

Renewable energy as a driver for regional economic growth and employment

Journée de la recherche – Fonds Nature et technologies

Green, Sustainable and Renewable: Current Energy Issues

École de technologie supérieure Montréal, April 10th 2017

Energy Institute at the Johannes Kepler University of Linz

Regional Leaders' Summit – Energy Network

- Scientific coordinator of Upper Austria
- Tasks:
 - implementation of research activities and strategic development
 - coordination of mid and long term cooperation



Three departments:

- Energy Economics
- Energy Technologies
- Energy Law



the combination of these core disciplines allows comprehensive analyses and accounts for all aspects of future-oriented renewable energy systems and energy efficiency

Scientific staff

- Head of Departments: 3
- Project leaders, senior researchers: 10
- Phd-Students, research fellows: 12

Energy Institute at the Johannes Kepler University of Linz

“Green, Sustainable and Renewable” - our recent research activities

■ ENERGY STORAGE

- In the area of energy storage systems, the Energy Institute focusses especially on R & D in the field of *power-to-gas*. The term "*power-to-gas*" refers to the use of electrical energy from (predominantly) renewable energy sources for the production of hydrogen in an electrolyzer and, optionally, the synthesis of the produced hydrogen with carbon dioxide into methane. In this context, the Energy Institute also coordinates the Austrian power-to-gas platform.

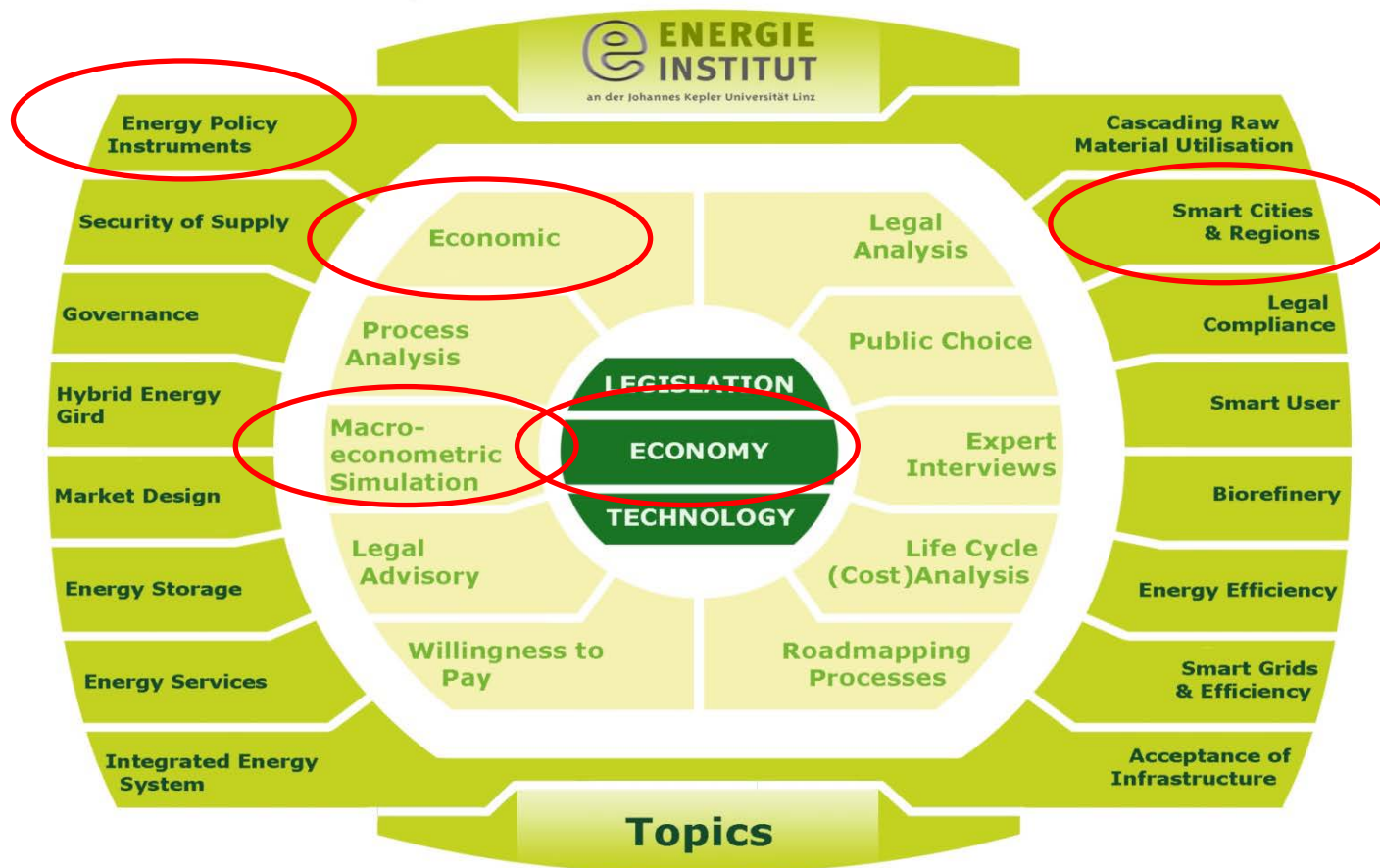
■ INTEGRATED ENERGY SYSTEMS & HYBRID NETWORKS

- A hybrid network is understood to be a power network system which is strongly connected / integrated via (new) interface technologies from different energy networks (e.g. electricity, gas, heat), which are bidirectionally coupled.

■ BIO REFINERIES

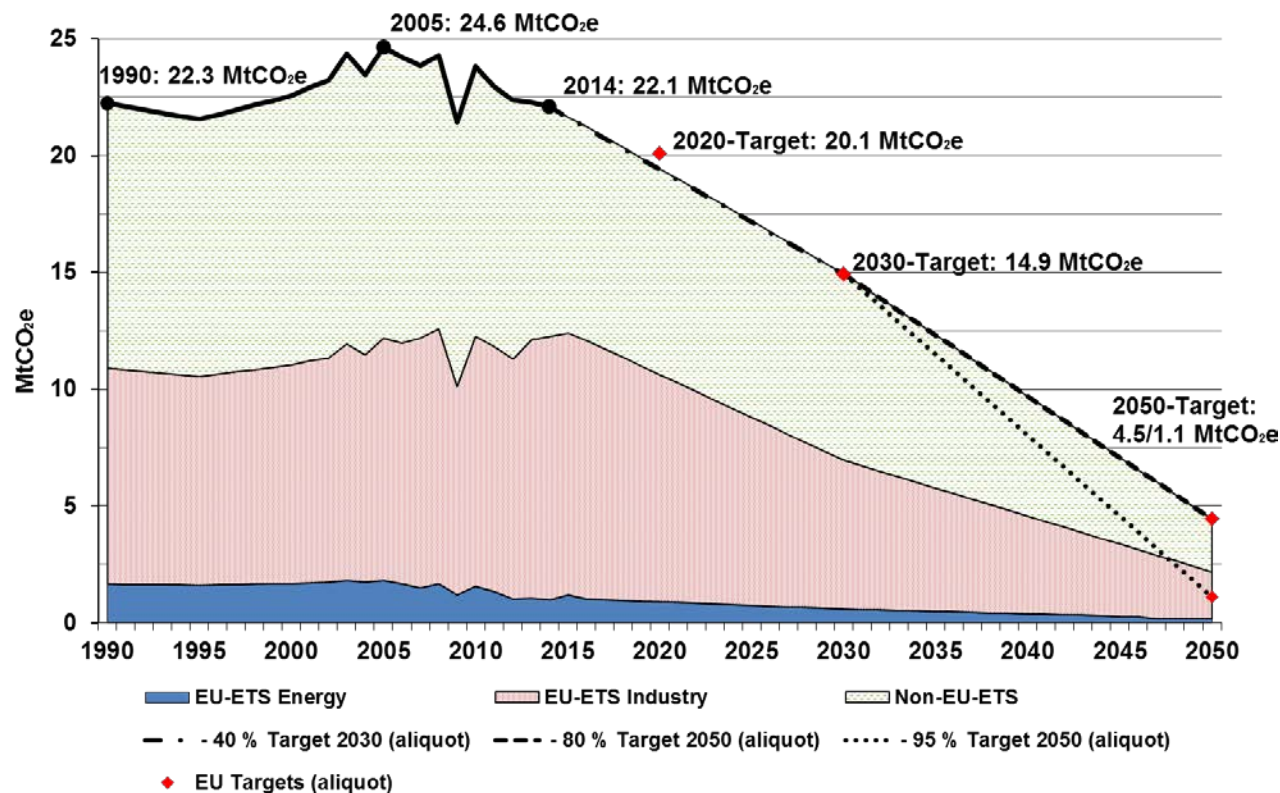
- Under the management of the Energy Institute, the feasibility of green bio refineries was examined in a small industrial demonstration plant.

Energy Institute at the Johannes Kepler University of Linz



Introduction

Historic Upper Austrian GHG emissions & Upper Austrian GHG Emission Targets for 2020, 2030 and 2050 (derived proportionally from EU climate policies)



THG emissions (in m tCO ₂ e)				
Targets	2014	2030	2050 ¹⁾	2050 ²⁾
Total	22.1	14.9	4.5	1.1
Non-ETS	9.9	8.0	2.3	0.6
ETS	12.2	6.9	2.2	0.5

¹⁾ 80 % target, ²⁾ 95 % target

Introduction

Results of Eurobarometer survey for Austria, Spring 2015

What do you think are the two most important issues facing Austria at the moment?		
Rank	Issue	Responses in %
1	Unemployment	33%
2	Immigration	31%
3	Government debt	22%
4	Economic situation	20%
5	Rising prices/inflation	19%
6	Education	14%
7	Health	14%
8	Pensions	11%
9	Environment/Energy/Climate	9%
10	Crime	8%
11	Taxes	6%
12	Terrorism	4%

When “**green**” is not enough for society, firms and politicians...
... **economic effectiveness** can be convincing.

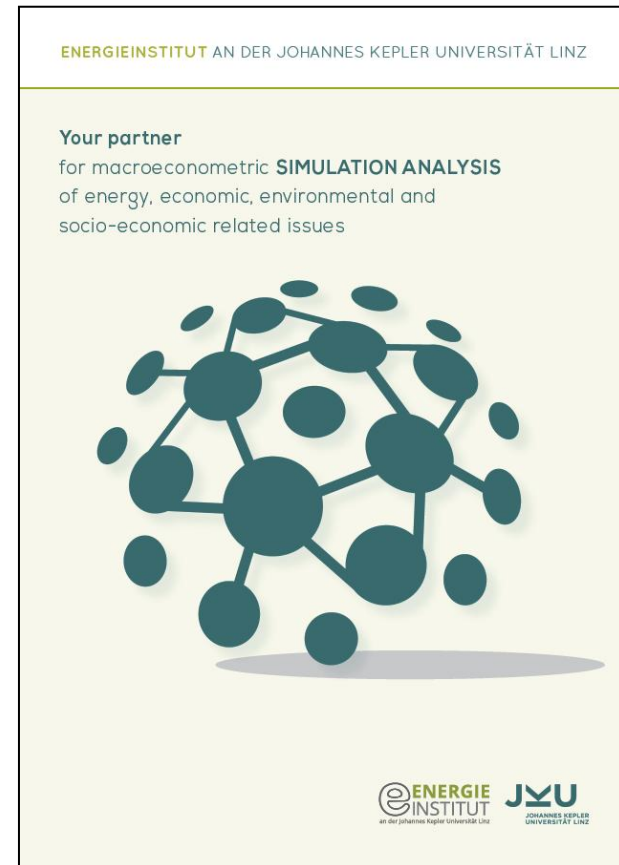
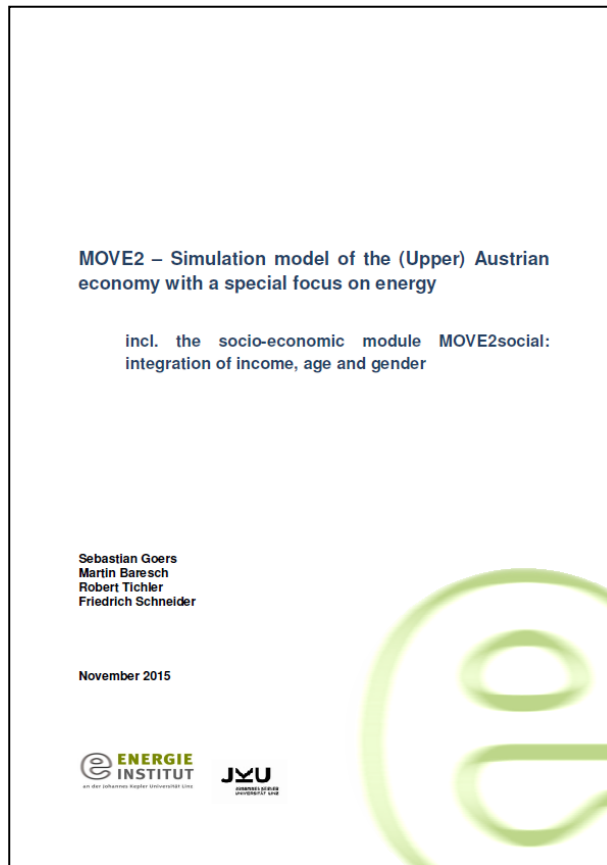
Introduction

Renewable energy as a driver for regional economic growth and employment

- Development of strategies to respond to economic, social, ecological, political and technological challenges is crucial.
- The issue arises of whether **“green” policies** can possibly produce a **double dividend** in terms of both environmental and social goals.
- Within the research of **the department of Energy Economics** we measure the employment and distributional effects of green policies / renewable energy in Upper Austria
 - **Macroeconomic and socio-economic effects**
 - Gross regional product
 - Employment
 - Consumption of private households
 - Investment of firms
 - Trade balance

Introduction – Simulation tool for (macro)economic analysis

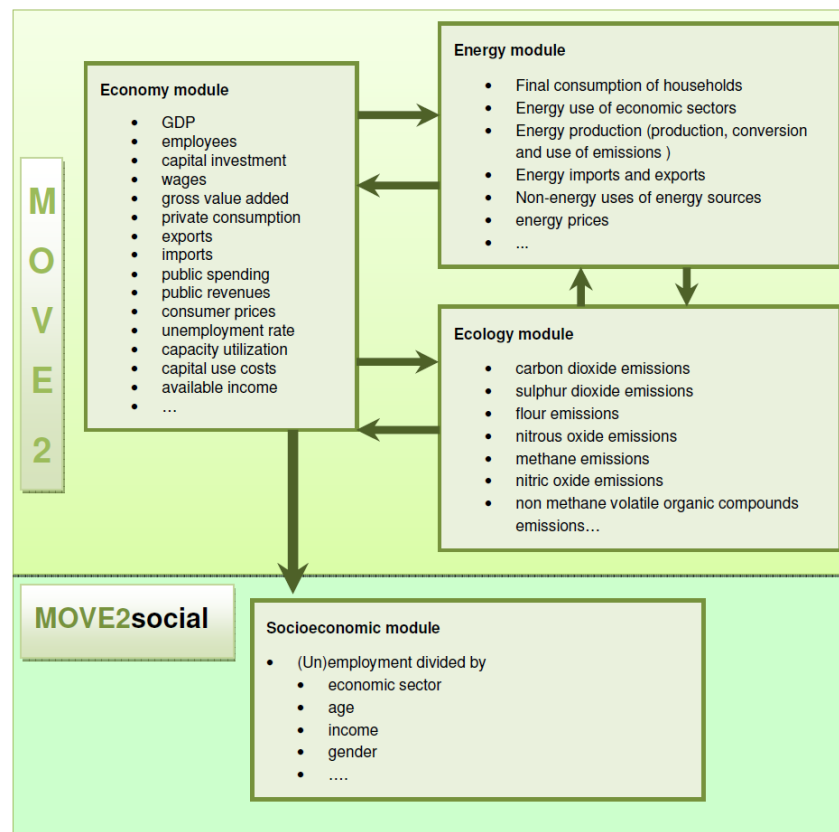
Renewable energy as a driver for regional economic growth and employment



Introduction – Simulation tool for (macro)economic analysis

Renewable energy as a driver for regional economic growth and employment

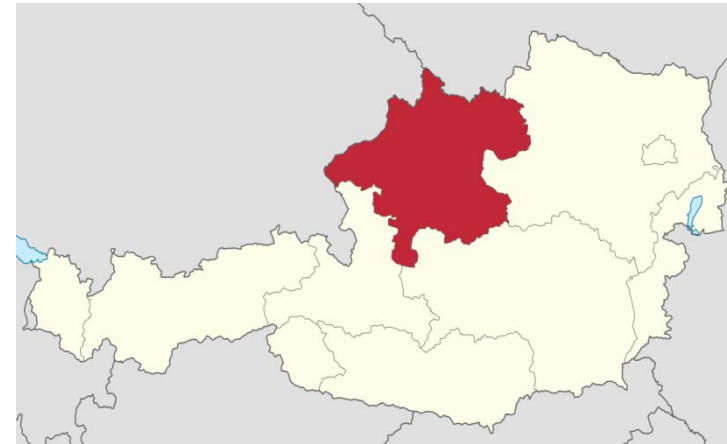
forestry and fishery
mining industry
real assets production
energy and water supply
building industry
commerce and repair of automobiles and durable goods
accommodation and restaurant
transport and communication and information transmission
credit and insurance industry
real estate and business services
public services
other services



ambient heat	diesel	liquefied gas
bio fuel	district heat	natural gas
brown coal	electric power	other refinery inputs
coal briquets	fire wood	petrol
coke	fuel oil (heavy)	solar and wind power
coke oven gas	fuel oil (light)	stack gas
combustible turf	hydro power	stone coal
crude oil	kerosene	waste

Upper Austria - Profile

- Upper Austria is one of Austria's nine regions/federal states.
- It covers an area of 12,000 km² and has a population of about 1.4 million.
- Upper Austria accounts for about one quarter of the industrial production and exports of Austria.
- The region is characterized by a dynamic development, economic prosperity and a low unemployment rate.
- **The renewable energy and environment technology sector shows rapid growth with currently approx. 45,000 employees.**



Source: <http://www.nationsonline.org/oneworld/austria.htm>

Source: https://en.wikipedia.org/wiki/Upper_Austria

The Upper Austrian Energy Strategy

- Since the mid-1990s, there have been strategies to stimulate **energy efficiency**, **renewable energy** and **other innovative energy technologies in Upper Austria** that generated measurable results in energy generation and demand as well as a significant number of innovative projects.
- Already with the energy concept adopted in 1994, specific goals were defined up to the year 2000, which included both the consumption and the supply side. With the concept "**Energy 21**" adopted in 2000, this energy strategy was continued.
- The starting point for the **new energy strategy** is the Upper Austrian Energy strategy regarding energy generation in 2030. This strategy was planned to be implemented until the year 2030 and is now being expanded by the **new equally climate and location-oriented energy strategy "Energie-Leitregion OÖ 2050"**.

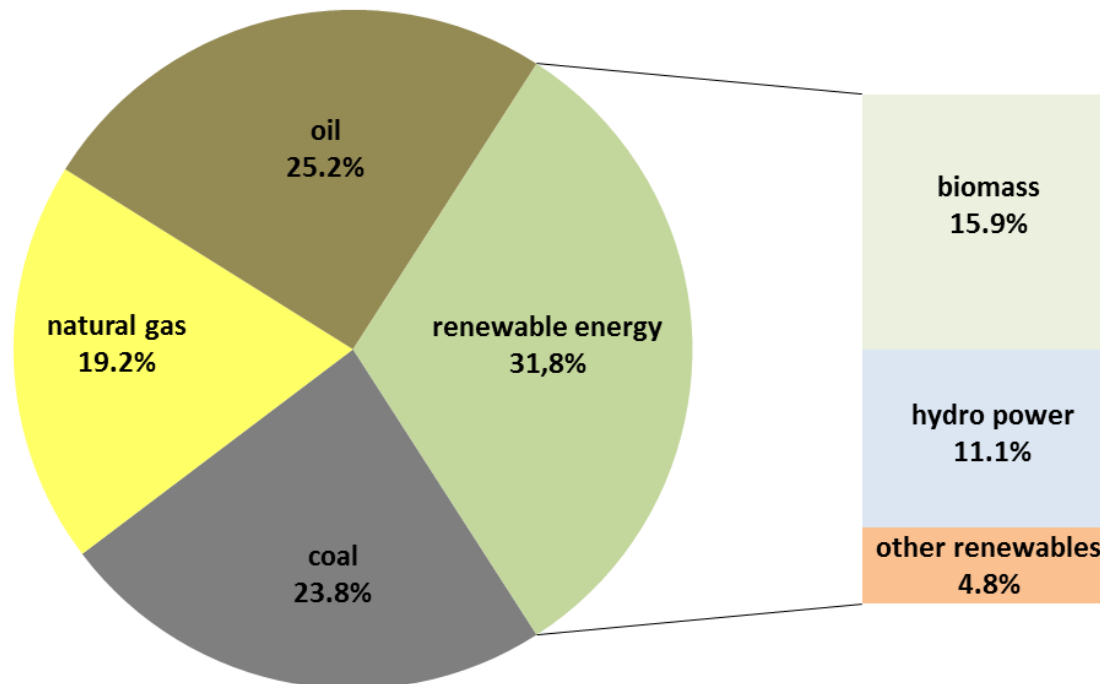
The Upper Austrian Energy Strategy

- The vision of this strategy is the establishment of Upper Austria as region with regard to the improvement of **energy efficiency**, the application of new technologies (**Upper Austria as the first "smart region" of Europe**), as well as an international **technology leadership** in selected core areas of **energy and environmental technology**.
- The revised energy strategy comprises five equal-ranking objectives in the areas:
 - **energy efficiency/renewables**
 - **supply security**
 - **competitiveness / profitability**
 - **innovation / location / research and development**
 - **acceptance / interest representation**



Upper Austria – Key Energy Data

Gross domestic energy consumption by energy source Upper Austria 2014: 316 PJ/88 TWh



Renewable energy in

Heat – **45%**

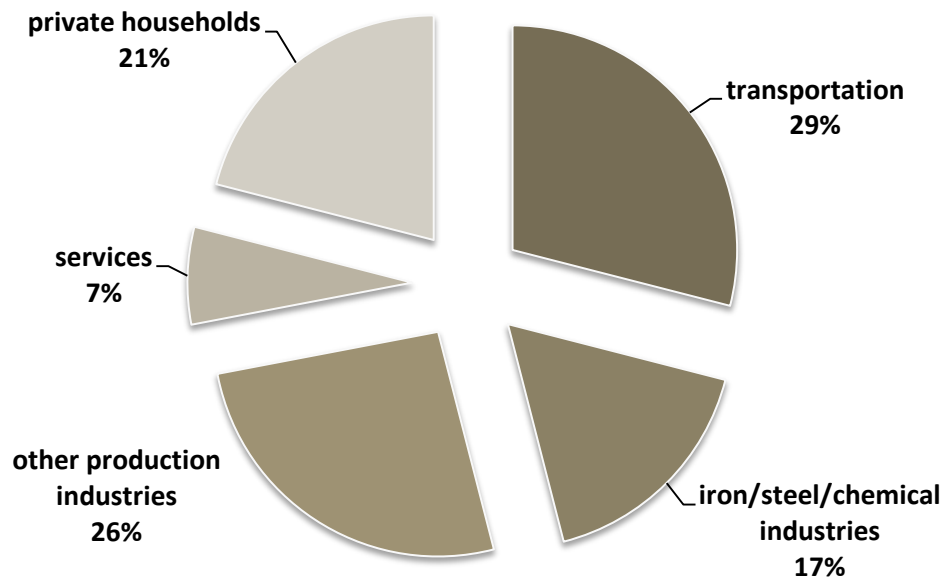
Electricity – **80%**

Transport – **7%**

Source: Upper Austria energy report 2015 (Upper Austrian Government, 2016)

Upper Austria – Key Energy Data

Final energy consumption by sectors Upper Austria 2014: 225 PJ/ 63 TWh



Source: Upper Austria energy report 2015 (Upper Austrian Government, 2016)

Upper Austria – Key Energy Data

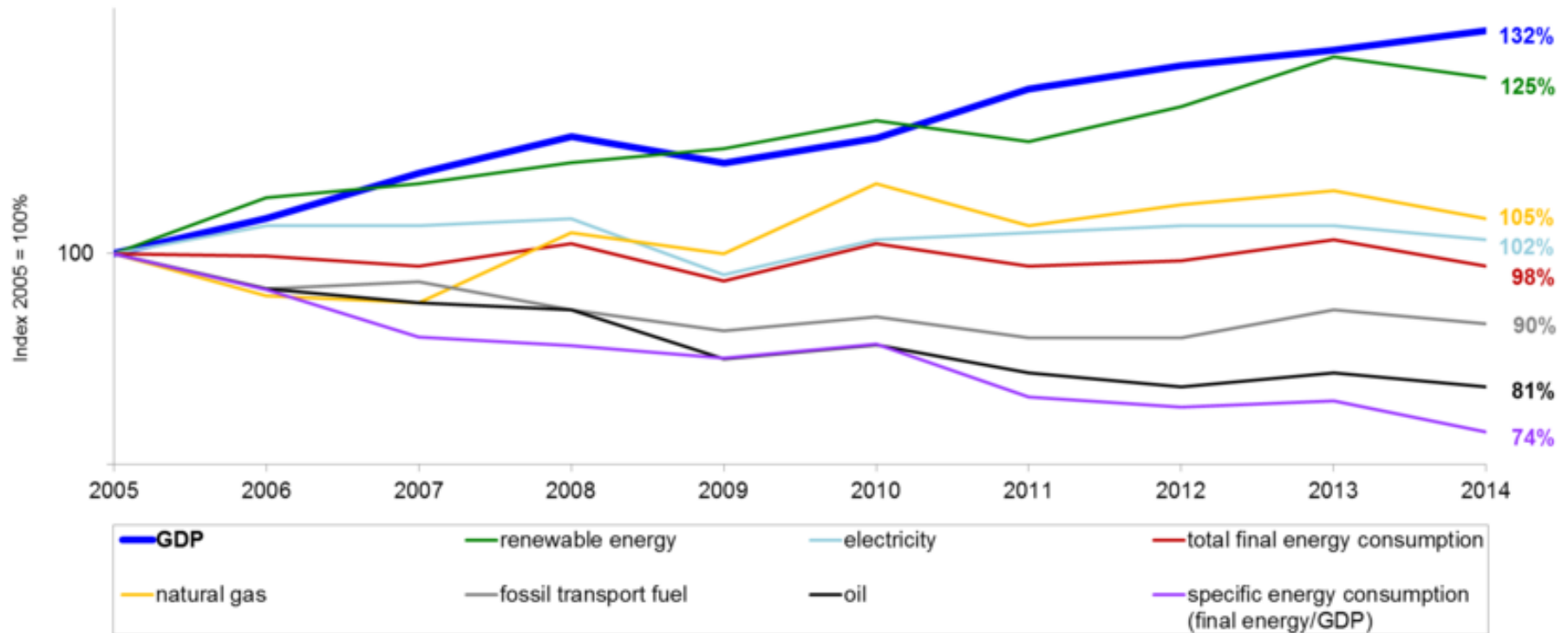
Important results 2015

- The overall capacity of the 2015-installed **PV systems** reached 30 MW_{peak} (2,600 new plants installed).
- In 2015, approximately 30,000 m² of **solar thermal systems** were installed.
- More than 2,000 modern **biomass heating systems** and around 1,700 **heat pumps** were installed in 2015.
- Since 2005, the energy demand for the **space heating** of the regional administrative buildings has decreased by 18 %.

Source: Upper Austria energy report 2015 (Upper Austrian Government, 2016)

Upper Austria – Longer-term energy development

Development of energy consumption and GDP
Upper Austria 2005 - 2014



Source: Upper Austria energy report 2014, LEB

Green jobs and economic growth in Upper Austria

Study: **green jobs in Upper Austria.**

Energy Institute at the Johannes Kepler University of Linz (2015)

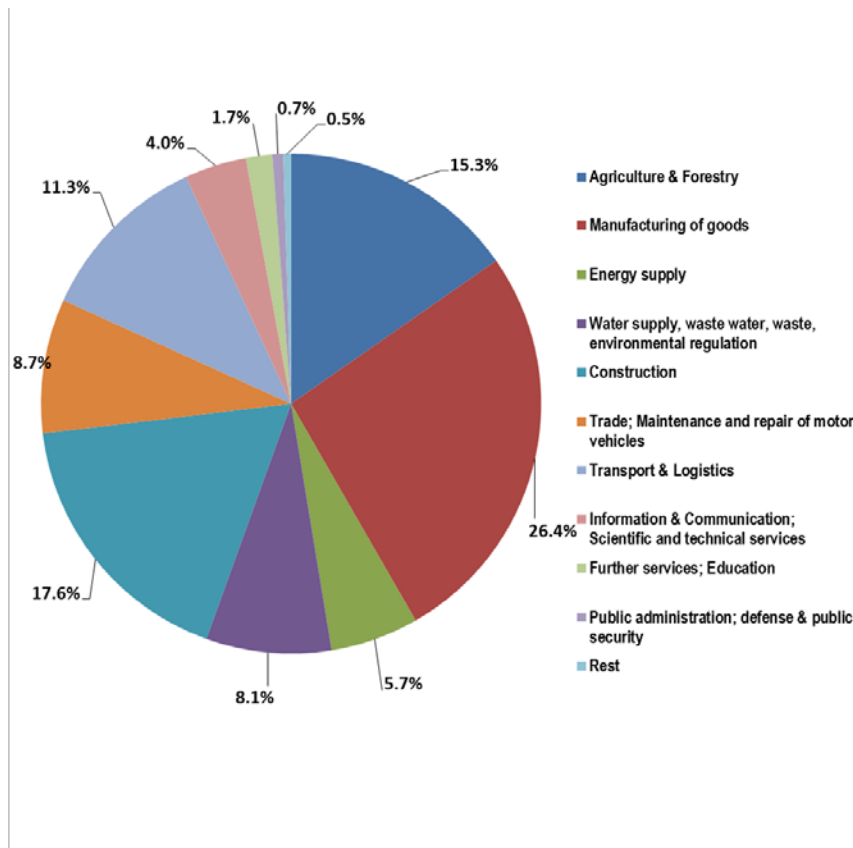
- **Green economy**

**Economic data: Environmental economy and resource management,
Upper Austria, 2008-2011**

	unit	2008	2009	2010	2011
Total Revenue	m €	7.418	7.409	7.362	7.686
Relativ to GDP	%	15,0	15,5	14,9	14,7
Environmental services	m €	2.578	2.671	2.470	2.480
Environmental goods	m €	3.386	3.282	3.415	3.619
Environmental technologies	m €	1.454	1.456	1.477	1.587

Green jobs and economic growth in Upper Austria

• Green jobs in Upper Austria



	2011
green jobs – total [employees]	43,311
Relative to total employees [%]	6.9
Environmental services [employees]	13,586
Environmental goods [employees]	14,877
Environmental technologies [employees]	6,274
Public transport [employees]	4,876
Trade [employees]	3,698

Green jobs and economic growth in Upper Austria

In the study, the following measures were analyzed:

- **increasing the production of electricity from renewable energies;**
- expanding the production of district and household heat from renewable energies;
- increase the rate of renovation of residential and service buildings to 3% by 2020;
- increased support of energy research.

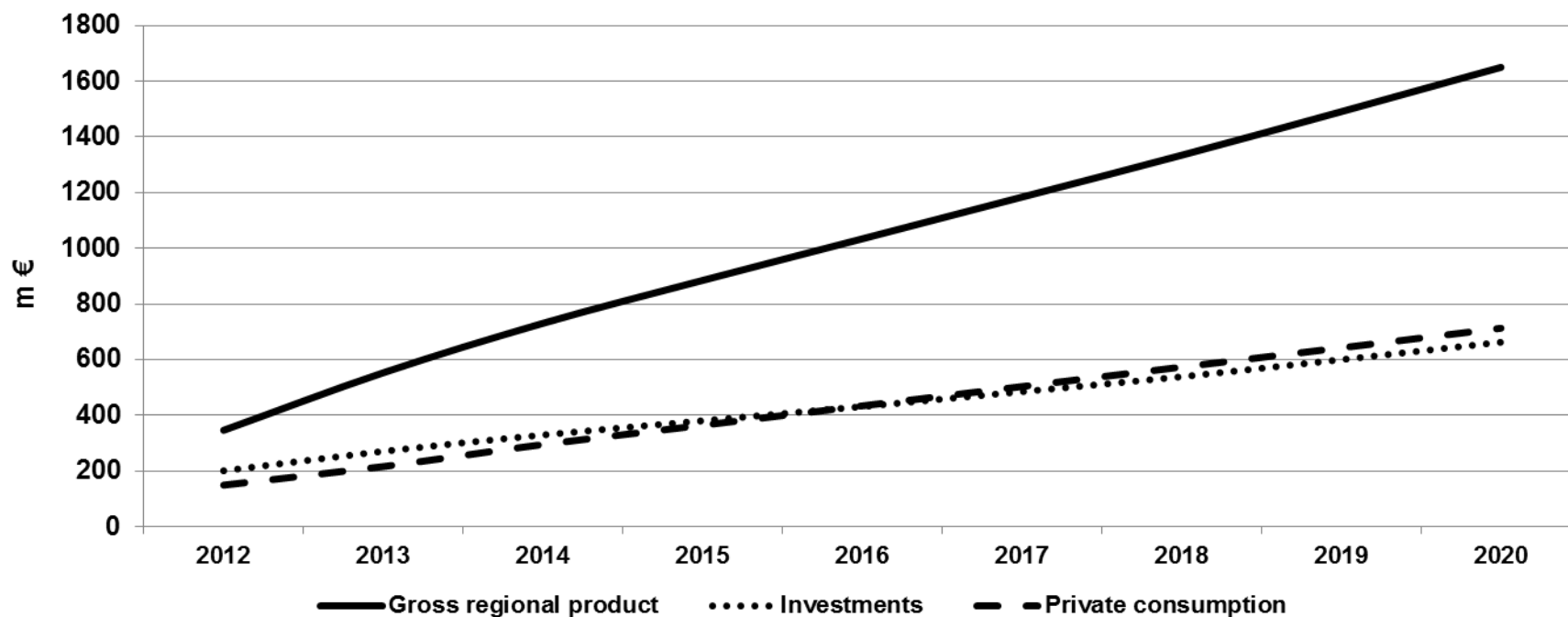
The measures to **increase the share of electricity from regenerative sources** included

- expansion of **hydropower**,
- increased use of **wind energy**,
- widespread introduction of **photovoltaic systems and concentrated solar energy**,
- exploitation of the domestic **biomass** potential (solid biomass, biogas, liquid biofuels)
- applications of **renewable energy in cogeneration**.

In addition, considering the installation of required pumped-storage power plants and the expansion of transmission networks by 2020 was necessary.

Green jobs and economic growth in Upper Austria

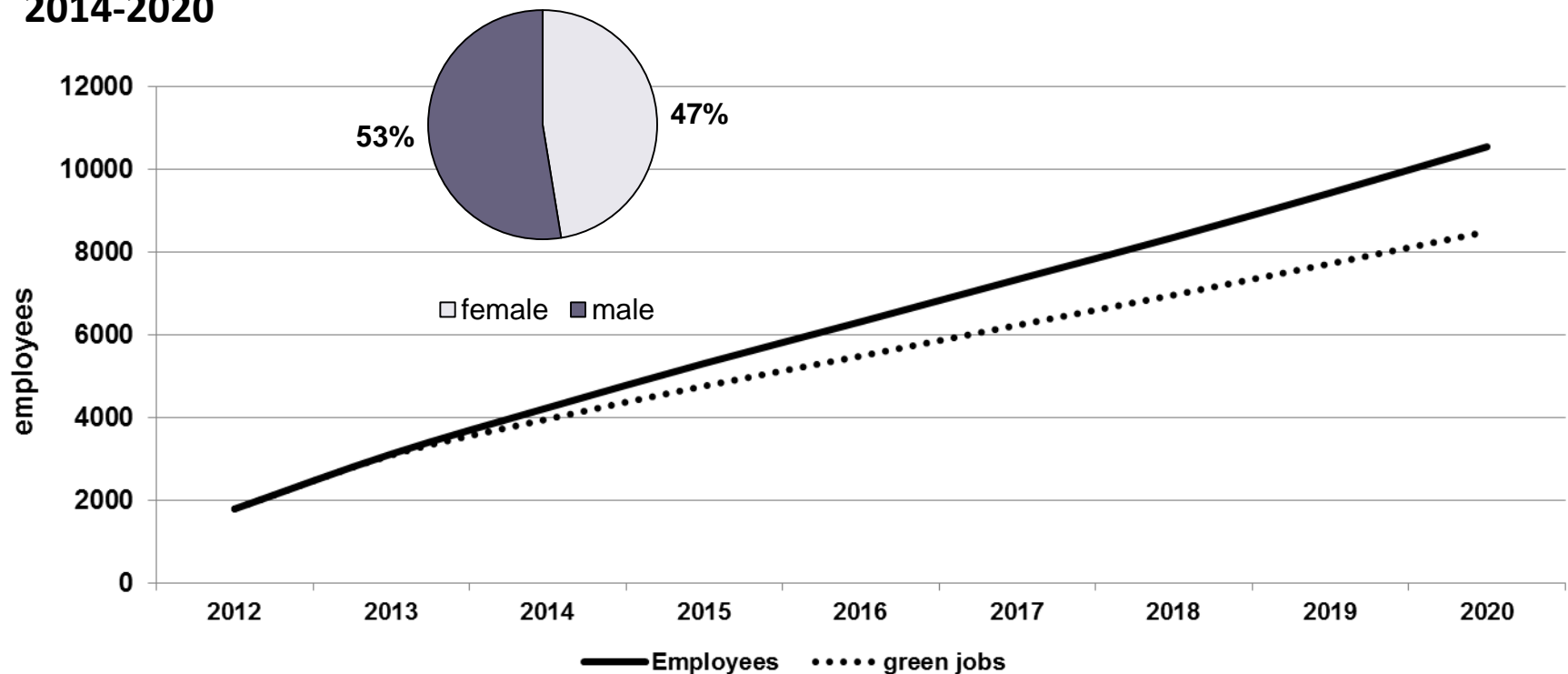
Macroeconomic effects in Upper Austria resulting from energy and climate policy measures, 2014-2020



Source: Own calculations based on the simulation model MOVE2, Energieinstitut an der JKU Linz, July 2015

Green jobs and economic growth in Upper Austria

Employment effects in Upper Austria resulting from energy and climate policy measures, 2014-2020



Source: Own calculations based on the simulation model MOVE2, Energieinstitut an der JKU Linz, July 2015

Green jobs and economic growth in Upper Austria

Growth projection of green jobs (including those from the dynamic simulation analysis)

	Scenario 1	Scenario 2	Scenario 3
green jobs 2015	44,800	43,000	45,800
green jobs 2020	55,000	48,000	54,600
growth 2011-2020	58.3 %	38.2 %	57.1 %

**Implementation
Report Energy
Strategy Upper
Austria:**

*“The renewable energy
and environment
technology sector
shows rapid growth
with presently approx.
45,000 employees.”*



Source: Own calculations based on the simulation model MOVE2, Energieinstitut an der JKU Linz, July 2015

Conclusion

Renewable energy as a driver for regional economic growth and employment

- The Upper Austrian economy and industry used the chances of transforming the energy system so far very well and gained competencies in central areas of energy and environmental engineering .
- These competencies can be used as a basis for further growth and the creation of additional added value.
- From the point of view of economic and socio-economic science, a double dividend by the means of achieving climate-friendly and economical/social goals simultaneously can be postulated.

Thank you for your attention!



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