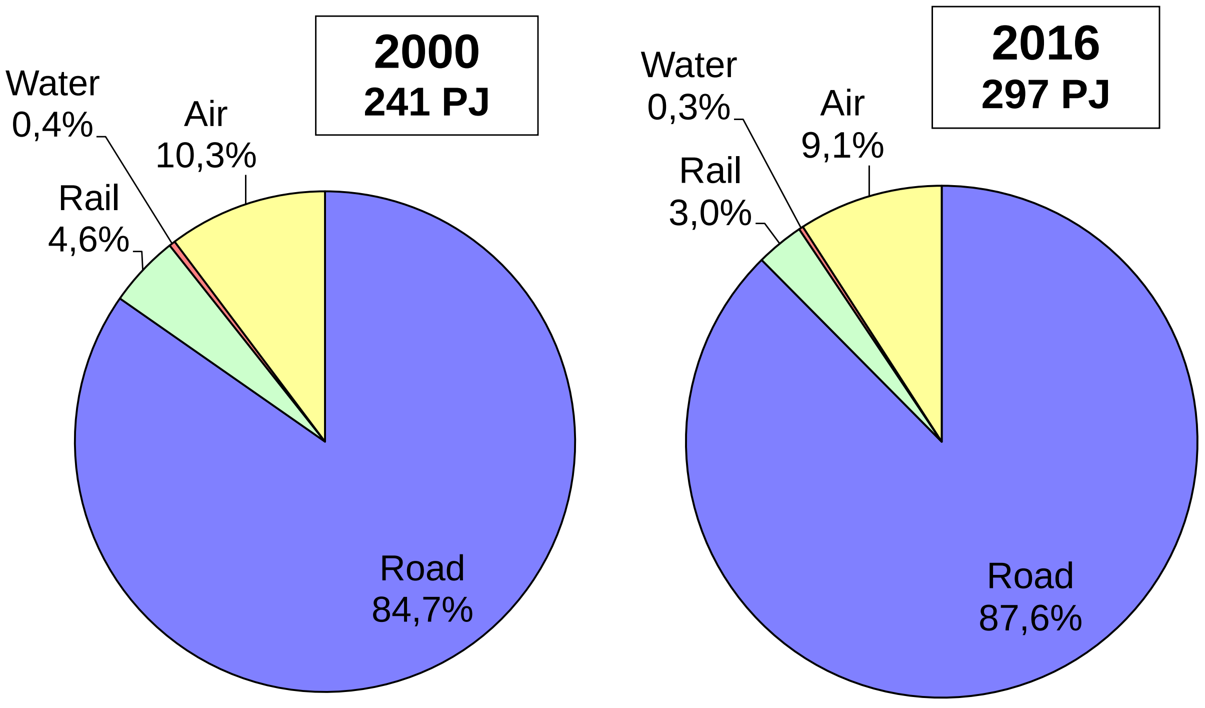


Figure 17 shows the share of energy consumption for road transport vehicles for the year 2000 and for the year 2016. The share of energy consumption for all modes of road transport remained on a similar level in the period under consideration.

Figure 17: Road transport: Energy consumption by vehicle type

Source: ODYSSEE / Technical University Graz

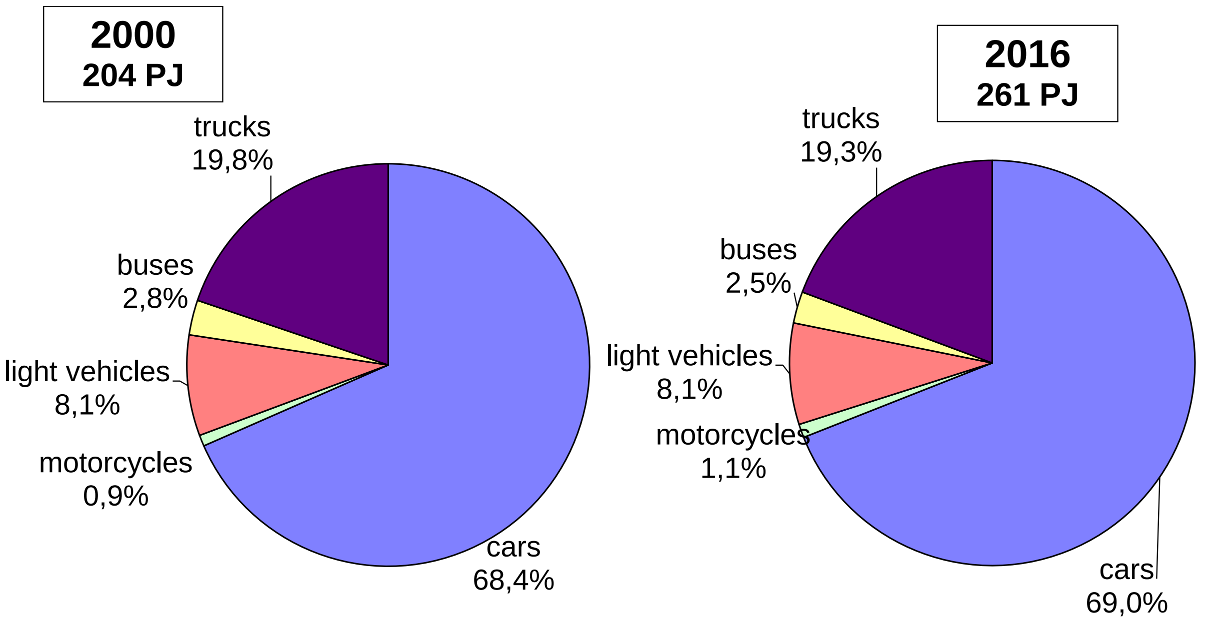


Figure 18 shows the effects of "fuel tourism", i.e. the development of energy consumption of road transport vehicles including the amount of border trade, which rose considerably in Austria in recent years. Since the end of the 1990s an increasing discrepancy between total Austrian fuel sales and the computed domestic fuel consumption has become apparent. Fuel is currently somewhat less expensive in Austria than in some neighbouring countries (mainly due to lower excise duties). For this reason, many foreigners cross the border just to purchase fuel at the closest filling station in Austria, which means that to a great extent fuel is filled up in Austria and consumed abroad. This also applies to truck drivers refuelling their truck in Austria when driving through to their final destination. Freight traffic is by far the most contributing factor for fuel tourism. It is estimated that by the year 2016 23% of the fuel purchased in Austria for road vehicles is due to fuel tourism, 85% of which is diesel, of which 73% are used by heavy goods vehicles. This practice has a positive effect on the mineral oil tax revenues for Austria; however, the relatively low tax rate encourages the use of individual motor cars. Furthermore, the fuel export problem is relevant for climate policy, e.g. the Kyoto commitment, because emissions are allocated according to national fuel sales. For this reason, GHG emissions from fuel exports are assigned to Austria in total.

Energy consumption by border trade rose by 132% in the period 2000-2016. Energy consumption of cars increased by 29% and the consumption of light vehicles by 27%. Consumption of trucks also rose by 24% in the overall period under review, with a peak in 2007 which was 23% higher than 2000. In 2016, consumption of trucks was still on a similar level (+1%) compared to the 2007 level. Consumption of motorcycles increased by 54% and consumption of buses increased by 14% in the period 2000 to 2016 (both at a very low level).

Figure 18: Road transport: Energy consumption by vehicle type and border trade 2000-2016

Source: ODYSSEE / Technical University Graz

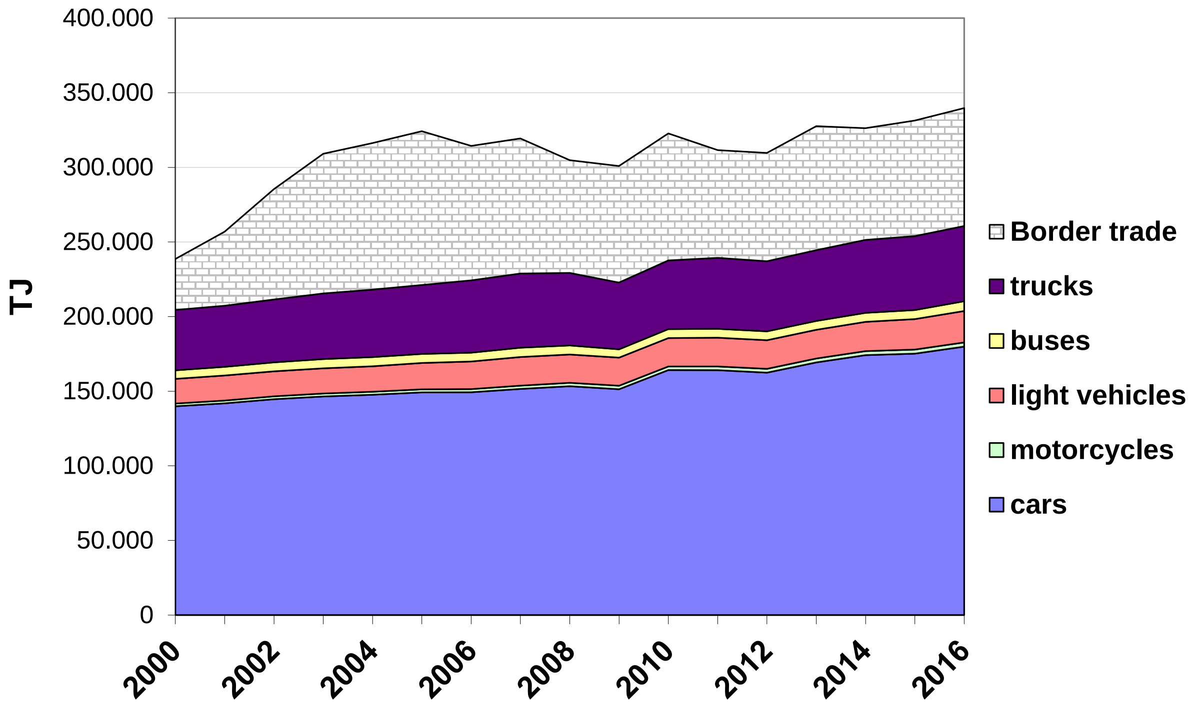


Figure 19 shows the indices for energy intensity of transport and unit consumption of road goods transport as well as unit consumption per car. Energy intensity (measured in koe/€2010) fluctuated, increasing until 2005 and decreasing since then in most of the years. In 2016 energy intensity of transport was 5% higher than in 2000. Unit consumption of road goods transport (measured in kWh/tkm) decreased by 14%. Unit consumption per car (measured in MWh/veh) decreased until 2012 but shows an upward trend since then. This indicator was 3% lower in 2016 than in 2000.

Figure 19: Energy intensity in transport from 2000 to 2016

Source: ODYSSEE

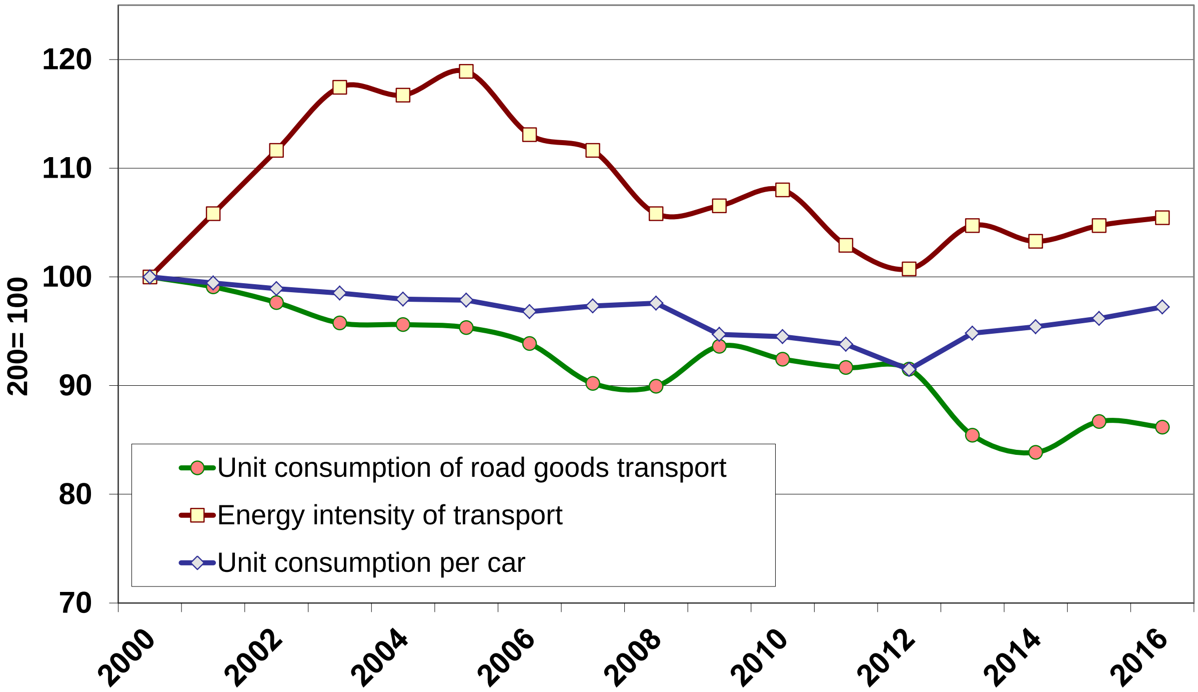
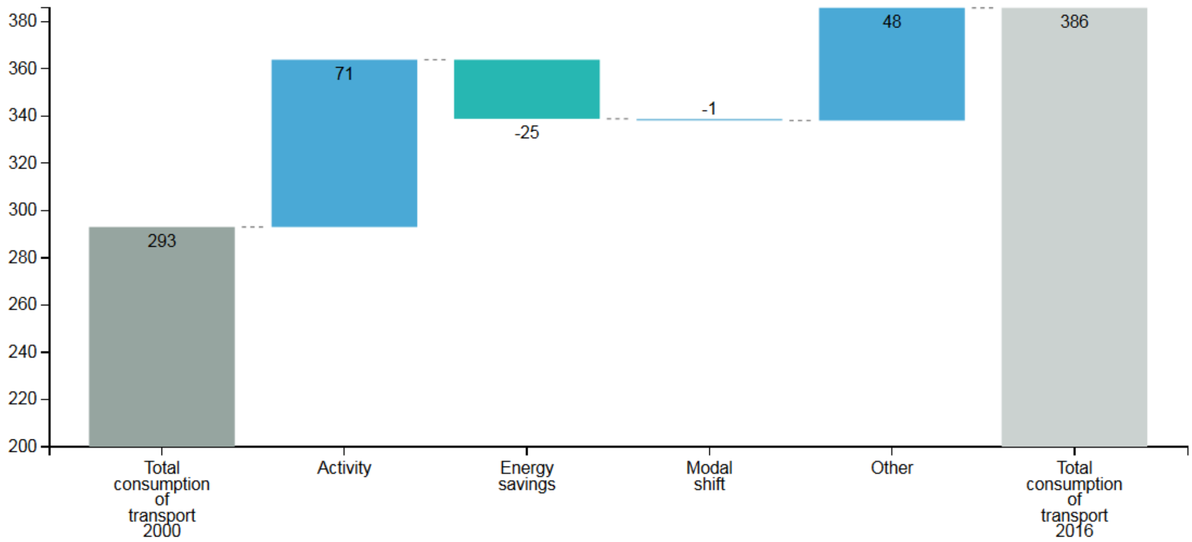


Figure 20 displays a decomposition analysis for the transport sector. The largest part of the variation between 2000 and 2016 of the transport energy consumption (i.e. +93 PJ) can be explained by the influence of a change in passenger traffic including air and traffic of goods (activity effect), followed by ‘other effects’, i.e behavioral effects and "negative savings" in freight transport due to low capacity utilization, which both increase the consumption. Technical energy savings (i.e. change in the efficiency of cars, trucks, airplanes etc.) decrease the consumption to a much lesser extent. Modal shift for land transport, i.e. change in the share of each transport mode in the total land traffic, had almost no effect on the variation.

Figure 20: Variation transport consumption (2000-2016)

Source: ODYSSEE



2.2. ENERGY EFFICIENCY POLICIES

The **General Transport plan for Austria**, published in 2012, defines the targets and strategies of the Austrian policy on transport up to 2025. It aims at creating a more social, safer, environmentally friendlier and more efficient transport system through the implementation of measures in the field of modern infrastructure, public transport, safety, planning and integration, technologies and innovation, removal of barriers, environmental protection and resource efficiency as well as international integration.

The establishment of an environmentally friendlier and more efficient transport system provides for the reduction of CO_2 emissions by 19% until 2025 compared to 2010 in this sector. The energy consumption in this sector shall be reduced from 240 PJ to 210 PJ in 2025. To achieve these goals, measures in the following areas are planned:

- Electro mobility
- Shifting transport to more sustainable modes
- Cost transparency
- Reduce traffic congestion
- Noise control
- Spatial planning
- Motorized individual transport

The General Transport plan for Austria was published by the Federal Ministry of Transport, Innovation and Technologies. The realisation of its targets and strategies contained falls within the competency of the different implementing bodies (federal state, provincial states, etc.).

The **car registration tax** was introduced in 1992 as a tax on the standardised fuel consumption of vehicles (Normverbrauchsabgabe/NoVA). It has to be paid when a vehicle is registered for the first time in Austria and is calculated as a percentage rate of the vehicle price.

In 2008, the car registration tax was amended in a way that a CO_2-malus system was introduced linking the tax burden to the fuel consumption and CO_2-emissions of the vehicle. Amending the car registration tax in that regard was meant to discourage drivers from buying cars with high CO_2-emissions/km.

The maximum percentage of car registration tax to be paid is 32% of the net purchasing prize. Vehicles operated exclusively by electricity are exempt from the standard consumption tax.

The tax influenced the purchase of new vehicles shortly before and after its introduction. Shortly before, the share of sales of cars with higher consumption increased, as buyers of small cars waited for the introduction of the CO_2-malus system. Shortly after, the share of cars with lower fuel consumption correspondingly increased.

The Austrian Environmental Agency shows in its CO_2-monitoring reports to what extent newly purchased cars fall within a certain range of CO_2-emissions: For cars emitting more than 160 g CO_2/km the percentage of cars bought dropped from 19% in 2010 to 12% in 2012. Further comparisons are not possible, as the ranges were set differently for the following years.

The climate protection programme **klimaaktiv mobil** was set up by Austria's Ministry for Sustainability and Tourism and in 2005is managed by the Austrian Energy Agency. Klimaaktiv mobil is part of the klimaaktiv initiative for active climate protection and one of the central strategies to make the transport sector more energy efficient and environmentally friend ly by targeting all relevant stakeholders.

The klimaaktiv mobil programme bundles funding programmes and so called "soft" and "voluntary" measures in transport (mobility management), that do not necessarily need to wait for legislation or specific administrative framework conditions.

In its comprehensive nation-wide and long term (2004 to at least 2020) approach and also in its effects regarding the reduction of GHG emissions, klimaaktiv and especially klimaaktiv mobil seems to be one-of-a-kind in Europe.

With activities in five fields (mobility management consulting programmes, awareness & information campaigns, financial support programmes, partnership & awards, and advanced education & certification, klimaaktiv mobil targets all the issues raised in energy efficiency discussions in transport such as fuel-, technology- and behavioural transitions, new business models for car use and ownership, electric mobility and other alternative fuels and drivetrains, mobility management, urban and regional planning, further education and empowering regarding sustainable transport issues etc.

klimaaktiv mobil set up:

- Free-of-charge consulting programmes addressing specific target groups (companies, cites & municipalities, real estate developers, schools & youth, tourism)

- A financial support programme with 108 Mio € since 2007 for mobility management measures, fleet conversions to low-carbon technologies, work travel plans etc.
- An EcoDriving training programme with up to now 1,500 EcoDriving trainers and 25,000 trainees (mostly truck and bus drivers), and mandatory EcoDriving trainings for all approx. 90,000 novice drivers in Austria
- A broad awareness raising campaign
- More than 11,000 klimaaktiv mobil partners among the target groups implementing sustainable transport measures.

The target of klimaaktiv mobil, set in the National climate Strategy, was to reduce 300,000 tons of CO_2 per year until 2009. With now more than 500,000 tons of CO_2 emissions reduced every year, the programme exceeded this goal and furthermore created or saved 6,000 green jobs in transport and induced green investments by companies and administrations 6 to 10 times higher as the funding.

3. ENERGY EFFICIENCY IN INDUSTRY

3.1. ENERGY EFFICIENCY TRENDS

Almost one half of the energy consumption of the manufacturing sector in Austria can be attributed to two sectors: steel and paper industry. In 2016, steel industry has held its dominance as the largest energy consuming branch of manufacturing with a share of 21%, which is slightly less than in 2000 (25%). The share of paper industry slightly decreased from 23% in 2000 to 21% in 2016. The share of chemicals (13%) and the non-metallic minerals industry (mostly cement, including glass industry) (12% and 11% respectively) remained at a similar level in 2000 and in 2016. Machinery increased from 6% in 2000 to 8% in 2016. However, the largest increase is observed for the share of wood industry which increased from 5% in 2000 to 10% in 2016.

Figure 21: Energy consumption shares of branches of manufacturing: 2000 and 2016

Source: Statistics Austria

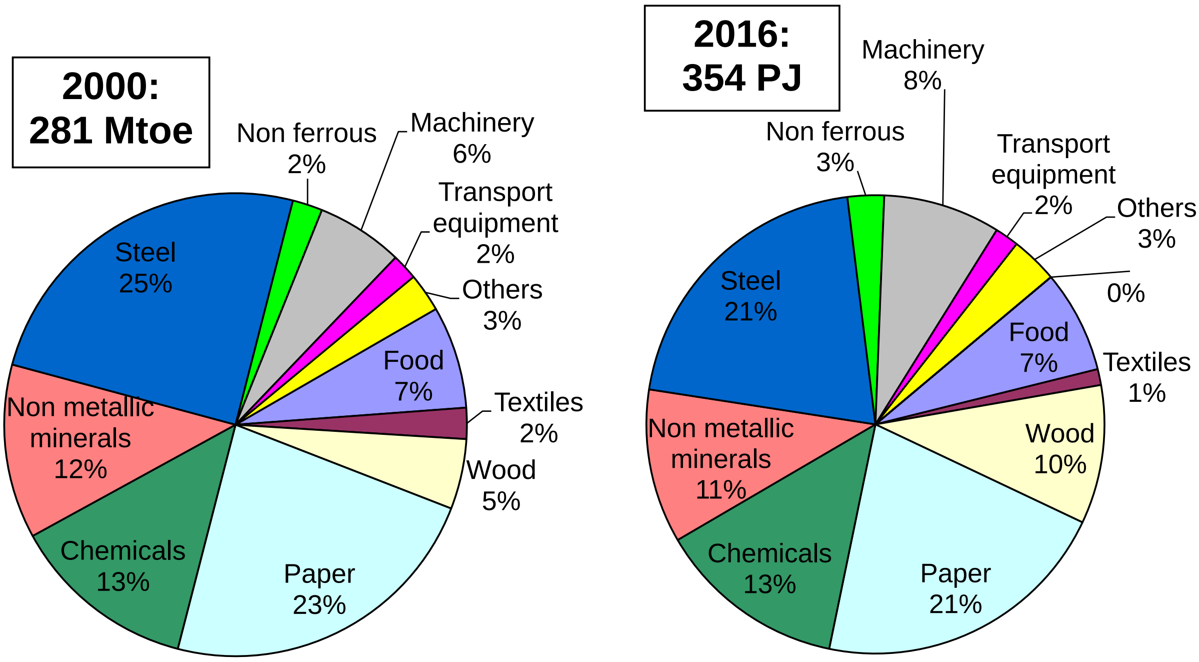


Figure 22 shows the development of energy consumption in the manufacturing sector as well as in construction and mining. Energy consumption of the manufacturing branches rose by 23%, while consumption of construction increased significantly (+84%). Energy consumption of mining, which has a minor role in Austria, rose by 12% in the period under consideration. In 2016, the share of manufacturing in total industry energy consumption was 92%. The share of construction was 6% while mining accounted for only 2% of industrial energy consumption. A decrease for all sectors can be observed for the recession year 2009. However, this decrease was more than outweighed by a substantial increase of energy consumption in manufacturing in the following year 2010. Another decrease of Austria's industry was recorded for the year 2014.

Figure 22: Energy consumption in manufacturing and in construction and mining: 2000 - 2016

Source: Statistics Austria

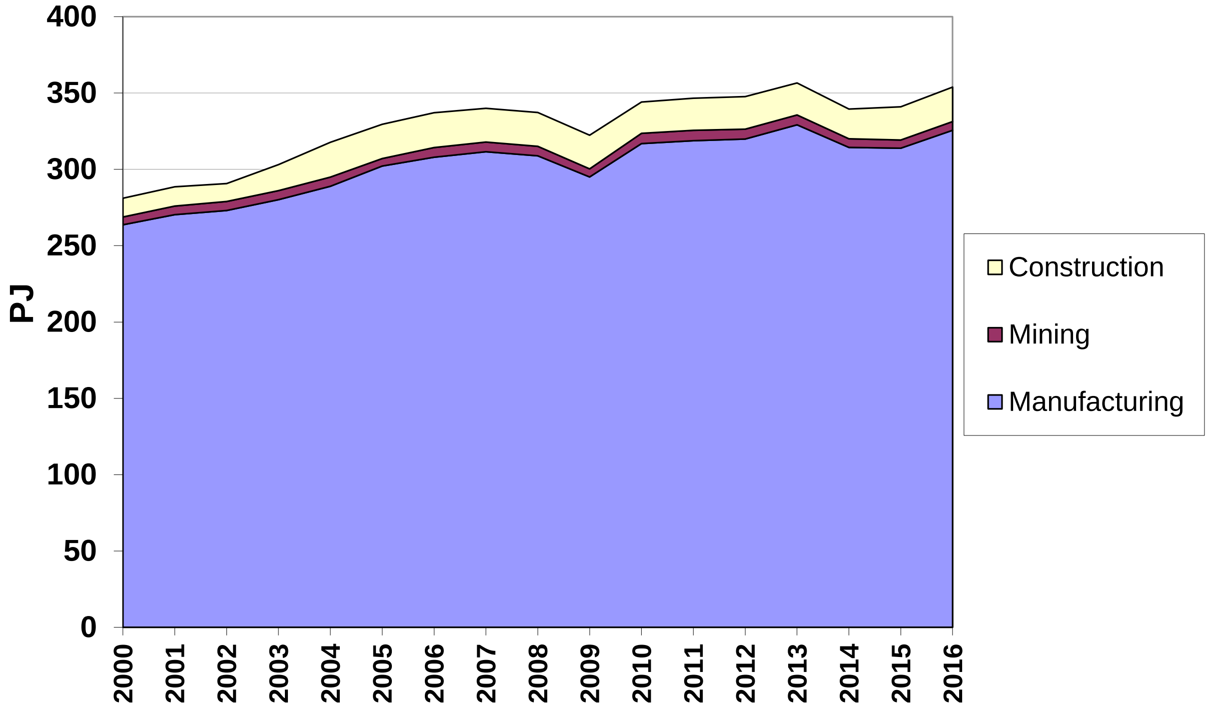


Figure 23 illustrates the development of energy consumption in the manufacturing branches. The most prominent increase within the period 2000 to 2016 is observed for wood industry (+119%), followed by non ferrous industry (+86%) and food industry (+79%). The only branch recording a decrease of energy consumption is textiles (-48%).

Figure 23: Energy consumption of the branches of manufacturing: 2000 – 2016

Source: Statistics Austria

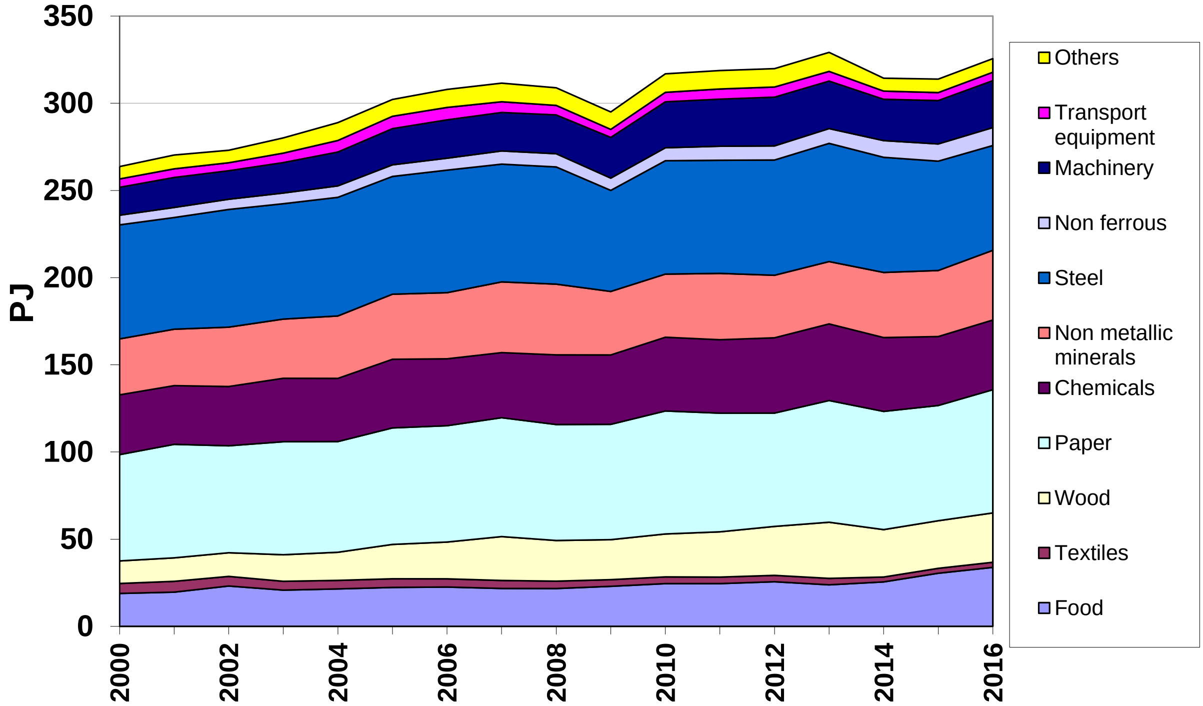
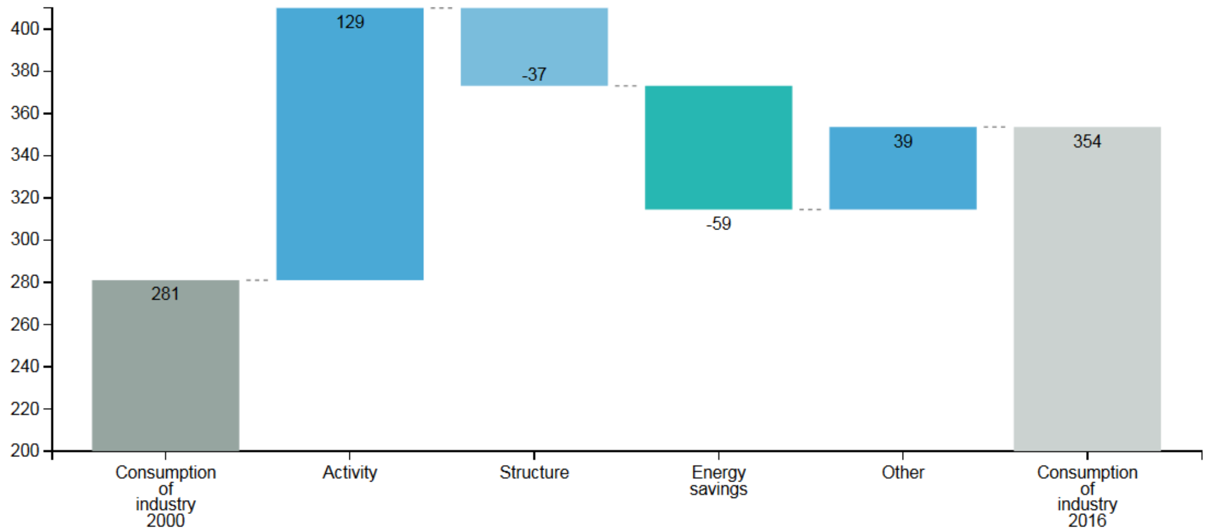


Figure 24 displays a decomposition analysis for industry for the period 2000 to 2016. The increase of the industrial energy consumption is influenced mainly by changes in industrial activity (measured with the value added), while there are fewer structural changes recorded, i.e. the fact that the production of individual branches with different specific consumption are not growing at the same rate as the average production index of industry. Energy savings (calculated from changes in energy consumption per unit of production at branch level) contribute significantly to a reduction of consumption. Other effects (mainly "negative" savings due to inefficient operations in industry) contribute to the increase of consumption.

Figure 24: Variation of industry energy consumption 2000 - 2016

Source: ODYSSEE



3.2. ENERGY EFFICIENCY POLICIES

The **obligation of energy consuming companies** is based on the size of each company or corporate group in accordance to the Energy Efficiency Act.

Large companies must in accordance with § 9 EEffG for the years 2015 to 2020 either (1) carry out an external energy audit every four years, or (2) implement a management system (Energy Management System, Environmental Management System or EMS or UMS equivalent, intra-nationally recognized management system), which must include an external or internal energy audit. Persons who carry out these external or internal energy audits must meet certain qualification standards. In addition, external auditors have to be listed in a public register.

Small or medium-sized enterprises (SMEs) can consult an energy advice service and can report the contents and findings to the National Energy Efficiency monitoring agency.

The **obligation to provide evidence of energy efficiency measures for energy suppliers** commits each energy supplier in Austria, provided that it has exceeded the minimum sales limit of 25 GWh in the previous year, to prove energy efficiency measures that meet 0.6% of its previous energy sales to end customers. The measures have to be implemented by the energy supplier itself, their own customers or other end-use energy consumers.

It is crucial, that measures are taken to improve the input-output ratio (e.g. of an appliance or process) and that those are directly attributable to the energy supplier via a credible verification. However, this does not necessarily mean that an actual reduction of total energy consumption has to be achieved. Thus, companies are not being forced to restrict their production, nor are suppliers obliged to reduce their energy sales to end customers.

The energy supplier can set the measures in the following way:

- set them itself
- set them within the trade obligation of the energy efficiency law together with other suppliers
- buy them from a third party
- allocate them directly (direct award contracts)
- call for tender

Alternatively, energy suppliers can also make a compensation payment with discharging effect, which directly go to an investment fund. This fund sponsors substitute energy efficiency measures.

The compensatory amount is currently trading at EUR 0.20 / kWh and can be adapted by E-Control in 2016 by decree. All measures must be documented thoroughly.

The **Environmental Support Programme** ("Umweltfoerderung im Inland, UFI") is one of the most important subsidies for companies with the emphasis on climate protection, energy saving, renewable energies and prevention of air pollution. The basis of this subsidy is regulated in the federal law "Umweltfoerdergesetz". The UFI incentive scheme is financed from the budget of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water. The Kommunalkredit Public Consulting GmbH is entrusted as a settlement agency with the practical development of support programmes. Since 1993, KPC has managed the environmental support schemes of the Federal Government.

Until the end of 2014, the funding under the UFI amounted to approx. € 90.000 million per year.

The subsidy programmes provide grants of up to 30% of the investment costs. Multiple grants by public (e.g. by the EU or by provincial governments) are also possible within the maximum limit of the EU. There are grants for energy saving and efficiency measures, improving thermal insulation, CHP, district heating and heat from renewable energies.

According to the 2nd NEEAP theoretical bottom-up savings of 2675 TJ are achieved in the year 2010 (including early actions). 5.578 TJ of savings are expected for the year 2016.

One of several Austrian **klimaaktiv programmes** within the Austrian Climate Strategy is the national programme for **energy efficiency in companies**, which started in 2005 under the management of the Austrian Energy Agency.

In order to find companies interested in reducing energy costs a wide base of marketing activities are set :

- Cooperation: The klimaaktiv management cooperates with market-partners for specific technologies, e.g. compressed air, variable speed drives, pumps, fans, lighting systems, steam systems and waste heat to answer the need of companies for very detailed and professional support.
- Information, Awards: Information on these advanced technologies are spread via newsletters and trainings. Until April 2015, more than 550 consultants have been trained in using tools for energy audits and about 200 companies have been awarded by the Minister of Environment for

implementing energy efficiency measures.

- Energy Audit Guides: The technological approach of the programme has been dedicated to motor driven systems so far: Since 2008 specific PR-materials, tools, and a training concept for consultants for different technologies were developed: compressed air, pumps, fans, steam, cooling systems, lighting, and waste heat. In 2015 the programme emphasises on the different possibilities to meter energy and calculate energy savings. For all technologies the most relevant saving measures are described for a very quick on-site evaluation. For the evaluation of all measures, the necessary data to be collected are stipulated, and rough economic and technical criteria are developed to decide if and how a specific technology component should be improved. Furthermore, a standard report is developed. Consultants and energy managers are trained with this tool and check their company or customers and provide their results to AEA.
- Sector specific information and benchmarking: Sector specific information is developed within the branch concepts. So far five concepts have been published. For this concepts information on energy consumption and other relevant indicators are surveyed and energy performance indicators are developed. This information forms also the basis for the „Benchmarking simple“ tool which comprises at the moment 11 branches with 52 sub-categories.