INTERGOVERNMENTAL PANEL ON climate change

Working Group III (WG III) – Mitigation of Climate Change

ENHANCING THE INTERACTION BETWEEN BOTTOM-UP ASSESSMENTS AND TOP-DOWN APPROACHES IN THE FIELD OF RENEWABLE ENERGY RESEARCH

Main Conclusions Drawn from the IPCC Expert Meeting
Modeling Renewable Energies:
Coherence Between Model Assumptions and Latest Technological Knowledge
30-31 August 2009, Oslo, Norway

The potential role of renewable energies for mitigating climate change is traditionally analyzed along two different lines: The bottom-up approach focuses on the properties and distinctive features of technologies in great detail. The top-down approach focuses on the extent to which the respective technologies might be applied in business-as-usual scenarios and to what extent they should be used to achieve least cost climate protection goals considering integrative aspects. Whereas the focus of bottom-up assessments is on the technologies themselves (technology appraisal), the main goal of top-down models is to identify the economic implications of different climate protections goals, with a particular focus on determining least cost climate protection strategies.

In the past, modeling comparison exercises (e.g. EMF-22, ADAM and RECIPE) contributed significantly to explaining the strengths, limitations, and caveats associated with different analytical approaches to address selected issues in the fields of energy economics or climate policy. In order to achieve this goal, key input parameters or policy characteristics were identified and subsequently harmonized. Concerning renewable energies however, the input data (resource potential, investment cost, etc.) selected by different top-down modelers has often been taken from diverse sources. With few exceptions, there has been no attempt to construct a database for resources and costs that could reflect the current consensus in the field of technology specific assessments.

A main goal of the IPCC Special Report on Renewable Energy Sources and Climate Mitigation (SRREN) is to provide (1) a comprehensive, technology specific assessment of the most important renewable energies along with (2) a discussion of integration challenges in order to (3) identify their overall mitigation potential and associated costs in the context of different climate protection goals. In a subsequent step, (4) suitable policies will be identified that facilitate the application of renewable energies. In order to achieve this goal, the IPCC brings together leading experts from the bottom-up and top-down communities. This provides a unique opportunity to enhance mutual understanding and to improve the interaction between both communities.

An Ideal (Long-term) Approach to Enhance the Interaction

In order to achieve the aforementioned goal, in an information exchange with the different top-down modelers often participating in modeling comparison exercises, the bottom-up community would ideally provide a list of best-guess input data (including uncertainty ranges). Modelers could request specific data that, for instance, might ask for regional resource curves broken down in a

number of different grades (reflecting, e.g. different load factors). In addition, specialists in the field of integration options might support top-down modelers in their effort to develop innovative methods to adequately capture integration costs. In a next step, top-down modelers would run their models, taking the information provided by the bottom-up community into account. The results obtained would then be assessed by bottom-up experts in terms of their feasibility. The entire process would be iterated until consistency is achieved. If carried out in this way, a truly integrated assessment of the role of renewable energies can be achieved. As the process described here is time consuming (for running models and especially for publishing results), it is suggested that this approach is adopted in preparation of the IPCC Fifth Assessment Report (AR5).

The next steps in this process are as follows: At the next meeting of the Integrative Assessment Modeling Community (IAMC), the Co-Chair of the IPCC WG III Ottmar Edenhofer will explain the rationale of the aforementioned approach. Based on a summary of the identified knowledge gaps, the IAMC community will be invited to run their models and to publish their results with such timing that they may be included in the IPCC AR5. It will be crucial to define a way to communicate results back and forth between the two communities. The timing of policy instruments in the achievement of ambitious climate protection goals is a possible issue to be addressed by a future model comparison study. Another issue for consideration is the question whether or not "carbon cost policies" (e.g., emission trading schemes or carbon taxes) must be complemented by additional technology specific support schemes (e.g., feed-in tariffs) if climate protections goals are to be achieved in a least cost manner.

A Pragmatic (Short-term) Approach Suitable for the IPCC SRREN

Unfortunately, due to long lead times and stiff time constraints, the ideal solutions mentioned above are not suitable within the context of the IPCC SRREN. Nevertheless, there is an opportunity to enhance the interaction between both communities for the Special Report. In order to improve the consistency of the SRREN, the following approach is recommended:

Tasks that should be addressed by Chapter 10 (Mitigation Potential and Cost):

- The CLAs and LAs responsible for chapter 10 (Mitigation Potential and Cost) proceed in their effort to collect reference and climate protection scenarios and to analyze the results of these scenarios with a special emphasis on the associated application of renewable energies. In order to explain the different outcomes, they should explore the underlying world views and key input parameter assumptions.

- Development of energy cost curves based on a reasonable selection of scenarios that span the range observed in the data base.

- An important issue to be addressed is whether technology specific support schemes (e.g., feed-in tariffs) are needed in addition to carbon costs if a large scale application of renewable energies is required. Information on this topic should be forwarded to chapter 11 to support the discussion on policy instruments taking place there.

- In addition, Chapter 10 (C)LAs should ask top-down modelers to reveal their key assumptions concerning important input parameters.

Tasks that should be addressed by Chapters 2 to 7 (Technology Chapters) and Chapter 8 (Integration of Technologies):

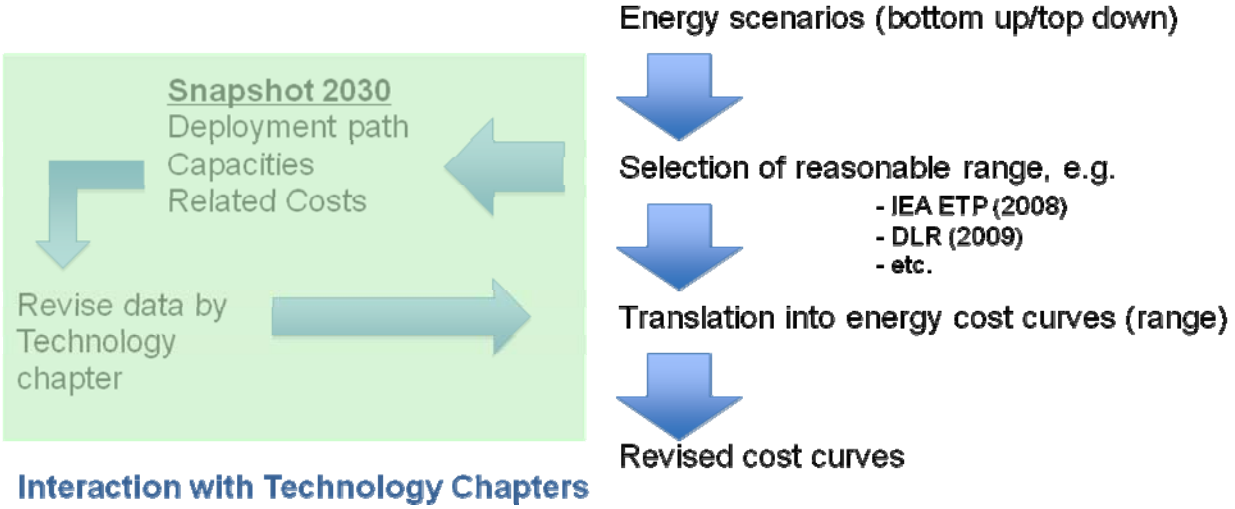
- Specialists from the technology chapters should review the overall outcome of the top-down scenarios (included in the database or other published literature), and give particular attention to the time-dependent range of the deployment of different technologies. As part of this effort, the following issues should be addressed: Are the renewable energy deployment paths consistent with technology specific assessments of the overall resource potential? Is the rate of market penetration within reasonable bounds? Are integration issues covered sufficiently? What are the preconditions that must be fulfilled in order for the respective development to come to fruition? In addition, chapter 8 should comment on the associated integration challenges.

- Due to learning effects and associated cost decreases, investment costs and resulting levelized costs, as well as key technology characteristics (e.g., performance indicators like load factors) depend on the past application of the considered technologies. The deployment range provided by the top-down scenarios might assist the authors of the technology chapters in expressing the related path-dependencies contained in the cost and technology data presented in their chapters.

- The authors of the technology chapters suggest specific technology related revisions of the energy cost curves that were put forward by chapter 10 (in particular concerning the time-dependent costs corresponding to selected deployment paths). In addition, the authors are asked to recommend how diversity of costs even within the same technology category (costs differ by size, site, region etc.) could be depicted.

- Furthermore, specialists from the technology chapters should evaluate the key input assumptions made by the top-down modelers in order to explore the top-down results.

The following flow chart describes the interaction between the "Mitigation Potential and Cost Chapter" (Chapter 10) and the "Technology Chapters" (Chapters 2-7) in a visual way:



Key question to be answered by both groups

Energy efficiency improvements (and fuel switching), the use of renewables, nuclear energy, and carbon capture and sequestration (CCS) technologies are important emission mitigation options. In order to reveal their relative importance in the achievement of climate protection goals the following key questions should be addressed:

- Are renewable energies capable of providing enough energy also to meet high energy demand scenarios?
- Is there a resource limit that would constrain the contribution of renewable energies even in the context of low stabilization scenarios?
- Is it possible to exclude nuclear energy or CCS from the mitigation portfolio without endangering the achievement of ambitious climate protection goals? How large is the associated cost increase?
- Under what conditions (in terms of concentrations stabilization goals or considering a delayed response) does the combined deployment of CCS and biomass energy become imperative?

The next steps in this process are as follows: Details on the suggested interaction within the SRREN process will be discussed in the cross cutting group on supply curves, which is scheduled to take place at the 2nd SRREN lead author meeting in Oslo. It was agreed that a further meeting of bottom-up and top-down experts would be useful to clarify the details of the long-term approach and to exchange results of the pragmatic approach. Similar to the scenario expert meeting in Oslo, this should be a back-to-back meeting with the 3rd SRREN lead author meeting that will take place in Oxford in 2010. The first results of the pragmatic approach should be exchanged in a timely manner to allow for its inclusion in the first order draft of the IPCC SRREN.

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