Renewables Grid Initiative

# RGI Future Scenario Exchange Workshops Insights, Comments & Messages

Summary, Status March 2017

This summary is based on the discussions in the previous future scenario workshops. It aims to provide:

- An overview of main insights and comments and
- A suggestion of possible messages that could be communicated jointly in the future

You can find all information about RGI's future scenario exchange here. So far, two workshops have taken place. These discussed the following studies:

- **'Energiewende Outlook 2035'** presented by 50Hertz
- **'Strategic Grid 2025'** presented by Swissgrid
- **'e-Highways'** presented by Amprion
- **'Infrastructure needs for local communities'** presented by RTE
- **'100% renewable electricity mix?'** presented by ADEME

## 1. Insights and comments

This section summarises both major joint insights of the discussion which took place during the previous workshops. It also lists comments and recommendations on what would be desirable to understand better from future modelling exercises.

### *1.1 The term "Extreme Scenarios" is misleading*

RGI organised the first workshop of the serious under the title 'Extreme Scenario Exchange'. There was however a general consensus from participants that the considered 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.

### *1.2 Evaluating environmental impacts*

One of the challenges of RES is their extensive usage of space. This leads to the question if there is enough space and resources available to realise 100% RES in

Europe, taking into account that certain resources, e.g. biomass, are used by other sectors too. Furthermore, it threatens the natural habitats of animals and the variance of local flora.

- We should include measurable scientific criteria for the assessment of environmental impacts, e.g. the EU commitments on biodiversity in future research

### *1.3 Integrating spatial planning elements and public acceptance*

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.
Furthermore the wish for including stakeholder influence and social acceptance in the modelling process was expressed, taking into account threats but also possible benefits that may come from the prospect of e.g. job creation or increased tax revenues. Time savings which can be reached for building solutions which are socially more acceptable should be monetized.
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”.

- We should include spatial planning issues (valuable habitats, areas of natural beauty etc.) in future studies in order to assess public acceptance
- We should include possible benefits and threads resulting from social acceptance in future studies
- Time savings which can be reached for building solutions which are socially more acceptable should be monetized

### *1.4 The costs of undergrounding cables should be properly considered*

The 50Hertz study was completed prior to new German legislation that preferences the undergrounding of cables. For future studies, 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.

- We should include the possible cost of undergrounding cables and the impact this may have on the cost benefit analysis results of individual projects in future studies

### *1.5 Evaluating the measures that can enable the energy transition*

The RTE study showed that a city cannot be self-sufficient by means of RES only, but needs infrastructure, eventually complemented by other measures, to enable system adequacy. A cost comparison between the different options, such as grid reinforcement, storage, steerable back-up generation, DSM, sector coupling (or decoupling) should provide further insights on which way to choose, especially when it comes to the choice between storage and grid infrastructure.

- We should research prospective costs of solutions that can enable the energy transition (grid reinforcement, storage, steerable back-up generation, DSM, sector coupling...) to identify the cost-optimal solutions in future studies

### *1.6 Understanding the true impact of sector coupling and intercorrelation between affected sectors*

Resource consumption and greenhouse gas emissions happen across a wide range of sectors. Especially heat and transport are generally on the list of sectors which are envisaged to be electrified in the future and hence will be coupled with the electricity sector somehow. Sector coupling by power-to-X applications (power-to-gas, power-to-heat, power-to-fuel, etc.) can make significant differences regarding factors like emissions and costs in all sectors involved. The aspect of sector coupling needs to be understood much better, both to make more evident which role this can play to combat climate change and with regards to the consequences for future grid requirements.

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.

- We should include further sectors that are affected by sector coupling in the scope of future studies
- We need to develop an understanding of which energy services will shift from other sectors to the electricity sector and how power plants and industry will adapt to this
- We should use a more ambitious set of goals in this area which will have more significant impact on the results

*NOTE: ADEME is working on a power-to-X study researching on the question how RES in the electricity system can make other sectors greener.*

### *1.7 Predicting technology development and the influence of future incentives on consumption patterns*

Key elements that enable the energy transition and are expected to evolve significantly in the future are efficiency, flexibility and sector coupling. However, many of the technologies that are likely to be employed to realise these concepts are still in a development stage.

- We should find a common understanding of how uncertainties regarding emerging technologies should be included in future studies
- We should develop a joint communication strategy towards relevant stakeholders on why these technologies are believed to play such an important role in the transition
- We should put more emphasis on researching the possibilities of the demand side, including smart applications and DSM, in future studies

### *1.8 Consideration of climate change impacts*

Climate change evokes changes in the way we use electricity, both in terms of consumption (more air con units etc.) and generation (water constraints, sea level rise, more extreme weather events etc.). This is not properly represented in existing studies.

- We should properly consider the impacts of climate change to make the scenarios more accurate

### *1.9 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 and 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.

- We should engage in more TSO – NGO collaboration to include non-TSO perspective in the scenario development process

### *1.10 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.

Another criticism was that almost all studies presented so far rely on the interconnections to other European countries, which usually are modelled with less ‘extreme’ development then the country of focus in the respective study in the scenarios. An example is the assumption from the ADEME study of having 20% conventional generation left in all countries outside of France even when an energy mix with100% RES is regarded for France. This allows counting on import of conventional energy when it is not possible to cover the national demand with RES or on provision of system services from conventionals abroad. Thereby external sources enable a local energy transition, without consideration of the possibility that neighbouring countries might have a 100% RES target as well and will therefore not be able to provide these services in reality.

These points 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.

Another question is, if the entire Europe will move in the same direction. There are scenarios missing that examine what happens if e.g. Western Europe and Eastern Europe will develop in an opposite direction.

- We should engage in a stronger European collaboration and joint, regional scenario development
- We should look into scenarios that assume different developments within different parts of Europe

### *1.11 Differentiating between decentralised and centralised RES*

There is a discussion around the differences between decentralised and centralised generation from RES. Some people are wishing for even more extreme decentralisation scenarios (100% decentralised RES) whereas others would like to avoid the debate at all and concentrate on the differences resulting from RES compared to fossil generation. It was pointed out that due to spatial and weather restrictions, there is a limit to the share of decentralised RES in the European context.

- We should consider comparing scenarios with extreme shares of using specific technologies, such as 100% decentralised RES, 100% large central RES and 100% conventionals

### *1.12 The need for better market design and political incentives*

A point of discussion was whether political incentives should be designed based on cost or on potential usefulness of the technology in question, especially with regard to power2X applications that feature low efficiency and high prices today. It was pointed out that from a technical perspective, there are often several technologies that can provide a certain service and that the prices will determine which one will prevail. Still, in order to increase RES shares above 50%, market design and acceptance for certain technologies should be regarded in more detail.

- We should research to which degree market design and political incentives are required to foster the transition towards 100% RES

### *1.13 Understanding what it means to operate a grid with 100% RES*

The wish for deep dive on the operational challenges of a system with very high RES share was expressed, as this is one key factor in evaluating possible future generation fleets. Furthermore, a common understanding on criteria and tools to evaluate the optimal generation mix for specific regions within Europe needs to be derived. It was proposed to place a focus on generated energy instead of installed capacity here, as the overall goal is reducing CO2 emissions. Otherwise, there is a risk of phasing out conventional generation, which can provide crucial system services, too early.

For the future, DSOs should be included in these discussions, as they evolve not only around the transmission grid, but the entire electricity system.
With regard to the changes in the European energy landscape the question arises, how the roles of system operators will evolve in the future. It was suggested to investigate on the question if having a common TSO is a reasonable approach for system operation in the future and how system borders could be defined.

- We should deep dive into the operational challenges of a system with very high RES share
- We should develop a common understanding on criteria and tools to evaluate the optimal generation mix for each region within Europe
- We should include the DSO point of view in our discussions
- We should consider the challenges and implications a common European TSO could bring along

## 2. Possible messages for joint communication

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

### *2.1 Ambitious green scenarios are considered economically manageable from a grid and market perspective*

The results from the 50Hertz and Swissgrid studies demonstrated that even in the high RES future scenarios presented 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.

The ADEME study showed that there is only a small difference in the average electricity price between systems with 40%, 80% or 100% renewable generation. This sends an important message to all the countries that have already committed to integrating a certain share of renewables into their grid. From an economic point of view it means that in terms of renewables integration it makes little difference to take a small step towards the energy transition versus taking a big leap forward towards full commitment for the energy transition. If we commit to the energy transition a bit, we can therefore also commit fully (from an economic point of view).

### *2.2 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 to develop a joint understanding of what a desirable but consistent scenario could look like.

### *2.3 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.

### *2.4 Renewables can support each other mutually in a superregional way provided there are grids to enable this*

Locally, the level of demand and the real-time electricity production from wind or solar usually don't match. However, the difference between supply and demand becomes smaller when looking at larger areas. Since weather conditions are different across Europe there is always locations where electricity generation is higher than demand and locations where demand is higher than generation. Different regions can therefore mutually support each other. This mutual support is enabled by the grid and should be taken advantage off. These properties have to be complemented, but cannot be replaced by other solutions such as battery storage.

### *2.5 High shares of renewable energy sources require transmission corridors to go from the outskirts to the centres of population in Europe*

One challenge of RES is their spatial requirements. The higher their share in the generation fleet, the more RES will have to be installed at the 'outskirts' with low to no population. Consequently, they require main transmission corridors to go from the outskirts to the centres of consumption, thereby enabling the transition to more RES.

### *2.6 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.

### *2.7 We can build on the existing grid to enable the energy transition*

The results from the 'e-Highways' study shows, that we don't need a higher voltage level than what the TYNDP already foresees in order to handle the changes that may arise in the European energy landscape in the future. Instead, it is possible to build on the existing 380kV AC or HVDC grid by reinforcing and expanding it where it is necessary. This holds true for scenarios with conventional power mixes, with large central RES or with high shares of distributed RES likewise.

### *2.8 50Hertz and Swissgrid are in "good shape" to facilitate high RES scenarios*

The TSOs that presented studies with focus on their respective grid 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.

### *2.9 Very high shares of generation from RES in Europe require complementation from seasonal storage or another long term solution*

While grids will allow to optimally seize renewables across a large geographic area, there will be a threshold share of renewables in the system which in addition to grids requires seasonal storage. This seasonal storage will become indispensible in long phases of little sun and low wind (likely a couple of weeks during the European winter). Geographical balancing will then no longer be sufficient to respond to the overall demand. Potential solutions such as power-to-gas and power-to-heat are still in early stages of development. Further research to develop and evaluate different options is needed to get prepared for the times with very high shares of renewables in the system.