Modelling at EU and MS level

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Introduction

Modelling of economic and technological developments as well as emissions is key part for policy and strategy development at the EU level and in a number of Member States. Requirements such as the reporting of integrated national energy and climate plans and long-term strategies by Member States increase the need for modelling at the Member States level. However, exchange and coordination of modelling at the different levels is so far very limited. Rather, there are clear differences between the models applied and the assumptions and input data used at EU level and the models used in the individual Member States.

Modelling at the EU level

At the EU level, there are two central models/model suits currently being used or under development for modelling of energy and climate related questions: the PRIMES model (linked with GAINS and GLOBIOM for modelling of non-energy related emissions) developed and deployed by the National Technical University of Athens and the E3MLab and the POTEnCIA model that is currently being developed by the EU's Joint Research Center IPTS in Sevilla. In the context of development and application of the two models, two different approaches in communicating with member states and national experts could be observed.

The PRIMES Model

The PRIMES model is an energy system model covering all EU member states individually. In the past, the model was used for the development of reference scenarios (e.g. the EU reference scenario 2016) and in the context of different impact assessments (e.g. on the low-carbon economy roadmap 2011, the energy roadmap 2011 and the EU long-term strategy to be published at the end of this year) on behalf of DG Energy. In context of these modelling exercises and over the years, an interactive process has developed between the Commission services, the contractors and member states, within this process, the contractors develop a first set of data and assumptions for the modelling. These data and assumptions are then circulated and discussed with experts from the member states and the Commission during discussions in Brussels. National measures and policies related to capacity building, new infrastructure, etc. in the fields of energy (primary production, transformation into secondary energy, final consumption in industry, transport and buildings), agriculture and climate are collected from member states by a detailed questionnaire to be answered by national administrations/experts. Based on this set of data and assumptions, a first reference scenario is created by the contractor. In order to validate the individual country results, these are reviewed by experts from the member states. Based on the review, the scenarios are adapted, finalised and published after approval by the Commission.

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The modelling suite (and in particular the PRIMES model) tasked by the Commission is a proprietary model that is not available for external investigation except for limited aspects. As a result, the model is in many aspects considered as a "black box" by member state experts and their results are taken with caution by national administrations. The possibility of written questions and bilateral meetings, at which sensitive aspects such as technological potentials in relation to institutional restrictions (e.g. PV capacity potentials) as well as assumptions on the member state level could also be discussed, improved understanding and acceptance of the model and its results in the member states. However, in particular smaller countries' representatives report that uptaking of their inputs by the modelling team is rather slow. Despite these efforts, the fundamental concerns about the transparency of the model remain. Especially, since some modellers report that attempts to gain more insight into the PRIMES model and to discuss open questions were often not answered.

The POTEnCIA Model

In answer to the criticism of modelling with PRIMES, the European Commission (by one of its joint research centers (JRCs)) is currently developing an in-house energy-system model. The new model POTEnCIA (Policy Oriented Tool for Energy and Climate Change Impact Assessment) - once the first development phase is successfully completed - will be freely available to Member States in the future to carry out impact assessments of their own policies. The model includes all EU member states individually and has a projection horizon until 2050 in annual time-steps. The model is validated through technical peer reviews and is continuously updated through interactions with member states on policies, technologies, economic and demographic assumptions. The exchange with the national experts started in late 2017 and is still ongoing. Currently, a central scenario is being developed.

The model is based on a new database, which is also being developed by the JRC and publicly available: the JRC-IDEES database. It contains energy-related historic data on the member state level from 2000 to 2016 (partly building on Eurostat data) and will be updated annually.

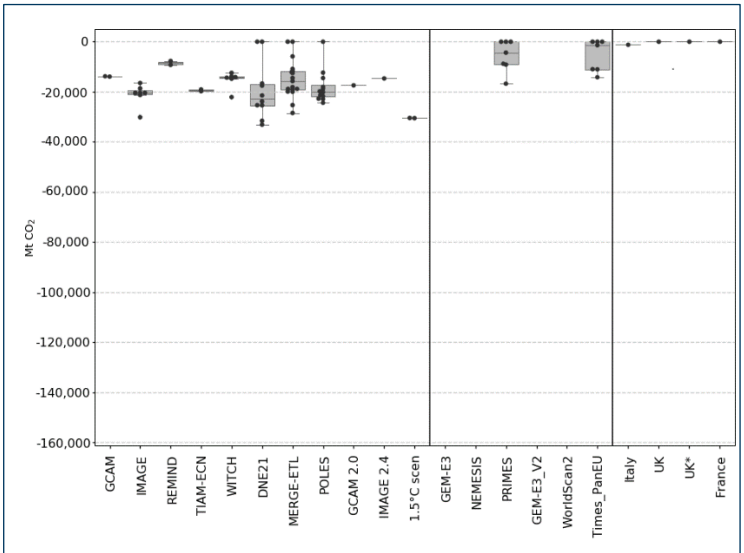
According to participants in the exchange with the Commission, the process in the development of the POTEnCIA model and the database was much more transparent than the exchange on the PRIMES modelling activities. Continuous improvements in the transparency and exchange of EU modellers with national modellers and experts have been achieved. However, the Commission's efforts have not yet delivered on its promise to make the model accessible to the wider modelling community (open access).

Also, it should be kept in mind that the POTEnCIA model does not yet represent a real alternative to the PRIMES model. Links to other non-energy models (Globiom, Capri etc.) do not yet exist. Therefore, and due to the length of the process to define inputs and elaborate outputs, it seems uncertain whether the overall (EU) consistency of the Integrated National Plans on Energy and Climate will be verified using the POTEnCIA Model. The PRIMES model is more likely to be used for this purpose.

The role of EU Level and MS modelling

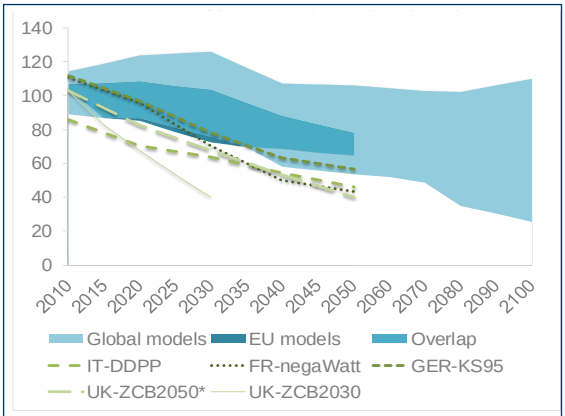
Currently, there is no uniform procedure with regard to the determination of assumptions or the use of models at the member state level. In contrast to the EU level approach, which rather models the individual member states on an aggregated level, some of the models used by member states are very detailed. This means that the member state models much better represent the characteristics of the countries, especially with regard to available techniques or specific geographies and individual policies and measures. It is therefore not surprising that the scenarios in the individual Member States often differ significantly from the scenarios developed at EU level and especially for smaller member states, these deviations can be very large. The difference in the modelling approaches partly also determines the mitigation strategies. For example, there are higher negative emissions in the EU wide scenarios until 2050 than in the comparable scenarios of the member states. In contrast, in the national scenarios the increases in energy efficiency are significantly larger than in the comparable scenarios at EU level (see Figure **Error! No text of specified style in document.**-1 and Figure **Error! No text of specified style in document.**-2).

Figure Error! No text of specified style in document.**-1: Negative emissions in EU-level models compared to MS-level models**



Source: Duscha et al. (2018)

Figure Error! No text of specified style in document.**-2: Final energy demand per capita (GJ/a)**



Source: Wachsmuth and Duscha (2018)

When comparing the EU level and member state level scenarios, it should be kept in mind that they have different roles and that a higher consistency is not ultimately necessary. The EU level modelling can show different strategies for decarbonization which can be used as source of inspiration by national governments. This is particularly relevant for smaller member states with limited modelling and strategy development capacities.

Case study: A tentative approach to bringing a net-zero MS scenario to a EU level

As described in the previous section, there are often large differences between EU level scenarios and scenarios at member state level due to the level of detail of the models and differences in assumptions. A detailed approach at EU level is very difficult to implement due to national circumstances such as technology, geography or tradition. The Association negaWatt is currently working on a project idea to bring its own national modelling philosophy for France to a broader - possibly EU-wide - scenario.

The 4th négaWatt scenario (2017) is the first and only 2050 scenario reaching zero carbon emissions in France. The approach follows a systematic application of a 3-step holistic sustainability strategy to France. The three steps for decarbonization applied are: (i) sufficiency (individually and collectively optimising energy services), (ii) efficiency (fulfilling services in the most effective way) and (iii) substitution (phasing out stock-based energies, shifting to flow-based ones). The approach follows a bottom-up view with detailed descriptions of the required and possible changes. The scenario is based on a physical energy-system model that models the energy sector from final demand to primary energy supply. It uses cautious assumptions on technology and economics, it addresses carbon neutrality in synergy with other sustainability issues and it provides a clear, year by year trajectory bridging today's decisions with a long term vision. In France, the scenario has had a major impact on the energy and climate debates and has proved to be an effective tool for elaborating, assessing, discussing and strengthening stakeholder support for policies and measures aiming for the relevant scale, scope and pace of action.

So far, a similar approach has not yet been applied at the EU level. The implementation of a bottom up, systemic, energy services based approach is by nature very much influenced by the specificities of the system it is applied to, e.g. level of services and social preferences, mix of energy carriers (existing uses, change potential, infrastructures), renewables (existing natural resources), agriculture, forestry, land use

constraints (geography, population density) and other industrial, regulatory, social, historical factors etc. Expanding the négaWatt scenario approach to the EU scale would not better catch these national specificities than developing a top-down modelling approach on EU level. Conversely, the addition of national systemic ambitious would not appropriately address e.g. optimisation through mutualisation of potentials and constraints (e.g. electric system, land use…), harmonisation of efforts, benefits, living standards, etc. or leverage potential of policies at European level (e.g. industrial strategy, trade…). Therefore, the idea is to - instead of extending the model applied by the Association négaWatt to the EU level, to build a network among modelers that develop ambitious scenarios in different European countries, not covering all EU countries from the beginning, but a network that can be extended over time. In a first step, this network develops and agrees on an ambitious, systemic vision that describes the energy shift towards net zero emissions in Europe based on a bottom-up approach that includes national specificities. For that it is important that the partners share global ambitions and systemic mindsets. Following the development of the central vision, another central element is the development of a common methodology that enables a holistic and comparative interfacing of national scenarios. This means:

- sharing a detailed segmentation of the energy system by sectors, sufficiency / efficiency / substitution leverages per sector, and corresponding indicators to measure the level of action
- identifying the way to implicitly or explicitly address them in the various models used by the partners, to reach an harmonized level of systemic comprehensiveness
- discussing the potential for further action in each national scenario, the need for mutualisation, the potential for optimisation at European level, etc. to develop an integrated vision

The collaborative learning by doing approach is currently in a pre-figuration phase, which will run until the end of first term in 2019.

References and further reading

1. Duscha, Vicki, Alexandra Denishchenkova, and Jakob Wachsmuth, Achievability of the Paris Agreement targets in the EU: demand-side reduction potentials in a carbon budget perspective, Climate Policy (2018): 1-14.
2. Wachsmuth, Jakob, and Vicki Duscha, Achievability of the Paris targets in the EU—the role of demand-side-driven mitigation in different types of scenarios, Energy Efficiency (2018): 1-19.