

## How do we reach our climate goals? New research findings and problem solving approaches

*Can Austria reach current energy and climate goals by 2020? The research institute SERI along with its partners tried to figure out answers to this question in the e-co project by order of the "Klima- und Energiefonds (Climate and Energy Fund)". On the one hand, they examined how necessary changes in Austrian energy consumption could look like and on the other hand they analyzed the resulting effects on the economy. Therefore, different scenarios with diverse foci were developed, such as expansion of renewable energy, increase in efficiency and reduction of consumption through behavioral change. Results are disillusioning. Only one of the scenarios achieves the target of a 34% renewable energy share of final energy consumption by 2020. Not a single scenario provides a decrease in CO<sub>2</sub>-emissions below the level of 1990 (62,08m tons CO<sub>2</sub>) – the Kyoto emission target for Austria would be 13% below the level of 1990. However, the transition towards sustainable forms of energy use has a positive effect on the GDP as well as on employment rates.*

The scenarios- all developed and modelled by SERI in cooperation with GWS ([www.gws-od.de](http://www.gws-od.de)) and RWTH-Aachen (<http://www.cepe.ethz.ch>)- equally consider all three cornerstones for implementing sustainable energy use: Substitution of fossil fuels by renewable energy (scenario "we use the right energy"), increase in energy efficiency (scenario "we use energy efficiently") and reduction of energy use through behavioral change (scenario "we use energy responsibly"). The integrating scenario ("We use the right energy responsibly and efficiently") contains all parameters of the different scenarios. Hence, it considers all three cornerstones in a single scenario.

To show the differences between the respective goals of a scenario and the probable development without further political action, a reference scenario has been developed: Business-as-Usual (BAU) describes the probable future development up to 2020 under the assumption that no political measures additional to the currently decided ones are taken. Like all other scenarios, BAU solely focuses on private households and their supply and demand of electricity and heating.

### **"Business-as-Usual"- Minor economic growth and slightly increasing employment**

The GDP in this scenario increases slightly due to the assumed recovery of the economy (GDP in 2020: 288 billion Euro). Private consumption (in 2020: 147 billion Euro) is supported by a tax reform and by enlarging the transfer income. Still, increase in private consumption is lower than the increase in GDP. First, public expenditures rise in response to measures taken against consequences of the financial crisis. Nevertheless, towards the end of the simulation period the public sector focuses on budget consolidation. Employment numbers increase by 70.000 people.

Furthermore, renewable energy can gain shares of the GDP in the BAU-scenario. It becomes obvious that the use of renewable energy intensifies even in the BAU-scenario, but to a substantially lesser extent than in the scenario "We use the right energy!" (plus 62 PJ in BAU, plus 155 PJ in the scenario). The share of renewable energy increases to almost 30%. Even though minor economic growth resulted in lower energy consumption, neither the 34%-target nor the aimed CO<sub>2</sub> reductions are reached. However, energy productivity increases and contributes to a better ratio of GDP and gross national consumption.

### **"We use the right energy!"- Significant energy savings, but not enough**

Massive development of renewable energy generates higher investment (about +1.9% in contrast to BAU-scenario), which positively affects the GDP. Moreover, the majority of the investment goods are produced in Austria. Parallel to the economic development, employment numbers rise by 73.000 (BAU-scenario: 70.000) between 2007 and 2020. Higher feed-in tariffs and higher amortizations lead to higher prices. However, that has only marginal effects on the economy. Due to higher efficiency of renewable energies, the gross national consumption of energy decreases. Nevertheless, the use of electricity increases slightly, which can be partly related to the growing use of heat pumps.

Resulting, a substantially higher proportion of the total energy sector has been reached through massive investments in renewable energies (+20.000 TJ in contrast to the BAU-scenario). However, the 34%-target in this scenario has not been reached in this scenario (33,3 %). In contrast to the BAU-scenario, CO<sub>2</sub>-emissions in 2020 are reduced by 6.7%, but still the numbers of 1990 (62.08 million tons CO<sub>2</sub>) have not been reached. A positive side of this scenario is the extensive decoupling of CO<sub>2</sub>-emissions from GDP.

#### **“We use energy efficiently!” - Only minor savings as compared to BAU**

Between 2008 and 2020 around 16.5 billion Euros are spent on housing and renovation which stimulates growth and employment. These positive economic effects, however, decline over time, as private household consumption suffers from the burdens of paying back loans.

Consumption of final energy develops stronger as compared to the reference scenario in the first years due to investments in the housing sector. From 2011 onwards, the development is comparatively weaker. This can be related to improved efficiency in regards to the production of heating. Compared to the BAU-scenario, households save about 6% energy in 2020.

In the final analysis of this scenario the ratio of the different sources of energy does not change significantly, except for the more efficient use of existing energy sources. Therefore, the target of producing 34% of the total consumption of energy with renewable sources is not met (almost 30%). Similarly, CO<sub>2</sub> emission targets are clearly missed: Compared to the BAU-scenario, they differ only slightly (- 1%).

#### **“We use energy responsibly!”- Long-term positive impetus toward expansion**

In this scenario it is assumed that the number of persons per household grows. As a result, the demand for apartments, hence, the number of new buildings decreased. In order to adapt to changed living arrangements, private households invest about 2.5 billion Euros between 2010 and 2020 into renovations of current housing. For the building industry this implies a reduction in production (about -6% p.a.) as well as employment (about -5% p.a.).

A further assumption in this scenario is that consumers change their demand for goods and services (towards energy saving services), which triggers positive growth signals. Goods with high import-share are less demanded; services with low work productivity are increasingly demanded. In total, private households act more consciously in regards to energy.

Regarding employment numbers, initial negative effects of lower housing investments are balanced in the long run. The increasing demand in the service sector leads to increased employment, which will outweigh the reduction of employees in the housing sector from 2015 onwards.

In comparison to the reference-scenario the percentage of renewable energy grows by about 2% to 31.8%. This improvement results mostly from the decline in housing, which is also responsible for the reductions of CO<sub>2</sub> emissions. The assumed low level of mobility of the households further contributes to this trend. Altogether, CO<sub>2</sub> emissions decrease around 10% in 2020 as compared to the BAU-scenario. “This scenario, which is based on behavioral modification, shows clearly that sustainable behavior might result in constraints in the short-term. However, it does not necessarily and permanently imply a decline in economic possibilities”, states SERI-scientist Andrea Stocker, supervisor of the project.

#### **“We use the right energy responsibly and efficiently”: Scenario that reaches 34% goal**

The integrating scenario, which combines all three previous scenarios, shows in total the strongest economic growth with increasing employment. The behavioral-change scenario- „We use energy responsibly“- has been slightly adapted for this scenario (the savings from the scenario assumptions have been reduced by a fifth). However, it still has a strong influence on the total outcome: On the one hand, employment and growth have been stimulated and on the other hand, energy and material consumption have been reduced.

The traditional scenarios with foci on expansion of renewable energy and energy efficiency respectively, are useful to reach changes in the energy mix and considerable savings. “We use the right energy responsibly and efficiently” is the only scenario to realize the 34% goal. Nevertheless, with 67m tons CO<sub>2</sub> emissions, CO<sub>2</sub> targets have not been reached in this scenario as well.

### **Profound behavioral change shows the most potential. A sustainable energy transition has positive effects on the Austrian economy**

Project Manager Friedrich Hinterberger summarizes the results of the e-co project as follows: “The scenario calculations show clearly: The biggest savings can be reached with profound behavioral change. The potentials of expanding renewable energy and increasing energy efficiency are not sufficient to induce the necessary energy transition” Especially in regards to increasing energy efficiency, the so-called rebound-effect shows negative consequences: Energy consumption- as can be seen on e.g. household appliances or private transport- increases continuously since years despite improved efficiency. “One problem solving approach would be an increase in energy costs to the extent of improved efficiencies”, suggests Hinterberger.

The probability of achieving behavioral change towards a sustainable energy transition within the coming years, is however low. “Studies show that technical measures tend to be more accepted than behavioral measures. Least accepted are changes in consumption patterns. Further: Energy is foremost saved to reduce costs, hardly to protect the environment”, says SERI-researcher Lisa Bohunovsky.

However, this should not be used as justification for lacking efforts to change behaviors. Improved energy awareness is necessary to induce an energy transition. “Political measures should focus on those sectors that are responsible for the majority of the Austrian private energy consumption, namely traffic and housing. Hereby, behavioral change of the Austrian population has to be addressed. Mobility is the fastest growing and most energy-intensive sector. Individual traffic can no longer be a taboo in politics”, urges Bohunovsky.

In regards to housing, measures are necessary to guide people’s perception of the preferred housing form: dense housing needs to be promoted and living in green areas needs to become more expensive.

### **Other current SERI research in the energy sector**

- **Consumers and Energy Saving Measures: Modelling Impacts of energy-political measures on consumers (KONSENS).** SERI analyzes how consumers are affected by different energy political measures. Hereby- additionally to highlighting the potential to save energy and CO<sub>2</sub>- economic and social compatibility are examined.
- **Feasible Futures.** The project examines (1) the natural resources requirements to restructure the energy system, (2) anticipated geological, political and economic availability of key resources, (3) the impacts of resource scarcities on the energy transition in Austria and (4) risks and opportunities of energy and climate politics on Austrian and European level.
- **Energy consumption patterns (EV-Stile).** In this project, SERI defined different energy consumption patterns and validated them through sampling across Austria.
- **Private Engagement in the energy sector (PEng).** Does private engagement in the energy sector contribute to the development of energy-sensitive ways of living? How can these engagements be fostered?