DO RENEWABLE ENERGIES REDUCE REGIONAL DISPARITIES IN GERMANY?

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Overview

The expansion of renewable energy constitutes a major structural change in the German economy. Because at present the increased deployment of renewable energy is mainly driven by politics, the analysis of distributional effects is essential. This is the focus of the research project ImpRES. This paper focuses on regional distribution effects.

There are significant regional disparities in Germany and reducing them is declared objective of both European and German policy. The European Union classifies (with only few exceptions) the former eastern German regions as transition regions whereas the former western German regions are classified as more developed regions. The rural / less dens populated structure of the eastern regions makes them attractive for production of renewable energy, especially biomass. An integrated assessment model is used to analyze the question wether renewable energy expansion reduces regional disparities and thus energy policy positively contributes to cohesion policy objectives.

Methods

The system dynamic integrated assessment model ASTRA-D is used to simulate 2 scenarios, one with moderate and one with strong renewable energy expansion. The time horizon of the simulation is from 1995 to 2030. Various impacts of the technology mix on the energy sector are taken into account, such as the sectoral and regional structure of the energy sector´s investments and its intermediates, the impact on gross value added and price of energy. Not only these direct effects but also indirect effects due to inter-sector-linkages lead to change in regional and sectoral gross value added and thus have an impact on regional income distribution.

The macro economic section of the model covers 72 sectors. Their inter-linkage is depicted in an input-output (IO) module. Consumption, investment, export and government consumption are modelled separately and enter the input-output module as final demand. Gross value added per sector is the output of the IO module and is linked via labour productivity with the employment module. There are several closures and feedback loops between the single modules.

There is only one energy sector in the macroeconomic section, so a bottom-up module is developed which takes into account the technology mix of the scenarios. Exogenous input to this bottom-up module is cumulated and new installed capacity for renewable energy technologies (Wind onshore and offshore, PV, water, biomass) and conventional energy technologies (coal, lignite, nuclear, gas), with high resolution in space (39 NUTSII zones) and time (yearly from 1995 to 2030). For each technology the module contains investment vectors (taking into account planning, production and installation of the facility and covering the 72 IO sectors), vectors of intermediates and gross value added. Each vector element additionally is assigned to a region: either the region of energy production,

the region of the main supplier of the facilities, “national not specified” or imports. Outputs of the bottom-up module are investments of the energy sector as well as its input structure and elements of gross value added. These as well as the scenario dependent energy prices are used in the macro economic section to determine national gross value added per sector including indirect effects.

One part of regional gross value added is directly specified in the bottom up module. The rest is derived from national gross value added which is distributed top-down based on regional and sectoral gross value added and employment data with certain assumption regarding regional productivity. Aggregated regional gross value added serves as a proxy for regional GDP and is combined with population to determine regional GDP per capita.

Results

A comparison of the scenarios is used to analyse the impact of renewable energy expansion on regional income distribution. Typical methods to measure income distribution (Lorentz curve, GINI) are applied and thus make results comparable to outcomes of other models / methodologies.

The project is still on-going and the conference would be used as a forum for discussion of the results. Preliminary results indicate the following:

Regional distribution of renewable energy production: Solar energy is mainly produced in the south of Germany, wind energy is mainly produced in the north of Germany, especially north-west, energy production from biomass is about equally distributed.

Regional investment impulse: Only a part of the investment impulse occurs in the region of energy production and its size differs between technologies; for wind energy the main effect (>80%) occurs in the region of the main producer of the technology whereas for solar energy only 25% of the investments occur in the region of the German component producers, 30% are imported and 35% occur in the region of energy production.

Regional impact of operation and maintenance: Similar to investments, the technologies differ with respect to the region of impact. For some technologies, the region of energy production dominates whereas for others the region of the main supplier of technology components benefit

Regional impact of altered energy prices: Results indicate that richer regions (e.g. in the south of Germany) are more affected due to their economic structure.

Change in gross value added: Still ongoing research. First results indicate a slight increase in national gross value added, dominated by the positive investment impulse. Richer regions slightly benefit more but the overall impact on income distribution seems not to be significant.

Conclusions

Renewable energy expansion has various impacts on regional income distribution which differ in direction and magnitude. A systemic analysis is necessary to derive the net effects.

References

www.astra-model.eu