Proceedings of IRENA IEW 2018 Side Event

Renewable energy and the future of long-term energy scenarios: Emerging practices and channels for policy impact

Clean Energy Ministerial Campaign "Long-term Energy Scenarios for Clean Energy Transition"

DATE: 19 June 2018
HOUR: from 16:45 pm to 18:15 pm
PLACE: RunAn room, Chalmers University of Technology, Gothenburg, Sweden

Event background

In 2014, IRENA launched its project "Addressing Variable Renewable Energy in Long-term Energy Planning (AVRIL)", with the first brainstorming meeting taking place during IEW 2014 in Beijing. The project aimed to bridge the state-of-art modelling practices from research communities to the application of scenarios by government planners. Inputs from the modelling community have been of critical importance throughout the project, and resulted in IRENA's publication of *Planning for the Renewable Future – long-term modelling and tools to expand variable renewable power in emerging economies* in 2017.

In 2018, to expand upon this work, IRENA began to support a new Clean Energy Ministerial (CEM) campaign on "Long-term Energy Scenarios (LTES) for Clean Energy Transition". The campaign was proposed by the governments of Germany and Denmark, and has now been joined by eight other countries. The campaign is a manifesto of strong interest from the policymaking community to improve the quality and use of long-term energy scenarios in guiding the clean energy transition.

As IRENA and the research community begin to explore deep decarbonization scenarios further, and the role of low-cost renewables in these scenarios, challenges begin to go beyond the integration of variable renewables in power systems, toward issues such as the integration of other end-use sector solutions, and potentially disruptive innovations like those enabled by digitalization trends.

Many perceive that the majority of long-term scenarios do not adequately address such issues, and IRENA's LTES campaign seek to identify examples of scenarios and methodologies that do explore this new ground. At the same time, governments are increasingly looking for various institutional arrangements to better link scenario developer and user communities. For example, in some countries, governments effectively use scenarios developed by the research community to spark political debates, while in others, scenarios are developed by in-house government modelling teams, and used directly as decision making tools.

This side event at the 2018 IEW meeting in Gothenburg, Sweden therefore aimed to discuss two topics – first, the interface between the scenario development community and ultimate scenario users (primarily policy and decision makers), and second, a self-critical identification of key gaps in current long-term scenarios with high shares of renewable energy (and their possible solutions). It was attended by over 120 expert participants.

Session format

This side event at IEW 2018 was oriented toward an open discussion with expert panellists and conference attendees. Following brief introductory remarks and presentation, the session had two panel sessions, each consisting of brief interventions from three panellists around pre-defined questions listed below. Following these interventions, open discussion was welcomed from attending experts in the audience around additional examples of best practice and methodological gaps (see summary of the full discussion further below).

Panel Session 1: Interface between scenario developers and scenario users

Session agenda

Moderator: Professor Brian O'Gallachoir (University College Cork)

16:45 - 16:50: Introductory remarks from the moderator

16:50 - 17:00: Setting the Scene
- » **Dr. Asami Miketa** (International Renewable Energy Agency)

17:00 - 17:35: Interface between scenario developers and scenario users
- » **Dr. David Daniels** (U.S. Energy Information Administration)
- » **Dr. Kenneth Karlsson** (Technical University of Denmark)
- » **Professor Tomas Kåberger** (Chalmers University, Japan Renewable Energy Institute)
- » Open discussion

17:35 - 18:10: Long-term scenarios for clean energy transition – key gaps and solutions
- » **Dr. Geoffrey Blanford** (Electric Power Research Institute)
- » **Dr. Uwe Remme** (International Energy Agency)
- » **Professor Clas-Otto Wene** (in absentia) (Chalmers University)
- » Open discussion

18:10 - 18:15: Concluding remarks from the moderator

» Which types of stakeholders currently have capacity to develop scenarios? Do other types of stakeholders need further enhancement of in-house capacity for scenario development?

» How can the link between the scenario development community (at different levels, be it national or international) and the scenario user community improved? Are there specific examples of best practice?

Panel session 2: Long-term scenarios for clean energy transition – key gaps and solutions

» What are the key gaps in current scenarios related to the clean energy transition? For example:
- Representation of VRE
- The coupling of power and other end-use sectors, e.g. transport, industry, etc.
- Innovations in flexibility, e.g. demand side response/management, storage, etc.
- Greater decentralization, e.g. sub-national and municipality-level systems
- Digitalisation
- Behavioural change

» Will new focus areas of clean energy transition within long-term scenario modelling mean a shift in the type of tools used for scenario development, or how those tools are used?

Summary of the discussion

Opening

The session was opened by the Chair, Prof. Brian Ó Gallachóir of the MaREI Centre, University College Cork and the IEA ETSAP Technology Collaboration Programme, who welcomed the participants to the side event.

He noted that in the last few years IRENA's side events at the IEW have focused on issues related to better reflect the unique characteristics of variable renewable energy (VRE) into long-term models. In this session, however, two relatively wider topics will be addressed related to:

> » How to effectively turn models and their results into something useful to underpin policy decisions? Through, for example, different modes of communication or scenario development processes; and
> » Where are the current gaps in long-term energy modelling, particularly related to the clean energy transition?

He stressed that one of the key aims of the session is to gather the thoughts of expert attendees in the audience on these issues, to feed into IRENA's ongoing work and an eventual report to be presented at the 2019 Clean Energy Ministerial (CEM).

Introductory presentation

Dr. Asami Miketa (IRENA) followed the opening of the session by introducing the background behind the two main topics to be discussed.

She explained that one of IRENA's key areas of work is to support governments in the use of energy models and scenarios for policymaking, often identifying challenges commonly shared in the process. As noted by Prof. Ó Gallachóir, one of those challenges

was the representation of VRE in long-term planning models, and previous IEW side events have been instrumental in the development of IRENA's recent *Planning for the Renewable Future* report on this topic. Based on this positive experience, IRENA feels it is well-positioned

to continue to provide an interface between policymakers and the modelling community on pressing issues.

As many sessions at this year's IEW have shown, exploring deep decarbonisation pathways often goes beyond the integration of VRE into power systems, with the need to also explore advanced solutions like the integration of end-use sectors and new opportunities due to innovations such as digitalisation. The challenge now in the modelling community is therefore how to better capture such transformative changes and associated uncertainties in scenarios to help make policy decisions.

Dr. Miketa explained that it is in this context that IRENA has begun to lead a new campaign on *Long-term Energy Scenarios (LTES) for the Clean Energy Transition*, in part through working with CEM, a consortium of 29 countries to promote clean energy. The campaign was initially proposed by the governments of Denmark and Germany, aims to promote the wider adoption and improved use of long-term model-based scenarios. To operationalise this goal, IRENA is organising a number of campaign workshops and best practice exchanges around three topics: improving the *use* of long-term energy scenarios for impact, improving the *development* of those scenarios to better reflect unique aspects of the clean energy transition, and building capacity for scenario planning by governments.

In this session, Dr. Miketa noted that she was looking forward to hearing the audience's thoughts on some specific questions that have been developed to guide discussion around the first two of those topics, including:

» The use of scenarios:
- How can the link between the scenario development community (at different levels, be it national or international) and the scenario user community be improved? Are there specific examples of best practice?
- Which types of stakeholders currently have capacity to develop scenarios? Do other types of stakeholders need further enhancement of in-house capacity for scenario development?

» The development of scenarios:
- What are the key gaps in current long-term energy scenarios in representing transformative/disruptive changes in the clean energy transition?
- Will new focus areas of clean energy transition within long-term scenario modelling mean a shift in the type of tools used for scenario development, or how those tools are used?

Panel 1: Interface between scenario developers and scenario users

Introducing the first panel of invited speakers, Prof. Ó Gallachóir noted that on this topic it will be interesting to hear thoughts on the role of policymakers in using modelling tools, but also whether the audience feels policymakers have the capacity to use scenario results. From his experience, the exchange between developers and users can produce mixed results, but the need for an interface is clear. It is more or a question of what structure that interface can best take, and which stakeholders in the policymaking process should be involved.

Invited interventions:

Dr. David Daniels (U.S. Energy Information Administration) began by proposing that the issue may be less about capability of developing scenarios but rather the interpretation of scenarios. He proposed a framework of three main types of scenarios, and noted that confusion about what kind of scenario was produced, and how the consumer of scenarios interprets them is where part of the problem lies. The types of scenarios differ mainly in the question they are asking, and where the decision maker lies:

1. **Forecasts: What is going to happen?** Most of the expert modellers in the room do not produce forecasts. In this type of scenario, the decision makers and decisions are reflected inside the model already. This is what the majority of decision makers ask from EIA's modelling team, to make investment decisions, but the scenario community does not produce such outputs.
2. **Backcasts: How do we get to a certain point in the future?** These questions are aimed at getting the best possible understanding of what implications certain decisions have for the future (what-if question). Decision makers are outside of the model and their decisions are depicted in different scenarios. This question is thought to be the most prominent type answered in the scenario modelling community, to see which measures would cost-effectively lead to a particular future.
3. **Reference cases: What would happen if no decision was made at all?** Different from a "BAU" scenario which still reflecs decisions being made; even though we know this is wrong, reference cases are frequently used as a baseline and are important to decisionmakers as they show the impacts of no action.

Dr. David Daniels concluded his intervention by noting that the modelling community serves decision makers to formulate on adequate policies, and lack of understanding on the distinction between these three types of scenarios (particularly non-forecasts) is the root of many issues.

Prof. Ó Gallachóir commented that in his experience, the models can provide insights, but what the decision makers want is an answer.

Dr. Kenneth Karlsson (Technical University of Denmark) shared the recent Danish experience in communicating scenario results with policymakers. They are currently looking at a range of deep-decarbonisation scenarios, but the large amount of scenario data makes dissemination challenging. Two important points emerged from their experience: need decision makers to understand why it's important to look at a number of sectors to find the best solution, and to have an open dialogue about different options to gain more insight.

At DTU, 2-day scenario workshops targeted at policymakers from different parties have been organized to help them better understand decarbonization options using long-term scenarios. DTU has now worked in collaboration with the Danish Energy Agency to place their own modelled interpretations of updated party manifestos online, making all the scenario results open to the public. This has proven to be particularly helpful for opposition party members to be involved in a more open discussion, as they do not have access to the modelling tools and capacity which inherently sit within the government ministries/agencies in the Danish system.

Prof. Ó Gallachóir commented that this was a good example of how to bring two communities together, and in this particular case finding a way to involve and build capacity for stakeholders that don't have the resources to understand the issues emerging from scenario analysis.

Professor Tomas Kåberger (Chalmers University, Japan Renewable Energy Institute) used his intervention to focus on three main points:

1. **"Plans are useless; planning is everything" (Eisenhower**): This statement is true for energy system modelling. Prof. Kåberger went on to specify this by pointing out that results of modelling exercises are usually wrong, but the improved understanding of how different opportunities in the energy system come together through modelling is valuable. In communicating with decision makers, never say "my model says", they would be more interested in what is behind these results.
2. **The energy sector is undergoing a period of dramatic change**: This makes modelling more difficult in comparison to times that were more stable. New technologies, policies, disruptive opportunities, new business models etc. are emerging, which may not be included in the modelling today. These changes require changes in both model structure and how these opportunities are represented. As the types of opportunities represented in the model will change the results, it is important to understand what is included in models and what is not to grasp the implications for the future.
3. **Players outside of the energy sector with significant resources are intervening:** This will change conditions for technologies as well as relative prices and learning curves. Such players include the SoftBank vision fund, for example, and the sheer size of their investments have a unique impact. This factor is difficult to foresee and to model, but such players are using scenarios themselves and are interested in their value for decisionmaking.

He concluded his intervention by reiterating the fact that things are changing in the world and will change even more in the future.

Open discussion with the audience:

Following the opening interventions, the audience was asked to engage in a debate on how the linkage between the energy modelling community and the policymaking community can be improved.

Aisma Vitina (Danish Energy Agency, Denmark) shared experience from Denmark: the system analysis department of the DEA works closely the Danish Technical University (DTU). The strong research capability at DTU and the fact that DEA works directly in policy making allows for a good combination of research and policy analytical capacity. DTU's engagement with actual policymakers is seen a successful example of an interactive approach. The formal process to advise policymakers is through the DEA, which communicates policy projections and analyses to the Ministry as an independent analytical agency. The fact that there is a multifaceted approach to policymaker advising (by both the DEA and DTU) is seen as beneficial and condusive to an environment of open dialogue.

Babak Mousavi (Stuttgart University) shared experience from interaction with Iran's energy ministry: even though national incentives for renewables were in place, they had problems with people. The issue of human resources to carry out work can often be missing. It was noted that minister understood the implications of scenarios, but stressed the deficiency is understanding 'how' to carry out the next steps.

Kevin Palmer-Wilson (University of Victoria) described how his university modelling team has interacted with policymakers in the Canadian context. From their experience, meeting directly with the ministry to present work and discuss modelling results worked well, as it allowed the ministry to better understand how the results were derived. It was also noted that it is important not only to look into questions from policymakers, but also to think outside of the box and raise ambition or issues that could potentially be politically important.

Prof. Ó Gallachóir commented that in his team, specifically answering questions raised by the government does still help the dialogue, and ultimately builds trust with policymakers. He emphasised the importance of not forcing a model to answer the question that the model is not suited to answer. Storage was a particular technological element of long-term scenarios that was highlighted as an area for serious improvement.

Brian Denvir (Sustainable Energy Authority of Ireland) noted that it is important not to assume a level of literacy in models and scenarios that may not be there – in their presentations they now begin with primers on model and scenario type to avoid misunderstandings. it is also important that modellers are honest about the limitations of the models to maintain legitimacy, and to avoid vague terms that could mean many different things to different people.

Tommi Ekholm (Aalto University) spoke from previous experience conducting policy analysis for the government, in which their results were accepted in open dialogue between experts, but other stakeholders found them problematic as they were not aware of the open process. Having a wider open dialogue can be very important to gain legitimacy, given the complexity of the modelling that is performed to those outside the process.

Nate Adler (WRI) noted that while it's good to hear about proactive approaches, e.g. Denmark, not all coutries are currently in the position to do so, and would encourage engagement of non-government stakeholders in these discussions as well, e.g. businesses which have signed up for ambitious long-term targets. As WRI synthesises energy and climate models for such purposes, they see a large appetitie for more granular data, as well as implementation roadmap information (e.g. the role of efficiency measurements vs. fuel-switching).

Edward Byers (IIASA) shared a perspective from work in the water-energy-land nexus projects in transboundary river basins, where analysing long-term scenarios of shared resources among countries was able to bring more and even hostile stakeholders to the table, e.g. from India and Pakistan – an example of where using different decision-making scales beyond the country level can bring useful insights for resource and infrastructure planning.

Panel 2: Long-term scenarios for clean energy transition – key gaps and solutions

Moderator Professor Brian O'Gallachoir announced three interventions on "long-term scenarios for clean energy transition – key gaps and solutions" by Dr. Geoffrey Blanford (Electric Power Research Institute), Dr. Uwe Remme (International Energy Agency), and Professor Clas-Otto Wene (in absentia) (Chalmers University).

Invited interventions:

Dr. Geoffrey Blanford (Electric Power Research Institute) began the second panel by building on the discussion taking place, noting that communication of the modelling results is possibly the biggest and the most important gap, particularly as models become more complex as the computational power increases. On the modelling side, he acknowledged the six examples that IRENA put forward are all relevant. A frontier issue is related to the higher resolution and more complex modelling capabilities that are becoming available, and howe we can take these into longer-term analysis. Leveraging big data and machine learning along with better computing power is also an area that should offer new opportunities, and is also worth exploring.

Dr. Uwe Remme (International Energy Agency) continued from a background of long-term and global modelling, agreeing in general that renewable representation is still a gap in this area, e.g., regarding time and space resolution. Sector definitions are also becoming blurry, e.g. the difference between consumers and prosumers, with technology like rooftop PV and battery storage. Integrated approaches that address short-term operational issues and long-term modelling will become more important, e.g. soft-linking long-term models and operational models to narrow the time resolution issue. The same can be said about spatial resolution. There is progress happening in prarametrising spatial aspects in long-term models, and ideally it would be good to have the model with a lever that can adjust the geographical resolution. Data remains an issue in terms of actual implementation, however – more data is available, but would be helpful if it can be better aggregated for sound use. In terms of research opportunities, big data may also be leveraged to understand consumer behaviour and how technologies are actually used.

Moderator Professor Brian O'Gallachoir presented the intervention of **Professor Clas-Otto Wene (Chalmers University)** in his absence. The intervention was focused on learning curves and their effects on long-term scenarios, particularly the risk that long-term energy scenarios may ignore the strong coupling between energy policy and industrial policy. Interactions occur here in reality that initiate value chans and create new industries, e.g. energy policy decisions related to Swedish hydropower or Danish wind. Considerable efforts are spent on

modelling energy-economy-environment links, but similar efforts are required to dissect the coupled development of energy system and energy technology industry/policy.

Two methodological dimensions were noted for improvement. The first relates to the organisation of the learning system, and how to integrate organisational transformations and structures that will drive the clean energy transition - e.g. the bottleneck of SMEs to meet electricity access in developing countries. Methodologies are needed to soft-link established long-term techno-economic models with organisational models – such as system dynamics models – to capture these elements. The second dimension relates to the fact that the technology landscape is created by our movements in it - this means that government market interventions through deployment programmes are legitimate and indeed necessary, but the risks of "technology traps" must therefore be analysed in long-term scenarios. What are the risks that limited learning investments only provide learning opportunities for nascent but in the long term in-sufficient technologies? E.g., bio-fuel vs. electric cars?

Open interventions from the audience:

Following the interventions, Moderator Professor Brian O'Gallachoir opened the floor to the audience, to give their thoughts on the key gaps they see in scenarios for the clean energy transition.

Aisma Vitina (Danish Energy Agency, Denmark) commended the points made by the expert panellists, but also raised the point that there is a different level of modelling tool usage in developing countries, where often the practice is still very far from the advanced gaps that have been discussed. The gaps are arguably even more critical in these countries, however, as they will have major impact on emissions in the near/medium-term. Basic issues in these contexts include straight-line assumptions for renewables to 2050, and low-resolution model time slices that make VRE modelling incompatible and result in artificial deployment limits. Considering different contexts can be important to balance the discussion of modelling gaps.

Claudia Aravena (Heriot-Watt University) spoke form experience in Latin America, and made an additional point to support better reflection of political barriers in modelling or scenarios, e.g. strong industrial influences. This can also become an issue in scenario communication, if certain industrial stakeholders are able to discredit modelling results they are not in favor of.

Jason Veysey (Stockholm Environment Institute) wanted to echo the previous point made about the importance of using long-term energy scenarios and modelling appropriately for developing countries. Three considerations can be taken from experience in SEI's work: the first is that there is a real need for modelling literacy amongst decision makers and their supporting analysts; the second is the need for better interfaces, which are so important for communication; and the third is to take on more of the advances in computer science and platforms to increase tool performance, so they can be used in more interactive and exploratory ways.

Edward Byers (IIASA) raised a key gap in incorporating the broader societal framework of the energy transition, such as interlinkages with the SDGs, which is not looked at as closely, but is both an important driver and area of transition impact.

Roberto Ferreira da Cunha (IHS Markit) raised a point that has been a topic of conversation for almost a decade with big models, that there is often too much focus on how many countries or sectors a model covers, without adequate discussion of how accurate or realistic that coverage is. Credibility in the modelling community can be lost if policymakers are approached with "super" models that don't live up to accurate representation of details.

Kannan Ramachandran (PSI) spoke from the experience of developing large and complex models, which makes communications challenging – e.g. explaining what is happening and why. Part of this challenge is that policy makers and politicians are only elected for limited terms, meaning long-term decisions are often re-made. Rather than trying to capture this in models, another approach could be to make sure the public is very well informed, so that elected officials maintain certain baseline views.

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