Joint IRENA – JRC Expert Workshop on "Benchmarking long-term scenario comparison studies for the clean energy transition"

Virtual event – Thursday 10 and Friday 11, September 2020

Overarching objective and focus of the workshop

The main objective of the workshop is to exchange experience on long-term energy scenario comparison in an effort to map the motivation, the focus and the methods of such studies. It intends to provide a platform to discuss a systematic and formalised approach to scenario comparison and to shed light on good practices. It also aims to identify how scenario comparison results and insights can be used in policymaking within the clean energy transition.

Background

Long-term energy scenarios (LTES) support policy debates, provide strategic insights to businesses, and as such mitigate uncertainty, risks and unnecessary costs for the society.

The variety of LTES produced by a variety of institutions result in a polyphony of insights to guide the clean energy transition. Such wealth of information needs to be reconciled in order to improve the understanding of similar aspects and trade-offs across the scenarios' results. While transparency is one of the key issues for building trust of scenario results, these are often presented in a black box manner and comparison of their insights is very difficult. However, it is understood that the use of multiple scenarios from multiple sources has its benefits as it allows the assessment of a broad range of results and accounts for the inherent biases stemming from scenario developers and modellers.

Growing interest

At the national, regional and international level, a number of institutions (see annex A) have developed scenario comparison studies in an effort to benchmark the assumptions and results of scenarios, to provide increased reliability on scenario outputs and to improve the robustness of insights for policy makers planning the evolution of the energy system**.**

In this context, the Knowledge for the Energy Union Unit of the Joint Research Centre (JRC) of the European Commission published recently the study "Towards net-zero emissions in the EU energy system - Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal" and undertakes several activities that encompass the use and comparison of global and European energy scenarios for the energy transition (see annex B). Also, IRENA is coordinating the CEM Campaign on "Long-term Scenarios (LTES) for the Energy Transition", a platform to promote the improved use and development of scenarios, enable the exchange of best practices and facilitate work to strengthen and broaden their use in guiding the clean energy transition. The JRC participates in the LTES Campaign as a technical partner.

Workshop format

The virtual workshop will comprise of a series of presentations on the first day, followed by a day of breakout group discussions with invited experts. Other registered participants will be able to follow the workshop as observers.

Participation and Registration

For more information and registration details please visit the event webpage here or contact ltes@irena.org**.**

Day 1, Thursday, 10 September – Scene setting & presentations

*** Central European Time (CET)**

15:00 – 15:15	**Welcome remarks** **Dolf Gielen**, Director, Innovation and Technology Centre, IRENA **Stathis Peteves**, Head of Unit, Knowledge for the Energy Union, Joint Research Centre of the European Commission
15:15 – 15:30	**Scene-setting - "The LTES Campaign and scenario comparison studies"** **Asami Miketa,** Senior Programme Officer, Power Sector Investment Planning, IRENA
15:30 – 15:45	**Keynote - "Towards net-zero emissions in the EU energy system" - *Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal*** **Wouter Nijs**, Project Officer, Joint Research Centre of the European Commission
16:00 – 17:30	**Presentations session: Global panorama of energy scenario comparison studies – *Brief expert talks on what can be learned from scenario comparison*** This session will showcase the work of leading institutions involved in energy scenario comparison exercises and provide a global mapping of the latest studies. The session will explore the following points: the main motivations behind comparing scenarios, the key features studied and the main findings of the studies. **See Annex A for a list of scenario comparison studies.* **Executive presentations:** **Group A** **William Zimmern**, Head of Global Macroeconomics, BP **Christoph Jugel,** Director - Energy Systems, German Energy Agency **Matthias Kimmel**, Lead Analyst, Bloomberg New Energy Finance **Sheila Samsatli,** Assistant Professor, University of Bath **Trieu Mai**, Senior Energy Analyst, National Renewable Energy Laboratory **Anahi Molar-Cruz,** Research Associate**,** Technical University Munich *10-minute break* **Group B** **Christof van Agt**, Director of Energy Dialogue, International Energy Forum (IEF) **Edward Byers**, Research Scholar, Institute for International Applied System Analysis **Jürgen Kropp,** Department Head for Climate Resilience, Potsdam Institute for Climate Impact Research **Andries Hof,** Senior Researcher, Netherlands Environmental Assessment Agency (PBL) **James Newcomb,** Managing Director, Rocky Mountain Institute **Anastasia Belostotskaya**, Associate Director of Scenarios and Special Projects, World Energy Council **Daniel Raimi,** Senior Research Associate, Resources for the Future **Moderator**: **Francesco Ferioli**, Policy Officer, European Commission, Directorate General for Energy
17:30 – 17:40	**First day wrap up session**

Day 2, Friday, 11 September – Breakout group discussions (parallel)

*** Central European Time (CET)**

15:00 – 16:30

- Discussion amongst presenters (60 min).
- Expanded discussion with other experts (30 min).

Breakout Group A: Focusing the scenario comparison – *What to explore when comparing energy transition scenarios?*

Different motivations for conducting scenario comparison studies can lead to the selection of different indicators for comparison. Some studies focus on benchmarking the input data and underlying assumptions (e.g. technology cost, GDP growth projections and emission targets) that drive ambitious transition scenarios, while other studies focus on the scenario output to highlight areas of uncertainty resulting from different energy and technology mixes (e.g. the role of hydrogen, the need for CCS, the rate of electrification of the energy system or investment needs).

This session aims to identify the key inputs, results and indicators or metrics that need to be underpinned for scenario comparison studies, in particular which indicators or metrics are most relevant for policymaking in the context of clean energy transition. **See Annex B for an example of similarities and divergences between clean energy transition scenarios for the European Union.*

Key questions that will guide this session:

- *What are the most relevant indicators for decision making when comparing clean energy transition scenarios?*
- *What are the main similarities and divergences in clean energy transition scenarios and what does this imply for advising policymakers in the pursuit of a low carbon energy system by mid-century?*

Moderator: Wouter Nijs, Project Officer, Joint Research Centre of the European Commission

15:00 – 16:30

- Discussion amongst presenters (60 min).
- Expanded discussion with other experts (30 min).

Breakout Group B: Improving the scenario comparison – *How to enhance scenario comparisons for policymaking?*

Data transparency and diverse modelling approaches are amongst some of the challenges faced when comparing clean energy transition scenarios. Communicating the results of scenario comparison studies is similarly complex and requires some level of expertise to distil and summarise the findings so they can better inform decision making.

This session aims to discuss how scenario comparisons can be improved to make results more robust, and how new communication tools can help make insights readily available to scenario practitioners and policymakers.

Key questions that will guide this session:

- *What new methods or systematic approaches can be used to improve and address the most common challenges for comparing clean energy transition scenarios?*
- *How can the communication of comparison results and insights be improved for policymakers?*
- *How can scenario comparison results be effectively used for policymaking and bring clear insights in a polyphony of – sometimes contradicting – views for the future?*

Moderator: Pablo Carvajal, Associate Programme Officer, IRENA

16:30 – 17:00 **Wrap up and final remarks – Joint session**

Annex A *- Recent comparison exercises of long-term energy scenarios (non-comprehensive)*

No.	Institute	Name of study/exercise	Scope	Year
1	European Commission – Joint Research Centre (JRC)	Towards net-zero emissions in the EU	Energy system (power and end-use sectors)	2020
2	International Renewable Energy Agency (IRENA)	Global Renewables Outlook	Aggregated energy system and power sector	2020
3	World Energy Council (WEC)	Global Energy Scenarios Comparison Review	Aggregated energy system and power sector	2019
4	PBL Netherlands (PBL)	Insight into Energy Scenarios - A comparison of key transition indicators of 2 °C scenarios	Energy system (power and end-use sectors)	2019
5	Deutsche Energie-Agentur (DENA)	Expertise bündeln, Politik gestalten - Energiewende jetzt!	Energy system (at a sectoral level)	2019
6	German Institute for Economic Research (DIW Berlin)	Energy outlooks compared: Global and regional insights	Aggregated energy system and power sector	2019
7	Rocky Mountain Institute (RMI)	Seven Challenges for Energy Transformation	Energy system (power and end-use sectors)	2019
8	International Institute for Applied Systems Analysis (IIASA)	1.5C Scenario explorer	Energy system (power and end-use sectors), including LULUCF	2019
9	Imperial College London (ICL)	Energy system changes in 1.5 °C, well below 2 °C and 2 °C scenarios	Energy system (power and end-use sectors), including LULUCF	2019
10	National Renewable Energy Agency (NREL)	Variable Renewable Energy in Long-Term Planning Models: A Multi-Model Perspective	Power sector	2017
11	Lappeenranta University of Technology (LUT)	Sustainability guardrails for energy scenarios of the global energy transition	Power sector Storage technologies	2018
12	International Atomic Energy Agency (IAEA)	Comparison of 100% renewable energy system scenarios with a focus on flexibility and cost	Power sector	2018
13	University of Bath (UoB)	The curious case of the conflicting roles of hydrogen in global energy scenarios	Hydrogen	2020
14	EU Calculator	European Calculator	Energy system (power and end-use sectors), including LULUCF	2016
15	BP	Energy Outlook 2019 edition	Energy system aggregated	2019
16	Resources for the Future	Global Energy Outlook	Energy system aggregated	2020
17	BloombergNEF	Comparing Long-Term Energy Outlooks 2018	Energy system	2018
18	Energy Modelling Forum	Key findings from the core North American scenarios in the EMF34 intermodel comparison	Energy system	2020
19	International Energy Forum	A comparison of recent IEA and OPEC outlooks	Energy system	2020

Annex B – Example of similarities and divergences between eight clean energy transition scenarios for the EU – (JRC, 2020), "Towards net-zero emissions in the EU energy system" - Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal

2030 similarities

- 58-65% reduction in ETS and 41-50% reduction in non-ETS sector emissions (compared to 2005);
- 70% reduction in total coal use and its almost complete phase-out from power generation;
- 25-50% reduction in oil use and up to 25% reduction in natural gas use;
- Based on JRC interpretation, this implies 10-35% replacement of oil and gas boilers in buildings mainly by heat pumps and district heating;
- 28-55% reduction in oil use in transport, while mitigation efforts are required in all transport sectors, the oil reduction for cars may be larger;
- Installed capacity of variable renewables increases by a factor 2 to 3.

2030 differences

- The level of **energy efficiency** influenced by the structure of the power sector and the reduction in energy demand for **heating of buildings** and for **transportation**;
- The **share of renewable energy**, influenced by the level of energy efficiency, the amount of wind and solar power and biofuel use in transport;
- The growth of **wind** power generation varies between a factor of 1.5 and 3.5 and the growth of **solar** power between 1.5 and 4.5;
- The use of **biomass** ranges from limited growth to an increase of up to 60%;
- **Nuclear** energy provides between 20% and 30% of the electricity, unless normatively phased out;
- **Hydrogen** and **CCUS** emerges in some but not all scenarios

2050 similarities

- A nearly complete phase-out of coal; a reduction of oil and natural gas use by at least three-quarters compared to today;
- Renewables provide 75% to 100% of the electricity, at least 60% of which coming from wind and solar; minimal thermal power from fossil fuels (up to 20% of the total capacity with very limited operation);
- Increased use of bioenergy, from 9% of total energy today up to 20% especially in the industry and transport sectors; increase in the use of biofuels, with the largest share as maritime and aviation fuels;
- Between 65% and 90% zero-emission vehicles in the total fleet; major uptake of electricity in transport, with the EU passenger battery electric vehicle fleet in most scenarios numbering between 100 and 220 million;
- Use of hydrogen in industry (5-20% of energy consumption, in addition to about 50% electricity), for fuel cell vehicles and for e-fuels (mainly for aviation);
- In buildings, electricity meets 40-60% of energy demand, notable increase of heat supply from heat pumps;
- Necessity for natural carbon sinks (LULUCF) or within the energy system (carbon removal technologies).

2050 differences

- The reduction of **final energy**, ranging from 30% to 60%, compared to today;
- The share of **renewable energy**, ranging from 65% to 100%;
- The degree to which biofuels, hydrogen and e-fuels replace oil in **transport**, including the maritime and aviation sectors;
- The amount of **power**: high growth (a factor of 2 or 3 increase) through direct electrification and hydrogen/e-fuels output; slow growth through strong energy demand reduction and/or CCUS deployment instead of e-fuels;
- Related to this, the growth of **wind** and **solar** power generation each varies between a factor of 3 and 13;
- The trade-off between hydrogen and electricity as final energy carrier in **industry**;
- The extent to which enabling technologies, such as **electrolysers**, or other new technologies (e.g. CCUS) will be deployed;
- **Assumptions**, among others, on industrial output, building renovation, utilisation and occupancy of different transport modes, which are driven by disruptive societal changes such as vehicle sharing;
- Wide range for natural **carbon sinks** (LULUCF), up to 100% increase compared to today; **carbon removal** with technologies may reach the same CO_2 sequestration level as LULUCF today.