Second International Forum

Long–term Energy Scenarios for the Clean Energy Transition

26 March 2020 | Virtual event

Questions & Answers

Please visit IRENA's website for more information on the LTES Network and Campaign at www.irena.org

Recordings and presentations of the Forum can be found in the following link:

https://www.irena.org/events/2020/Mar/Long-term-Energy-Scenarios-for-the-Clean-Energy-Transition

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Session 1: Electrification scenarios for a carbon-neutral energy system by 2050

Addressed to	Question Asked	Answer
Dante Powell	Do you think that Natural Gas could play an important role in the energy transition? Coal power plants are moving to natural gas in many regions of the world. Maybe the current crisis will push investors to move to natural gas instead of renewables. What do you think?	Natural gas will have its role in the energy transition. It should be made clear that it should be phased out in the long term, but it can play a useful role in reducing CO_2 emissions by switching from coal to gas. It also will provide support to the electricity system by providing dispatchable generation, voltage support and frequency support. In the TYNDP scenarios, the gas mix is fully renewable and/or decarbonised by 2050.
Dante Powell	Which dispatch rules are you considering, when deciding about the technologies for generation capacity expansion?	The generation dispatch is based on the day ahead market, we don't asses the intraday or ancillary services markets. In 2030, there are still some generation units with must run constraints to provide system services, but these are lifted in the 2040 top down scenarios.
Dante Powell	For Mr. Powell - On slide 22, the chart shows wind (on and off-shore) taking off in providing a larger share of distributed electricity. What is the reason there is such a sharp inflection point in 2030, and not a more gradual build-up between 2020 to 2030? Does this also have to do with the future development of the North Sea resource opportunity?	In 2030 many TSOs try to align with National and EU policy e.g. 32% RES, 32.5% efficiency. As a result, some TSOs have planned coal or nuclear phase outs by 2030. This of course creates a gap between supply and demand of electricity which is amplified due to the increase in demand. There is therefore a need to supply new low carbon energy in 2030 which is why this inflection point in 2030 is seen.
Dante Powell	Regarding the TYND scenarios: Why are the two scenarios (DE and GA) picked (or why not other scenarios)? Does Europe have to choose between solar supply from the South or wind power supply from the North? (A scenario with both solar in the south and wind power in the North seems more feasible)	The TYNDP starts with 5 scenarios and through stakeholder engagement are narrowed down to 3. Every scenario will be driven by all technologies but in some scenarios one technology will see a larger increase based on technology prices or renewable trajectories. In the TYNDP scenarios National Trends is the scenario which shows a more balanced view between wind and solar uptake.
Dante Powell	why power mix is modelled until 2045 and not 2050?	The power mix is modelled until 2040 as these are the timeframes required for the TYNDP. In future we may revisit this, but we have a limited time to develop and publish these scenarios so there is a constraint to how much we can do.
All	Where do the numbers come from? Are these the outputs of a specific model or expert opinions?	The numbers in the TYNDP scenarios come from a mix of experts and models, essentially the experts give boundary conditions for the build out rates and decommissioning rates of generation technologies. The scenarios use the boundary condition as a range for renewable expansion, and thermal plants are set by the opinion of the experts.
All	Newest NASA Report shows, that 1,5°C will be exceeded by 2035. Only 100% RES by 2030 can stop this then. Do you have reports on 100% RES by 2030. Do you see the possibilities and necessities for that?	ENTSO-E does not have a scenario with 100% RES by 2030 but there are some studies done by the Energy Watch Group which show 100% RES scenarios.

Session 2: Exploring the global landscape of LTES narratives and assumptions

Addressed to	Question Asked	Answer
Tiina Koljonen	What have been the challenges in realizing the Stagnation scenario? What has made that one so hard?	The major challenge has been in building a coherent story, where Finland is implementing ambitious climate actions, when the economy is not growing like in the other scenarios. In the original scenario framework the Stagnation was, in fact, called "Collapse", but it was never agreed what that would mead in GDP. In the Stagnation, we had, anyway give explanations and examples how the climate neutrality target could be achieved. Based on the inputs from the expert workshops, it was assumed that Stagnation would need strong regulation and control as global markets are not functioning.
Tiina Koljonen	What social indicators are you using to assess the results of the scenarios?	Impacts on people, natural environment, living environment and health are assessed according to the general framework, which is formulated in the Finnish legislation. Analysis of social impacts is largely based on qualitative assessments, but naturally quantitative indicators for employment, national and regional economies, etc. macroeconomic indicators are reported. In the forthcoming impact assessments of new climate and energy policies we have now put more effort on analysis of social impacts by using and testing a list of Key Performance Indicators (KPIs). I hope that I can answer into this question much better after one year.
Tiina Koljonen	Tiina said Finish policy was "without international trade". Does that include selling carbon offsets?	The primary goal of the Finnish policy is to reach the carbon neutrality by radically decreasing greenhouse gas emissions and by strengthening the forest sinks. That means Finland is not aiming at compensating its GHG emissions by buying carbon credits from the international markets. However, that doesn't mean that companies operating in Finland would not be allowed to buy carbon credits, especially if those emissions are included in the EU's emission trading system.
All	If you compare scenarios developed 5 years ago with today (actual development) - how "precise" were your models?	Tiina Koljonen: I must say that models could be precise but the question is behind the data, assumptions and even the person, who is running the model. One never ending question in Finland has been the electricity demand, which has been expected to grow above 100 TWh soon or by 2020 at the latest. We are still rather far away, but due to decarbonisation policies, we will someday reach that 100 TWh most obviously. Wouter Nijs: https://twitter.com/WouterNijs/status/1243208305947955201
All	What is your opinion on model "transparency" in the model evolution?	Tiina Koljonen: The current trend in creating open access models and databases is a good step in increasing confidence. However, there are still many practical constraints in publishing all the data and assumptions used in each scenario exercise. Wouter Nijs: https://twitter.com/WouterNijs/status/1243208305947955201
Tiina Koljonen	Was any analysis done before the decision to achieve climate neutrality by 2035? Is there any analysis available studying the effects on the whole economy in a CGE-model?	Before the target setting, were are analysing long-term scenarios, which indicated that Finland could reach climate neutrality around 2040. Based on the IPCC Special Report for 1,5 C mitigation target it was estimated that the global burden sharing for Finland would require that climate neutrality should be reached by 2035 and after that Finland should become climate negative. The 2035 target was written in the new Government programme in 2019, e.g. agreed by all the Government parties. CGE analysis has also been done and the report is available in Finnish. However, the main conclusion was that the impacts on GDP growth are rather small as energy and climate related sectors are only minor contributors to the whole economy.

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Tiina Koljonen	What are the main directions related to Energy Taxation law mentioned in the last slide? It would be good to have more info on this as it is related to implementation actions needed to reach set targets.	The current excise tax for heat and transport fuels are based on CO2 emission and energy content components. However, there are several exemptions and companies are also able to get refunds for the paid energy taxes. The renewal of energy taxation system is aiming at (gradually) phase out of these supports for fossil fuels. In addition, electricity tax for industries, data centres, large heat pump stations, etc. will be lowered to the level, which is the minimum based on the EU regulation.
Sven Teske	Switzerland is quite an interesting case with respect to GHG vs emission reduction commitments. Whilst the country is seemingly one of the lowest emitters, but one wonders if this takes into consideration the carbon footprint of the many Swiss corporates that operate outside of Switzerland.	Good point! Nd no, it does not consider indirect emissions from Swiss investors outside Switzerland. But to be fair, I don't think any other country has chosen this approach either. This would be a very interesting concept for future NDCs!
Sven Teske	What are the narratives to support 100% renewable energy system modelling especially in hard to electrify/decarbonise sectors like heavy industries?	This is a difficult question which can't be answered in one sentence. However, I try to give a short answer. Industries need electricity (usually high loads) and process heat. Electricity can be generated from centralized and decentralized grid connected RE. High loads can also be met by a "swarm" of decentralized RE – as long as the industry is not required to produce electricity on-side, which would be difficult. The only options would be to use CHP plants fueled by synthetic or bio fuels. Process heat could be – in theory – produced with CSP plants. But in practice this is not an option in most cases. Thus, process heat must be produced on-side with renewable fuels. Here are a few links to interesting research reports about industrial process heat and the role of renewable: https://arena.gov.au/assets/2019/11/renewable-energy-options-for-industrial-process-heat.pdf https://www.irena.org/publications/2015/Jan/Solar-Heat-for-Industrial-Processes https://www.solarpaces.org/csh-could-decarbonize-industrial-heat-globally/ https://ammoniaindustry.com/renewable-energy-for-industry-ieas-vision-for-green-ammonia-as-feedstock-fuel-and-energy-trade/
Sven Teske	I understand that energy orientated institutions should mention (define) phase-out dates for fossil fuels. However, unfortunately most of the energy-oriented institutions respond to member countries. According to you, which international entity may have the power to suggest this, and to have a real impact?	I personally think that the IPCC should be clearer in regard to the role of CCS and what this can and cannot deliver. Carbon emissions can only go down when we stop burning fossil fuels – that seems logic but many energy experts are to scared to say this openly as it would clearly go again large parts of the existing fossil fuel industry. So in short, I suggest that UNFCCC / IPCC demands a clear date for a phase-out of oil, gas and coal production to keep emissions within levels required to meet the Paris climate agreement.
Wouter Nijs	Is it possible to get access to the scenarios considered in the analyses by the JRC?	The scenarios are part of ongoing JRC work, please keep an eye on the (not yet published) report "Towards net-zero emissions in the EU energy system": https://ec.europa.eu/jrc/en/publications-list. You can also follow JRC on social media, for example on twitter: https://twitter.com/EU_ScienceHub. Slide number 5 of my presentation has the names of all 16 scenarios that reach at least 90% emission reduction by 2050.

Session 3: Stakeholder engagement for an inclusive LTES development process

Addressed to	Question Asked	Answer
Dennis Volk	One of the main arguments from the TSO and ISO in developing countries when it comes to large integration of VRE into power systems is that they jeopardize the safe and reliable operation of the power systems. How can we demonstrate the opposite?	Its not about a distinction between developed and developing countries. Its about the functionality of each electricity system in the jurisdictions. Electricity systems are likely to require amendments and/or expansion of operational practices and/or infrastructure. The safe and reliable integration of VRE is more a matter of available knowledge and will (which grows within the relevant institutions and stakeholders in each jurisdiction as growing shares of VRE are being deployed) as well as functional (political, financial, regulatory and technical) frameworks to allow the necessary changes to happen at the right time. As power systems differ from each other, decision makers may want to evaluate VRE impacts to the power systems in their jurisdictions beforehand, to identify upcoming / existing issues and solutions. Organisations such as IRENA are best placed to provide with a comprehensive overview on relevant studies and potentially even support some of them.
Ivetta Gemas	On the social, economic and political vision: is there any way that LTES models can help emerging countries to find financial help to develop their NDCs?	I think yes. First, international donors supporting LTES would want NDCs to be based on LTES visions, or at least to be aligned (NDCs have a shorter horizon, 2030 whereas LTES have a longer-term vision of 2050). Second, both NDC and LTES can identify measures that save not only emissions, but also free up or mobilise national financial resources through fossil fuel subsidy reform and fossil fuel taxation. At IISD, we've developed a GSI-Integrated Fiscal model. This modelling across 26 countries finds a simple national average of 6 per cent GHG emission reductions when consumption subsidies to fossil fuels are removed. This average reduction improves to 13.2 per cent with a modest fossil fuel tax and a switch from savings and revenues into renewables and energy efficiency.
Dennis Volk	What is the analysis in Germany showing in terms of net indirect and induced jobs in addition to direct jobs in EE vs RE sector in Germany?	The German Federal Ministry of Economics and Energy has conducted assessments on socio-economic aspects of the energy transition, including jobs. For detailed information please visit https://www.bmwi.de/Redaktion/DE/Artikel/Energie/arbeitsplaetze-und-beschaeftigung.html

Session 4: Systemic innovation in energy demand and consumer behaviour in LTES

Addressed to	Question Asked	Answer
Ron Benioff	Ron, can you say anything about the technologies that you are looking at? Is this direct electrification or (which I hope to see) do heat pumps for heating and cooling play a role in residential and industrial applications?	The study looked at the full range of electrification technologies, including electric vehicles, space and water heating and cooling, cooking, industrial curing and drying and other process technologies. Heat pumps for space conditioning was considered for residential and commercial buildings and for industrial applications.
Ron Benioff	With regard to the heat demand, are scenarios also considering energy efficiency in, for example, buildings, to reduce heat demands?	Service demand was kept the same for all scenarios (i.e., those with higher and lower electrification) and are based on the underlying assumptions from the U.S. Energy Information Administration's Annual Energy Outlook scenarios. These scenarios did include adoption of energy efficiency measures but we did not consider additional EE above and beyond those adopted.
Ron Benioff	If I understand slide 4 correctly: the big demand impact in summer stems from cooling? Do you model a parallel build-up of PV? Together with reversible HP, that should solve the issue	The deployment of PV, both distributed and utility scale, is being considered in our ongoing analysis of the "supply" side.
All	Any studies that have been done on integration of standalone electricity storage technology?	NREL has conducted several studies of standalone electricity storage and has recently kicked off a "Storage Futures Study" that will have a similar analysis format as the Electrification Futures Study.
Ron Benioff	The Global Power System Transformation Consortium will provide "deep technical" advise to developing countries. Will this be proprietary transfer, or will it utilize open source tools and open data.	We will use open source data and tool along with expert technical assistance and training programs
Ron Benioff	Are you working to close this gap by asking industry on their interest and acceptance rate?	Several stakeholders from industry have reached out for our scenario data and to be engaged with our analysis. We hope to work with industry in future research to share data and knowledge.
Deger Saygin	Can vehicle to grid become a reality for demand side response?	Turkey is currently discussing a comprehensive demand response legislation, where DR is also part of the country's National Energy Efficiency Action Plan to 2023. While this was not (through V2G) covered in SHURA's EV analysis as a potential, it will definitely play a role to reduce distribution grid losses (an important issue for Turkey) and to provide system flexibility to the DSO for integrating wind/Solar, either through TSO-DSO cooperation or in the distribution grids themselves.

Session 5: Robust and resilient LTES development processes

Addressed to	Question Asked	Answer
All	Important to distinguish between models of particular systems and modelling frameworks (LEAP, TIMES, etc). Different types of validation required for models vs modelling tools.	Validation of modelling frameworks should focus on the underlying methodology and mathematical formulation, ensuring that the constraints are generated correctly and test models produce expected results. The user community of a modelling framework can play in this process an important role, e.g. by reviewing and testing a new modelling feature in different model applications and circumstances. For a specific model application, e.g. model of a country or region, validation should demonstrate that one can replicate in the model the energy system for historic years, e.g. comparing model results for these years with energy balances or other relevant statistics. Running the model under a number of different scenarios and input assumptions can also help to test the plausibility of the model behaviour and how flexible the model is under different scenario settings.
Uwe Remme	What are the assumptions made to model VRE and energy storage technologies in LTES?	Various approaches exist to address VRE and flexibility measures in LTES. One approach can be to increase in long-term energy system models the temporal (and possibly also the spatial) resolution to incorporate directly operational aspects related to the integration of VRE in the investment decisions taken by the long-term model. The energy system modelling framework TIMES for example provides the possibility to include dispatch features in a long-term model. Depending on the modelled energy system, increasing the temporal (and spatial) resolution, however, can lead to very large models, which become computationally intractable. An alternative approach is to soft-link a long-term planning model with a dedicated dispatch model, with the long-term model providing the capacity information to the dispatch model, which analyses the operational feasibility of this capacity mix. Based on the finding from the dispatch model, constraints or capacity decisions in the long-term model can be adjusted to indirectly take into account some of the operational aspects.
All	How do developing countries build robust resilient LTES considering issues of economic instability and uncertainty	One way to analyse future uncertainties is to look at different scenarios or sets of input assumptions (e.g. Monte-Carlo analysis) reflecting the uncertainty range to understand whether common elements, e.g. technology choices, in the strategies of the different scenarios exist. An alternative or complementary approach is to test a strategy derived for one set of future assumptions under a different future outcome to understand the feasibility, impacts on costs, environmental impacts etc. of a strategy under different future outcomes.
All	In densely populated developing countries like Nigeria where statistics are not as perfect as you'd expect, how do you model their energy scenario in the short term, mid-term and long term. Especially, with exposure to economic shocks like low oil price and global pandemics?	Economic shocks or other crises are by nature impossible to predict. To understand the impacts of such shocks and actions to address them, one could exogenously impose such a shock in scenario, e.g. drastic change in energy prices or demand. For example, in long-term optimisation models, which often assume perfect foresight over the time horizon of the scenario, i.e. developments far in the future are assumed to be already known today, one could assume instead a limited or myopic foresight, so that the energy model is only run for a shorter time period (e.g. next 5-10 years), the solution from this model run, e.g. capacity mix, is then input into the model run for next time period and so on. In this recursive sequence of model runs, one can introduce a shock to understand what strategies could be to react and adapt to the suddenly changed situation, which could not be anticipated in the model runs and decisions for the earlier periods.

Session 6: Risk and systemic innovation in long-term energy policy-making

Addressed to	Question Asked	Answer
Giovani Machado	Demand Energy policy is regulated in Brazil?	The Law # 9,478/1997 establishes the principles and objectives of Energy policy in Brazil. It also created the Energy Policy National Council, which proposes national policies and specific actions to the President of the Republic. Regulatory Agencies regulate technical and sectorial conditions to do business in the market. With those considerations in mind, it is correct to say that energy markets in Brazil are open to new entrants, except those under natural monopoly structure such as network industries (power and gas transmissions, local distributed companies for gas and power). Even then, there are market reforms are in place to promote competition on those industries. Finally, as in any market economy, energy policy in Brazil affects demand through incentives, taxes, standards and market rules, but it does not regulate demand.