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Climate Change

Impact on Environment and Society
Energy and Electricity Supply

The Impact of Climate Change on Energy and Electricity Supply in Austria

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The COIN project assesses the economic impact of climate change on the Austrian energy and electricity sector by reference to future costs for heating, cooling, and electricity supply.

Main findings

- The average annual net savings in heating- and cooling-related energy consumption for the period between 2036 and 2065 are estimated at € 235 million (mn), based on assuming a moderate climate change scenario and moderate socio-economic developments.
- However, additional costs have to be expected in the area of electricity production, due to increased cooling demands resulting in peak loads. To cover the latter, over the same period, an additional € 230 million per year will have to be invested in new plants under moderate climate change and moderate socio-economic developments.
- The increased risk of power blackout caused by a power grid overload due to peak demands could affect the energy and electricity sector even harder.

Project info box

The interdisciplinary COIN (Cost of Inaction – Assessing Costs of Climate Change for Austria) project evaluates economic impacts of climate change in Austria. For this purpose, a scenario-based analysis of and across twelve key sectors is conducted, which assesses the possible impact of climatic change in combination with socioeconomic developments. The main scenario assumes a temperature rise within the two degrees Celsius margin for the period up to 2050. This assumption presupposes stronger climate policies than the ones currently in place. The analyses presented here only show that part of all potential impacts which has already been quantified and takes into consideration individual adjustments made.

A stable energy and electricity supply is indispensable for Austria as a centre of industry, trade and commerce. This central role and the long-standing energy infrastructure (in part more than 50 years) have made this area substantially significant for both public and private sectors.

What has been analysed?

The present study has investigated the impact of climatic change (esp. of temperature rise) on heating- and cooling-related energy demands. Furthermore, it has examined the time-related interplay of energy production and demand, focussing on energy from hydropower under changing climatic conditions. Covering over 50 % of the electricity production, hydropower is of vital importance to the electricity supply in Austria. Climatic developments, such as a seasonal fluctuation of precipitation towards winter or increasing temperatures in summer, therefore not only cause changes as to the absolute quantities of electricity production and demand in the country; they also lead to alterations as to when electricity demands and the need for production occur throughout the year. Impending peak demands – caused, e.g., by an increasing use of air conditioning during summer heat waves throughout large sections of the building stock – are essential in this context. Moreover, damages to the electricity infrastructure caused by extreme weather events (e.g., floods or storms) could lead to even higher costs for the energy sector. However, this has not been taken into account in the current study, where market interdependencies have likewise only been modelled in parts. Interrelations with the German market have been considered, but incidents (such as periods of extreme heat) which may occur in other (esp. Southern European) countries and which may strongly affect the Austrian electricity market and prices have not been outlined.

What impacts are to be expected?

In light of climatic change, thermal renovations, and more efficient new buildings, Austria's total energy demand for heating, cooling, and generating hot water (e.g., by means of electricity, district heating, natural gas, or fuel oil) is expected to decrease between 2008 and 2050. The current study has determined a decrease of 40 % within the context of moderate socio-economic developments[1]. Under a moderate climate change scenario[2] and moderate

1 Moderate socio-economic developments in the heating and cooling sector assume that the current political framework regarding the funding for building improvements as well as the respective building regulations and standards remain in force and will not be tightened until 2050.

2 Comparing the reference period (1981–2010) and the first (second) scenario period of 2016–2045 (2036–2065), the moderate climate change scenario assumes a mean temperature rise of +1.0 °C (+2.0 °C), changes in annual precipitation sums of +1.4 % (-2.3 %), and changes in the number of days with precipitation of +2.1 % (-3.5 %).

socio-economic developments[3], the research results thus show that the overall expenditure for energy consumption is decreasing[4] in the areas of heating and cooling: the energy-related expenditure for air conditioning buildings will rise by an annual average of approx. € 70 mn (€ 155 mn) during the 2016–2045 (2036–2065) period. However, these costs are much lower than the amount of energy saved due to reduced heating requirements, which are estimated at an annual average of approx. € 200 mn (€ 390 mn) over the 2016–2045 (2036–2065) period.

In the field of generating electricity, the research results show that under moderate climate change and moderate socio-economic developments an annual average of approx. € 230mn would have to be invested in plants between 2036 and 2065 to cover peak cooling loads. Furthermore, additional costs arise from reduced hydropower generation. However, those will in part be mitigated by the seasonal shift from summer to winter.

Do alternative projections for the future change the results?

When interpreting the results, it has to be considered that they may change, if future climate change were to prove milder or stronger than assumed in the model, or if alternative socio-economic developments (e.g., a stronger trend towards air-conditioned buildings or a higher demand for amenities) were to change the sector's sensitivity to climatic factors. Therefore, additional scenarios were carried out, assuming milder and stronger climate change[5] as well as a higher and lower sensitivity[6] of the sector (see Table 1). Table 1 shows that, in the area of energy consumption for heating and cooling, the results obtained under a strong climate change scenario (with a higher temperature increase) differ considerably (up to the factor of two) from those obtained under the moderate scenario, while in the area of generating electricity alternative socio-economic assumptions (e.g., increased air-conditioning) have altered the results to a considerably higher extent than other climatic parameters.

Table 1: Average annual climate-induced economic impact on the energy and electricity supply, based on climatic and socio-economic developments (in million Euros).

Economic impact* Ø 2036-2065 relative to Ø 1981-2010			Climate change		
			mild	moderate	strong
Energy for heating	Socio-economic development (sensitivity**)	low	293	294	619
		medium	395	390	809
		high	n/a	n/a	n/a
Energy for cooling		low	-153	-153	-218
		medium	-152	-156	-222
		high	-253	-253	-343
Electricity production		low	-207	-207	-355
		medium	-205	-227	-363
		high	-435	-435	-638

* Future economic impact: negative numbers indicate net losses, positive numbers indicate net gains, n/a: data not available.
**Result sensitivity with respect to socio-economic development parameters.

What impacts on the Austrian national economy can be expected?

The results obtained thus far examine the climate-related economic impact on electricity expenditure (for heating and cooling) disconnected from other sectors. Taking those interdependencies into account, the moderate climate change scenario and medium socio-economic developments show results of the gross domestic product (GDP) increasing[7] by an annual average of about € 30 mn (€ 50mn) over the 2016–2045 (2036–2065) period – an effect attributable to net savings in the energy sector. This would particularly benefit the areas of trade, retail, and real estate, as consumers would be able to spend more on respective products and services.

In comparison, the costs arising in the electricity sector have a much more negative impact on the national economy, which can be estimated at an annual average rate of about € 170 mn (€ 470 mn) over the 2016–2045 (2036–2065) period. In this case, the trade, retail, and real estate sectors would suffer losses, while the construction and energy sectors would profit from the developments. However, it has to be noted that, besides the costs mentioned, blackouts caused by peak demands and damages to the infrastructure (e.g., to power lines during storms) pose the highest potential risks for the national economy. It has not been within the scope of the current study to closely investigate these risks. In future, it should be avoided that high electricity demands, low hydropower electricity production, reduced compensating and storage capacities, and an inflexible demand for electricity occur at the same time.

3 See fn. 1
4 The results refer to the respective climate scenarios in comparison to the historic reference period (1981–2010).
5 In the »mild climate change« scenario, the number of cooling degree-days remains consistent, while the heating degree-days will decrease by approx. 13 % until 2050. In the »strong climate change« scenario, the number of cooling degree-days will increase by the factor of 6.5 until 2050, while heating degree-days will decrease by approx. 43 %.
6 Low/high sensitivity results from increasing and/or more ambitious building improvements and from the market penetration of air conditioning systems. The latter, in turn, is strongly influenced by developments in passive, building-related measures for reducing the cooling load (e.g., shadowing).
7 The result is based on comparing the respective climate change scenarios to a baseline scenario (which interprets the sector's socio-economic developments at a medium sensitivity level).

References

Kranzl L, Totschnig G, Müller A, Bachner G, Bednar-Friedl B. 2015. Electricity, Chapter 13 in: Steininger KW, et al. (eds.), Economic Evaluation of Climate Change Impacts: Development of a Cross-Sectoral Framework and Results for Austria. Vienna, Springer.

Kranzl L, Hummel M, Loibl W, Müller A, Schicker I, Toleikyte A, Bachner G, Bednar-Friedl B. 2015. Buildings: Heating and Cooling, Chapter 14 in: Steininger KW, et al. (eds.), Economic Evaluation of Climate Change Impacts: Development of a Cross-Sectoral Framework and Results for Austria. Vienna, Springer.

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