Renewables Grid Initiative

Future Scenario Exchange Workshop, 8th July 2016

Protocol

This protocol looks to provide:

- A brief reminder of the scenarios and conclusions presented by 50Hertz and Swissgrid,
- The main insights and comments from the workshop,
- Some initial joint messages,
- Conclusions and next steps.

1. Attendee list

Name	Organisation
Wilhelm Appler	50Hertz
Antonella Battaglini	RGI
Tom Brown	FIAS (Frankfurt Institute for Advanced studies)
Andrew Carryer	RGI
Bram Claeys	Flemish Renewable Energy Federation
Alice Collier	RSPB
Olivier Feix	50Hertz
Franziska Flachsbarth	Öko-Institut
Modesto Gabrieli Francescato	Terna
Arthur Janssen	Swissgrid
Thomas Köbinger	50Hertz
Sébastien Lepy	RTE
Sara Pizzinato	Greenpeace Spain
Timo Kahl	Amprion
Emily Rochon	Greenpeace International
Theresa Schneider	RGI
Stephan Singer	WWF International
Anders Skånlund	Statnett
Marius Strecker	TenneT
Jan Vande Putte	Greenpeace International
Edoardo Zanchini	Legambiente
Catalina Rams Ramos	REE

Carmen Dávila	REE
Oldag Caspar	Germanwatch
Lea Große Vorholt	50Hertz

2. 50Hertz study[1]

50Hertz presented their "Energiewende Outlook 2035" which looked to understand a range of possible developments of the energy transition, reflect their respective consequences and conclusions and forecast the required network investments. The central questions of 50Hertz's work looked to understand:

- Which development paths (scenarios) of the energy transition are conceivable and not unrealistic?
- What are the consequences for the power plants, power plant usage and the power flow in Germany and Europe that arise from the different scenarios?
- What drives the transmission network of the future and how does this relate to the various development paths of the energy transition?
- How robust are the planned grid expansion measures of 50Hertz? That is, individual measures how much are needed in different scenarios and appropriate to ensure the necessary transport?

50Hertz Scenarios

1. **Prosumer Orientated energy transition** - a strong build-up of distributed PV Systems coupled with storage.
2. **Energy transition according to the Germany renewable energy act** - a combination of various technologies.
3. **Competitive energy transition** - large wind energy systems in profitable locations
4. **Delayed energy transition** - planned implementation of various technologies is delayed.
5. **Incomplete energy transition** - insufficient acceptance due to, for example, high costs, prevents a complete energy transition.

The scenarios formulated to answer these questions were based on a main set of variable quantitative assumptions used to create a "consistent future", namely:

- Investment costs for generation technologies
- Demand (including allocation)
- Power from renewable energy systems (including allocation)

[1] For the complete report and methodology (In German with English executive summary) http://www.youblisher.com/p/1457252-Abschlussbericht-50Hertz-Energiewende-Outlook-2035

- Demand Side Management
- Prices for Primary energy and CO2
- Further assumptions (sector coupling etc.)

2.1 Main conclusions of study

- In almost all cases, grid development at 50Hertz can use the existing routes through grid reinforcement or new construction.
- The current grid development planning for the 50Hertz transmission system is robust for a wide range of scenarios.
- In many scenarios, there is also a long-term need for additional grid extension measures. This applies to the least extent in a prosumer-oriented energy transition.
- In order to make a prosumer-oriented energy transition more likely, significant cost digression is required for PV installations and small storage units. Furthermore, the resulting investments that need to be made in the distribution systems should be further studied.
- By comparison, the scenario with the greatest need for the construction of new transmission lines is that of a competitive energy transition with a high capacity of wind turbine installations.

3. Swissgrid Study[2]

Swissgrid presented their "Strategic Grid 2025". This is based on two different core scenarios for the years 2025 and 2035 with two marginal scenarios complementing these for 2035. As in the 50Hertz study, these scenarios should not be understood as a prediction of the future, but rather constitute a "scope of possible developments."

Swissgrid Scenarios

Core Scenarios 2025+2035

1. **On-track** - Growth in renewables and nuclear phase out by 2035
2. **Slow Progress** - Slow growth in renewables and no full nuclear phase-out before 2035

Marginal Scenarios 2035

3. **Sun** - Heavy growth in distributed PV ***(Developed with NGOs)***
4. **Stagnancy** - Energy prices remains at current level.

The study identified and presented the variables used to underpin the scenario development process. The following driving factors are those that impact the demand of the technical expansion of the existing grid. These are:

[2] For the complete report and methodology please visit http://grid2025.swissgrid.ch/en/

- **Major new power plants in Switzerland.** The major new hydroelectric plants are bringing about clear changes in the transport task of a region.
- **International interconnectedness**. Exchanging electricity abroad increases Switzerland's supply security. Expected imports and exports make domestic grid expansion necessary.
- **Supply of downstream distribution grids**. Distribution grids adapt to the demand for the generation of electricity. Connection requests can lead to structural congestion in the transmission grid.

In addition to these there are also indirect driving factors which determine the need for grid expansion. These are:

- Expansion of renewable energy in Switzerland.
- Switzerland's nuclear energy phase-out. Lack of capacity is to be replaced to an increased extent by decentralised electricity generation, e.g. solar and wind power plants or imports.
- Power plant fleet and electricity demand in neighbouring countries. Changes determine flows of electricity.
- Electricity demand in Switzerland influences the volume of imports and exports.
- CO2 and fuel price development affects the costs of grid congestion and energy flows.

3.1 Main conclusions of study

- The following kilometres have to be modernised or built new:
  - Optimisation; increase in voltage from 220 to 380 kV on lines dimensioned for this: **193 km**
  - Enhancement; replacement of existing lines to increase the voltage from 220 to 380 kV: **87 km**
  - Expansion; new construction of transmission lines on a new route: **370 km**
- The total investment costs in the grid expansion and preservation until 2025 amount to almost CHF 2.5 billion.
- Over CHF 1 billion for grid preservation (replacement, maintenance and easement renewal).

4. Insights and comments

This section presents a condensed version of the most important insights and comments made by participants during the presentations and the subsequent discussions.

4.1 The term "Extreme Scenarios" is misleading

There was a general consensus from participants that these scenarios are not necessarily "extreme" more "ambitious". The word "extreme" suggests dealing with "extreme" short-term events, such as blackouts or the ultra fast phase out of nuclear etc. Rather, what the scenarios represent are established goals at both national and European levels. Future events will be called simply "Future Scenario" exchanges.

4.2 Integrating spatial planning elements

The consideration of the environmental/spatial-planning context of modelling results and the respective impacts on line requirements and routing should be integrated when possible. As one of the fundamental problems is local acceptance, integrating spatial planning issues (valuable habitats, areas of natural beauty etc.) into the scenario development and modelling exercises could be valuable. It was considered that although this should be looked into, many things are very difficult to produce data on and integrate into such an exercise, such as assessing and mapping rates of "acceptance".

4.3 Understanding the true impact of sector coupling

The impacts of the electrification of transport and other sector coupling, especially in relation to climate protection targets for the building and transportation sectors, were considered too low by some participants and that this suggested the predicted overall electricity consumption was to low. It was suggested that a more ambitious set of goals in this area could be used and have a significant impact on the results.

4.4 The costs of undergrounding cables should be properly considered

As the 50Hertz study was completed prior to new German legislation that preferences the undergrounding of cables, the possible cost of undergrounding cables (50Hertz modelled all as overhead AC) and the impact this may have on the cost benefit analysis results of individual projects should be considered in future studies.

4.5 Consideration of climate change impacts

It was suggested that to make the scenarios more accurate the impacts of climate change should be properly considered. Both in terms of consumption (more air con units etc.) and generation (water constraints, sea level rise, more extreme weather events etc.)

4.6 Appreciation of Swissgrids collaborative approach to scenario development

Swissgrid included one scenario in its grid development process, of which the assumptions were provided by the Umweltallianz, a Swiss association of Greenpeace, Pro Natura, VCS and WWF. This "SUN"-Scenario assumes a transformation towards 100% renewable energy, based on both changes in production (e.g. massive solar increase) and consumption (e.g. energy efficiency) patterns.

In the course of the intensive collaboration, the Umweltallianz and Swissgrid together discussed and verified the NGO-assumptions in order to reach a well understood a consistent scenario. For the final scenario, Swissgrid calculated the needed high-voltage grid and in turn discussed and verified this with the Umweltallianz.

Swissgrid's process of involving NGOs in the scenario design process was appreciated by participants. Although Swissgrid did not consider this a necessarily easy or efficient process (especially as it was practiced for the first time), they did see

it as adding legitimacy and quality by receiving non-TSO perspectives. When designing scenarios, involving those with a good knowledge of the subject matter but who are external to the TSOs allows the often perceived secretive “black box” nature of these processes to be opened up.

4.7 The importance of fully understanding inter-country transmission flows and dependencies

As cross border interconnections become more important, understanding in finer details the profile of possible scenarios and the “knock on” impacts of both neighbouring and non-neighbouring countries were considered important. It was recognised that the basic profile of many non-neighbouring countries (Spain/Scandinavian countries) was taken into account by the scenarios of 50Hertz and Swissgrid. Although modelling in finer detail may be valuable, modelling accurate scenarios for non neighbouring-countries risks the process both becoming more complex and less accurate.

This point also stressed the importance of regional scenario development and modelling exercises and the regional forums that can facilitate this. These regional initiatives require both political will and available capacity from TSOs to engage, this capacity is not always there.

5. Key Messages

This section presents some initial key messages which reached a broad level of consent by participants and which could (in the future) form messages to be communicated jointly. **These messages should not be seen at this stage as a communication commitment by any individual participant or participatory organisation**.

5.1 Ambitious green scenarios (both prosumer and competitive) are considered economically manageable

The results from the exercise demonstrated to all participants that even in the high RES future scenarios presented (scenarios) the costs involved are manageable, at least concerning the extra high-voltage grid. This message is vital to bust the common myths that are held by many when thinking about the energy transition.

5.2 50Hertz and Swissgrid are in “good shape” to facilitate high RES scenarios

The presenting TSOs are in the position to say that they are able to cost effectively facilitate a range of potential high RES futures, if it is what “society decides upon”.

NOTE: It should be noted that the ambitious RES future scenarios developed by both TSOs are not the scenarios that are directly informing the TSOs grid development plans. Rather, they seek to better understand both the risks of stranded investments and understand system flexibility.

5.3 Grids are always needed, even in decentralised high-prosumer scenarios

People producing and storing their own electricity (50Hertz assumption for 2035: 2.1million small storage units combined with PV installations) was fully incorporated into the prosumer scenario by 50Hertz. No link was found between a rise in the prosumer take up and reduced requirement for grids. Requirements of grid strengthening/expansion in prosumer scenarios are similar to the other scenarios presented, with the exception of the competitive renewable led transition.

5.4 Sufficient cross border interconnector capacity is vital to enable RES

This should be followed with coherent and easy to understand justifications for required interconnectors. Understanding how to communicate the importance of the Pan-European context without scaring people.

5.5 If high RES scenarios are the "desired" future, action from citizens and decision makers must be immediate.

If we find the high RES scenarios desirable, then there is an immediate requirement for NGOs and citizens to start defining in more detail what they want the energy system of the future to look like**.** Such a process needs to be a collaborative process between NGOs and TSOs where a joint understanding of what a desirable but consistent scenario looks like.

6. Conclusions and next steps

6.1 Forming a joint 100% RES "RGI scenario."

It was found at the workshop that RGI partners are in a position to formulate a set of general assumptions for a scenario that reaches for the 100% RES target. Such a scenario would provide useful input for the further modelling work which urgently needs to be done to provide answers to the recurring question on what happens if really we move on to a (close-to) 100% RES scenario (how it can be done, which implications this would have). Such an RGI scenario would be a demonstration of our collective goals in finer detail, (demand, prosumer take-up, carbon price, DSM etc.)

Setting up a set of coherent qualitative assumptions that would go into such an "RGI Scenario" could achieve several objectives:

- Increase understanding: Co-operation on such an exercise would build a deep understanding of the rules, possibilities and limitations of scenario development within non-TSOs.
- Improve future processes: TSOs could learn from different stakeholder perspectives by understanding the underlying assumptions that drive their broader requests and expectations. The collation and future integration of these perspectives would improve upon future scenario development work.
- Transparency: Co-operation on such an exercise would increase transparency and mutual trust.

- Joint communication: A 100% RES scenario, which is jointly developed and coherent in its assumptions, could be used to communicate in detail what we (as RGI) could envisage the future to look like.

The next steps will be to understand who could lead and be involved in such an exercise whilst also beginning to understand the details and the scope. RGI to follow up

6.2 Grasp the "low hanging fruit" in terms of joint communication messages

Several initial messages were found during the workshop that could form the basis of a joint communication effort. Examples such as "Grids are always needed in prosumer scenarios/Ambitious green scenarios are economically manageable" etc. can form powerful positive messages on the need for grids. These messages will be followed up at a second "Future Scenario Exchange" workshop, and will also form new content to be discussed at the communication workshops being run by RGI. (Work presented by Theresa Schneider).

6.3 Pursue possible regional modelling activities

As seen, understanding the regional context when modelling for high RES scenarios is important if we are to reap pan-European benefits. RGI should explore possible closer regional co-operation between TSOs and other stakeholders and understand the extent to which scenario development and modelling could be done at the regional level (possibly through existing regional initiatives like the Benelux lead *Pentalateral Energy Forum*). Limits on TSO capacity should also be understood when exploring such options.

6.4 Organise second "Future Scenario Exchange" workshop with Amprion and RTE

A second future scenario exchange workshop will be organised by RGI. The suggestion is to look into a study done by ADEME on a 100% renewables in France scenario, to discuss the scenario of a local community (25000 inhabitants, 200 GWh) which goes autonomous (as prosumers) presented by RTE and for Amprion to present the work done on the E-Highways project.