Fifth RGI Future Scenario Exchange Workshop 11 June 2018, Brussels

Brief of studies and protocol

This document follows the Chatham House Rule and provides:

- Attendee list and agenda.
- A brief of the studies presented.
  - "Renewable Energy Prospects for the European Union by 2030" – *Luis Janeiro (IRENA); Sean Collins (University College Cork)*
  - "Paris-compatible 2050 scenarios for the EU Power System" – Paul Deane *(University College Cork)*
  - "Modelling the clean energy transition: Clean Energy Ministerial campaign on long-term scenarios" – Asami Miketa (IRENA)
- The main insights and comments.
- Conclusions and next steps.

1. Attendees

Name	Organisation
1. Luis Janeiro	IRENA
2. Sean Collins	UCC
3. John Paul Deane	UCC
4. Eva Schmid	Germanwatch
5. Stefan Singer	CAN International
6. Rafael de Dios	RED
7. Dante Powell	ENTSO-E
8. Carmen Dávila	RED
9. Andrew Dobbie	National Grid
10. Bram Claeys	ODE
11. Øyvind Vessia	Ørsted
12. Asami Miketa	IRENA
13. Daniel Russo	IRENA
14. Naomi Chevillard	Solarpower Europe
15. Jean-Francois Fauconnier	CAN Europe
16. Craig Morris	RGI
17. Antina Sander	RGI

18. Antonella Battaglini	RGI
19. Frida Kieninger 20. Nessim Achouch	Food and Water Europe

You can find all information about RGI's future scenario exchange workshops, previous presentations and workshop summaries here. A video about the origins of scenarios in Italian theatre from the 19th century was mentioned: https://youtu.be/xJZoVfnizsw.

2. First session: "Renewable Energy Prospects for the European Union by 2030" (*IRENA)*

2.1 Background and purpose of the study

The study was produced for European Commission. It covers the whole of the EU based partly on 10 previous country-level reports for all energy usage (not just electricity). The special feature of IRENA scenarios is the methodology for a joint accelerated renewable energy scenario development along with member states.

Although some 70 country analyses have been completed, the process makes the most sense at the regional level because resources (including IRENA's) are used more efficiently then, and joint learning is facilitated. The REmap Africa and REmap ASEAN studies are good previous examples.

The REmap EU study was developed in the context of the discussions around the winter package's call for 27 percent renewables by 2030. The data were country-specific, and each country had a single node for the power sector (which is often the case for determination of wholesale market prices in reality anyway), including localised fuel prices and localised demand and renewables profiles.

The study shows that the EU can go further than its current goals for renewables by 2030 and even post a net savings in the process.

REmap options

1. **Reference case:** based on current renewables energy plans for member states that provided data directly or best assumptions about current trends. In other words, Ref is a collection of national status quos/business plans.
2. **REmap Options:** deployment options for renewables in addition to the reference case. The Options are not predictions but affordable possibilities if the right policies are in place. Externalities are not considered here; this is a deployment model, not a dispatch model.
3. **Impact analysis:** the costs and benefits of the REmap Options relative to the Reference Case. Here, externalities – how savings from health benefits, for instance, will offset the costs of the REmap Options – are taken into account.

2.2 Overview of the REmap Options

A scenario was calculated for 2030 along with the BAU (Reference Scenario). IRENA's scenario is a bit different, however: renewable potential is shown and then the cost impact investigated relative to Reference scenario.

The ETS price was used to determine power market prices but was not a parameter affecting RE deployment because, strictly speaking, the Remap options are not calculated in a model, so there does not need to be an investigation of how the system will behave at different carbon price levels. Another way of thinking about it is that CO2 prices don't impact deployment potential, so they are not included until the costs and benefits of the Options are calculated.

An EU-wide dispatch model of the power sector was built to identify the key potential bottlenecks for a system with high shares of renewable energy. The modelling software used to simulate the dispatch was PLEXOS integrated energy model. The power sector was simulated at an hourly resolution for the target year of 2030 with 3,000 standard generation units which were broken out by 15 modes of generation. Heat pumps and EVs in particular add 230 TWh to demand beyond the Reference Scenario.

2.3 Conclusions of the study

21 billion euros would be ***saved*** in 2030 in energy costs[1] overall if the REmap Options are utilized. Integration costs from VRE were found to be measurable but manageable if best practices are implemented. This figure does not include integration costs.

Specifically, renewables would make up 41% of power supply in Ref and 50% with the Options, at which point 29% would be variable renewables. Very little additional congestion was detected at those levels with the exception of Malta, Croatia and Denmark. However, these results should be interpreted as a low-end estimation of potential curtailment. Curtailment levels could increase because of congestion in transmission lines within Member States, which cannot be captured in this analysis.

The total savings reach 44-113 billion in 2030 when the benefits of lower carbon emissions (412 Gt less GHG compared to Ref, roughly equal to Italy's current emissions and 42% below 1990 for EU) and health externalities are also factored in. Avoided health damages alone are estimated at 16 to 60 billion EUR/year by 2030.

2.4 Insights and comments

Inputs: International bunker fuel (fuel used / stored for use in ships) isn't accounted for, but national is. The grid needs were based on the latest TYNDP 2016, which includes interconnection with Norway. Biomass potential was based on official EU figures for sustainability. The carbon price was 25 euros for power sector modelling based on the impact assessment for phase IV of the ETS. For the externality analysis, a range of USD 17–80 per tonne CO2 for the year 2030 was used as suggested by a carbon externality values found in a review of integrated assessment

[1] Expressed as difference between LCOE of renewables in REmap case vs conventional technologies in Reference case.

models. 1989 was used for weather data because that year (along with 2012) turns out to be closest to the 30-year average.[2]

The one-node-per-country design meant that distributed v. central renewables could not be mapped, not could demand shifting. However, in one of the scenarios it was assumed that a fraction of the stock of EVs would charge and dispatch power from and to the grid based on price signals. EVs charging and delivering energy back to the grid in this manner increase the value of solar power significantly.

In addition, aggregating capacities simplifies the dispatch model: in reality, not all units would run at a capacity factor that allows for profitability, though this discussion lies outside of the study, which investigates deployment and CBA, not financials. The debate on how to ensure investments to maintain generation adequacy is open; capacity remuneration is only one option, and IRENA doesn't take a position on this.

The cost curve chart drew a lot of comments. The x-axis shows the volume of additional energy from the respective RE source; the y-axis shows costs (above baseline) or savings (below baseline). Because of the need for a mix in the system, however, the cost curve chart should not be read as literally as a "merit order": you don't take, for instance, all of the solar first, then build all of the wind, etc. Rather, the overall aggregate cost impact is shown for 33% renewable energy. Some wind projects will cost more than some solar etc., and biomass should not be considered to lie above the baseline in all cases. The large parts below the baseline allow for the small parts above it to be built towards one third renewables.

The figures for installed capacity by 2030 were considered realistic, but there was a feeling that comparability needs to be improved in general in the modelling world: IRENA with industry models, etc.

3. 2nd session: "Paris-compatible 2050 scenarios for the EU Power System" *(UCC)*

The presentation began with a look back to show how dramatic the required energy transition needs to be relative to energy transitions up to now. However, the graph shown was based on IEA data, with a high level not only of renewables by 2050, but also a severalfold increase in nuclear power and continuing high levels of gas, albeit less than today. It was questioned whether this scenario was Paris-compliant. It was added that "Paris-compliant" often means eventual negative emissions anyway.

The options for negative emissions investigated include: CCS, BECCS, and direct air capture (DAC). It was noted that these technologies range from the underperforming (CCS) to unproven (BECCS and DAC). DAC will consume a lot of energy itself, but it was argued that the option deserves further research. For biomass, it was noted that indirect land use change (ILUC) was rarely included in the climate impact analysis; the benefits of BECCS could thus be much lower than hoped.

Four "snapshots" of exploratory (not predictive) scenarios were produced as conversation starters:

---

[2] Collins S., Deane J.P., Ó Gallachóir B.P., Pfenninger S., Staffell I. Impacts of inter-annual wind and solar variations on the European power system. Joule. 2018.

- 2050 Reference: the PRIMES benchmark; love it or hate it, it helps make policy discussions coherent.
- 2050 negative scenario: with CCS where allowed by policy (carbon storage ruled out in Ireland, for instance).
- 2050 low carbon, no CCS.
- 2050 ultra-high renewables.

The data modelled were based, for instance, on European Commission scenarios. The work does not assume this mix is the best, but merely reveals what it might look like.

It was criticized that Integrated assessment modelling (IAM) is often optimistic on negative emissions but relatively pessimistic on renewables. Also, natural emission sinks accepted by NGOs (forests) are often downplayed even though they would be the cheapest option and have loads of other benefits (microclimate, etc.) – but how long would it take for new trees to reduce CO2 concentrations? And if forests and other natural carbon sinks can't do every alone, how much DAC and CCS might be needed?

The models found that very high levels of renewables power are possible, but inertia may become an issue – no solution yet. Robustness has not been completely demonstrated. Data availability is also an issue. Further work is needed for detailed modelling of transmissions and distribution systems. Market support and societal acceptance are not yet variables.

For the ENTSOs to model Paris, it is hard to know what assumptions to make about non-power sectors and different continents when allotting a carbon budget to the EU's power sector. The IPCC's special report expected this fall will at least provide new global numbers (currently at 200-800 Gt, so 20-80 Gt for EU). We need climate scientists to work on this!

The potential for countries opposing renewables / climate change mitigation to misuse unambitious scenarios or produce their own anti-scenarios was mentioned, but all countries using scenarios do so to promote renewables, especially in Latin America. But policymakers are not the only target group to consider: investors, NGOs, and international interest (French viewing German scenarios, etc.) should not be forgotten – how could their needs be better served by improved model designs?

4. 3rd session: "Modelling the clean energy transition – Clean Energy Ministerial campaign on long-term scenarios" (IRENA)

IRENA is working to build modelling capacity among its members, who are largely ministry representatives. Participants were asked to respond to a page of questions about how modelling can be improved.

Participants suggested that IRENA is in a unique position to produce a standardized protocol for modelling. In addition to crunching numbers, the need to communicate findings clearly must not be forgotten. Transparency builds trust, but engagement requires bravery; people will shout at you.

Not only in Latin America, but also in the UK: politicians use scenarios (such as those from National Grid) directly for policymaking.

Policymakers are only interested in the short-term because of elections, but voters also react more to 2030, when they are likely to be around, than to 2050, when they are less likely to be. So while everyone focuses on the long-term outcomes in scenarios, the next step to be taken is arguably more important.

Despite the focus on "multiple stakeholders," groups still get overlooked. For instance, a large number of people are at risk of living in "energy poverty."

One thing missing is a map of policy landscapes showing what has worked and what hasn't; however, IRENA and others have produced analyses of policy options.

The WEC still produces its narrative stories for scenarios, such as Jazz and Symphony. Several participants felt that these examples simply interesting to read. We should do such things when communicating our own scenarios.

It's important to have ambitious scenarios because describing a possible future repeatedly helps make it seem obvious. The point is not just understanding which direction is right, but imaging a possible future – and creating a foundation for it via this imagining.

Never do three scenarios; policymakers only look at the middle one. Do 2 or five.

5. Next steps

- The RGI secretariat is applying for resources to allow the NGO community to make a strong contribution with regards to developing a Paris Agreement-compliant scenario for the TYNDP.
- All present were encouraged to get in touch with the ENTSO-e team if they have new resources, studies, data that they wish to share.
- A sixth scenario exchange workshop will likely be held in Oct/Nov (date TBC). If participants have any interesting studies that they would like to share at this workshop, get in touch with RGI.