

## Second International Forum

### Long-term Energy Scenarios for the Clean Energy Transition

26 March 2020 | Virtual event

## Proceedings

Please visit IRENA's website for more information on the LTES Network and Campaign at [www.irena.org](http://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>

You can also contact [ltcs@irena.org](mailto:ltcs@irena.org) for further information.

## 1. Background

### The campaign on Long-term Energy Scenarios for the Clean Energy Transition (LTES Campaign)

The world's energy systems are entering profoundly uncharted territory – unprecedented technological advances in power generation, transport and innovation in digitalisation make predictions about future energy conversion and use highly uncertain. At the same time, urgent Sustainable Development Goals and the Paris climate accord insist on a transition to clean energy use as fast as possible, thus compounding the complexity of representing integrated energy systems in long-term scenarios. In this context, robust views of the future energy landscape have become invaluable, and how those views are developed requires a change in perspective.

IRENA is coordinating a group of government institutions from 13 countries and seven technical institutions to explore these issues as part of the [Clean Energy Ministerial Campaign on “Long-term Scenarios for the Energy Transition” \(LTES Campaign\)](#). **The campaign aims to promote the improved use of scenarios for the clean energy transition, enable the exchange of best practices and facilitate work to strengthen and broaden their use.**

The [Second International Forum on Long-term Scenarios for the Clean Energy Transition](#) gathered experts representing governments, technical institutions, academia, and the private sector, to exchange experience in the use and development of long-term scenarios to support the planning of the clean energy transition. Due to the social distancing measures advised due to the outbreak of the Coronavirus, the LTES International Forum had to go virtual. This allowed for a wider outreach, overall there were 754 registrants and over 625 attendees, from 83 countries.

### Overarching Objectives

- » **To enable deep-dive discussions with subject experts** on critical scenario issues identified by public and private practitioners from around the world.
- » To raise awareness of the importance of long-term energy scenarios for policymaking in the context of clean energy transitions.
- » **To take stock of good practices and discuss critical messages** that need to be presented to policy-makers using energy scenarios.

Presentation slides and recordings are available at: <https://www.irena.org/events/2020/Mar/Long-term-Energy-Scenarios-for-the-Clean-Energy-Transition>

## 2. Programme and speakers – 26 March, 2020

### Session 1: Electrification scenarios for a carbon-neutral energy system by 2050 9:20 – 10:40 CET

Moderator	Speakers			
				
<b>Dolf Gielen</b> Director, IRENA Innovation and Technology Centre	<b>Mark McGranaghan</b> Vice President of Innovation, Electric Power Research Institute (EPRI), U.S	<b>Dante Powell</b> Senior Market Modelling Specialist, European Network of Transmission System Operators for Electricity	<b>Kristian Ruby</b> Secretary General, Eurelectric	

### Session 2: Exploring the global landscape of LTES narratives and assumptions 10:50 – 11:50 CET

Moderator	Speakers			
				
<b>Brian O'Gallachoir</b> Director, MaREI, SFI Research Centre for Energy, Climate and Marine, Environmental Research Institute, University College Cork, Ireland	<b>Pablo Carvajal</b> Associate Programme Officer, Clean Energy Transition Scenarios, IRENA	<b>Tiina Koljonen</b> Principal Scientist, VTT Technical Research Centre of Finland	<b>Sven Teske</b> Research Director at the Institute for Sustainable Futures, University of Technology, Sydney, Australia	<b>Wouter Nijs</b> Project Officer and Researcher, Joint Research Centre – European Commission

### Session 3: Stakeholder engagement for an inclusive LTES development process 12:00 – 13:00 CET

Moderator	Speakers			
				
<b>Michael Renner</b> Program Officer, Policy, IRENA	<b>Dennis Volk</b> Team Lead, Network Infrastructure Development, Bundesnetzagentur (Federal Network Agency – BNetzA), Germany	<b>Ivetta Gerasimchuk</b> Lead, Sustainable Energy Supplies, International Institute for Sustainable Development (IISD)	<b>Marek Harsdorff</b> Green Jobs Specialist, International Labour Organisation (ILO)	

### Session 4: Systemic innovation in energy demand and consumer behaviour in long-term energy scenarios 14:00 – 15:00 CET

Moderator	Speakers			
				
<b>Paul Durrant</b> Strategy & Engagement Lead, Renewable Energy Innovation, IRENA	<b>Ron Benioff</b> International Program Manager, National Renewable Energy Laboratory (NREL), U.S.	<b>Deger Saygin</b> Director, SHURA Energy Transition Center, Turkey	<b>Klaus Willnow</b> Head of Innovation & Future Technologies, Siemens Gamesa	<b>Charlie Wilson</b> Researcher, Tyndall Centre for Climate Change Research, UK

### Session 5: Robust and resilient LTES development processes 15:10 – 16:10 CET

Moderator	Speakers			
				
<b>Pablo Carvajal</b> Associate Programme Officer, Clean Energy Transition Scenarios, IRENA	<b>Pieter Boot</b> Head of Climate, Air and Energy Department, Netherlands Environmental Agency (PBL)	<b>Alec Waterhouse</b> Head of Central Modelling Team, Department for Business, Energy and Industrial Strategy, UK	<b>Uwe Remme</b> Energy Analyst, International Energy Agency (IEA)	<b>Vincent van Steenberghe</b> Climate Policy Expert, Belgian Federal Public Service for Health, Food Chain Safety and Environment

### Session 6: Risk and systemic innovation in long-term energy policy-making 16:20 – 17:20 CET

Moderator	Speakers			
				
<b>Asami Miketa</b> Senior Programme Officer, Power Sector Investment Planning, IRENA	<b>Giovani Machado</b> Director, Energy Economics and Environmental Studies, Energy Research Office, Brazil	<b>Ruud Kempener</b> Policy Officer, Directorate-General for Energy (DG-ENER), European Commission	<b>Joana Portugal Pereira</b> Professor of Energy Planning, Federal University of Rio de Janeiro, Brazil; Lead Author, IPCC WG III AR6 Chapter 4	

### 3. Executive Summary

Session 1 presented the perspective of the electric industry. The discussion, which was re-emphasised in the following sessions, saw an across the board agreement that electrification will play a key role in the clean energy transition. This session showed clear consistency in the ranges provided of electrification rates required to achieve decarbonisation. Discussion continued to make an important distinction between direct and indirect electrification, stressing the uncertainty surrounding indirect electrification.

Session 2 scoped a range of different narratives and the impacts of the clean energy transition pathways, which will be varied in impact on different sectors. The distinction was made between 100% renewable energy scenarios and deep decarbonisation scenarios; the results are the same in terms of carbon emissions, but the energy mix will be completely different.

In session 3 the speakers discussed a just and inclusive transition and how this can be managed by improving stakeholder engagement in the scenario development process. All speakers discussed the challenge, importance and benefit of achieving transparency within the scenario development and use. The importance of engaging with policymakers was also emphasised.

Session 4 focussed on systemic innovation in energy demand and discussed the different approaches of some research organisations in addressing the challenges and implications posed by digitalisation and decentralisation. The speakers recognised the huge uncertainty regarding consumer behaviour and business models for systemic innovation. The role of decentralisation and digitalisation and the need for improving the representation of consumer behaviour and business models in scenarios, was also a recurring theme touched upon throughout the day.

Session 5 on robust and resilient LTES processes, discussed the importance of institutional processes and legal processes. This session echoed session 3, but from the perspective on innovation, calling for increasing stakeholder engagement and in particular engaging with the actors that influence decisions and have the power to implement the pathways represented in the scenarios.

Session 6 acknowledged the risk and challenge for scenarios and models to reflect systemic innovation. The challenge for strategists in investing in infrastructure and technologies that could potentially be leapfrogged or uneconomical was also discussed and the need for competitive markets in order to determine the best technologies, which requires infrastructure accessibility. However, it was emphasised that the risk of inaction needs to also be represented when considering the risk of stranded assets.

Another overarching theme of discussion was the consideration of COVID-19 outbreak. There were calls from many speakers that the stimulus packages being announced by governments should be an opportunity for governments to push the clean energy transition forward and in a fair and just way resulting in an increase of electrification, digitalisation and decentralisation. The COVID-19 outbreak also drew on a recurring theme, the need to improve modelling of changing behaviours, since the outbreak is expected to cause a paradigm shift.

## 4. Session Summaries

### Opening Session

IRENA's Paul Durrant officially opened the meeting, outlining the format and the technical aspects of such a virtual event.

Dolf Gielen, Director of IRENA Innovation and Technology Centre, provided some introductory remarks to set the scene for the 'Second International Forum: Long-term scenarios for the clean energy transition' discussions. Gielen outlined the current context for the use and development of scenarios, namely national policy making and global scenarios for global policy debates. However, the energy system is evolving with great uncertainty in order to achieve the clean energy transition. This brings to the forefront the importance of long-term energy scenarios as tools for long-term planning. Gielen emphasised that the LTES Campaign and Network and the resulting activities, including the Second International Forum, are focussed on promoting *the effective use and development of "long-term energy scenarios" (LTES) to guide the clean energy transition.*

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

**9:30 – 10:40 CET, 26 March 2020**

Electrification of the end-use sectors and increased use of renewable energy in the power sector is one of the critical pathways for achieving a carbon-neutral energy system by mid-century. This session discussed the perspectives of the electricity industry on crucial technological and societal transformations needed for taking this pathway and how they are represented in LTES. Furthermore, it provided a platform to discuss their readiness in planning for large-scale electrification as a means of achieving a carbon-neutral energy system by 2050.

This session confirmed a global consensus of the role of electrification as the key pillar for the clean energy transition. Amongst the speakers there was consistency in the ranges provided of electrification rates required to achieve carbon-neutrality. However, there was an ongoing emphasis within the discussion of distinguishing between direct and indirect electrification. Overall, direct electrification is simpler to predict, and the consensus is easy to achieve. However, indirect electrification, which includes technologies such as hydrogen and power to X, remains largely uncertain, with variables such as how we integrate it into the market, how we operate the market and who will operate the market still unknown. This requires scenario exercises to be repeated every 2-5 years as the market evolves with these new technologies.

In light of the COVID-19 pandemic, there is a potential for a huge impact on electrification. ENTSO-E's Dante Powell drew a comparison to the 2008 recession, which saw a massive decline in emissions and had a big effect on the European Emission Trading System (ETS). Powell highlighted one expected impact is a paradigm shift regarding demand profiles, which has already reduced demand significantly, it will be interesting to see how behaviours continue to change in relation to this societal issue. Eurelectric's Kristian Ruby stressed that it's important that governments use the stimulus packages announced in response to

COVID-19, to gear the economy towards the clean energy transition, investing in electrification and technologies.

Mark McGranaghan from EPRI, identified two main drivers of electrification: offshore wind and decentralisation. Community management and responsibility of resources is an important trend that will determine the success of decentralisation.

The challenge remains of converting these electrification scenarios into government actions using economic and policy instruments in order to achieve the electrification rates required for carbon-neutrality at the speed that is required due to the urgency of climate change. Dante Powell stressed that most projects need investment now as they are long-term projects, so a 30-year time horizon requires action today.

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

### 10.50 - 11.50 CET, 26 March 2020

The LTES campaign has facilitated discussion among national scenario practitioners in which they exchanged, among other topics, the key narratives and assumptions used in their respective LTES. This session focussed on the underlying narratives and assumptions driving LTES for an accelerated clean energy transition, building on the discussions held under the LTES campaign so far. The discussion also touched upon the compatibility among national, regional and global LTES, and how climate targets and carbon-neutrality aspirations for energy systems by mid-century are addressed in these scenarios.

IRENA's Pablo Carvajal provided an overview of LTES narratives and assumptions with clear definitions; a narrative being the qualitative storyline and the assumptions being the consequential quantitative variables. Carvajal highlighted the different implications of costs within different modelling approaches, is the result of cost projections of different technologies and the uncertainty of these technologies' large-scale deployment.

Tiina Koljonen from Finland's Technical Research Centre (VTT), highlighted the country's impressive ambition of achieving carbon neutrality by 2035. The scenario development work produced by VTT used innovative methods of communication, for example, they produced graphic designs to accompany all their scenarios and found this exercise to be extremely useful. Koljonen highlighted that continuous work needs to be done on a rolling basis and this is a huge drain on resources and could potentially become a bottleneck for planners.

Sven Teske from the Technical University of Sydney delved into key narrative turning points by distinguishing between required technology and policy trends and expected trends. The global required and expected trends seem to be misunderstood or under-represented in most national LTES. These trends need to be reflected in narratives and assumptions to reconcile energy institutions and the climate community, LTES and Nationally Determined Contributions (NDCs), and to achieve the Paris Agreement.

Wouter Nijs from the Joint Research Centre provided an overview of the ambitions of the European Green Deal and the European Commission's 'A Clean Planet for All' which comprises of eight narratives. This was accompanied with a more global perspective: since 2017 more than 67 energy scenarios have been published; 20 scenarios have a greater than 50% reduction by 2030, compared to 1990; and 16 scenarios achieve near net-zero emission by 2050. The Commission's mapping of these scenarios showed several



similarities such as the reduction in fossil fuels, electrification, the role of renewable electricity and zero-emission vehicles. The mapping also showed wide variation in relation to renewable energy share in final energy demand, reduction of final energy, the size of the power sector and reliance on different technologies.

The distinction was made between 100% renewable energy scenarios and deep decarbonisation scenarios; the results are the same in terms of carbon emissions, but the energy mix will be completely different. Koljonen interpreted this in the context of Finland, where 100% renewable target would result in stranded assets as Finland has been investing in nuclear. Therefore, this target is not recommended to the Finnish government however the scenario exercise is still insightful. From this exercise, Koljonen identifies the biggest challenge is decarbonising the industrial sector and particularly the chemical industry. Nijs said that 100% renewable energy does not necessarily mean the highest level of renewable energy. Some diversified scenarios (not reaching 100%) have higher levels of renewables because they have lower reductions on the demand side. Some sectors indeed require hydrogen and e-fuels, which may make these sectors less energy efficient.

### Session 3: Stakeholder engagement for an inclusive LTES development process

12:00 – 13:00 CET, 26 March 2020

The clean energy transition impacts different segments of society to different extents, which may create socio-political and economic tensions. This session focussed on how different countries engage different stakeholders in the scenario development process to ensure that the transition is just and inclusive.

Transparency was stressed as very important by all the speakers. The challenge for transparency is the technocracy of developing scenarios, which requires more effort and extra communication materials to make scenarios and the development process more accessible.

Dennis Volk from Germany's Federal Network Agency introduced the idea that local knowledge is an important regulatory resource and public consultation speeds along the network expansion regulatory process. Providing a transparent process creates trust, encourages engagement and makes cooperation for dispute resolution easier for regulators. Volk also alluded to the fact that the impact of the clean energy transition could benefit local communities due to decentralisation, enabling community management and access to the local wind energy production for example.

Ivetta Gerasimchuk from the International Institute for Sustainable Development concluded it is important for those who are impacted to be at the centre of the conversation, in order to avoid push back and minimise harm. Another concern is the matter of how to connect, how to translate the language of modelling into a language that those impacted will understand.

Marek Harsdorff from the International Labour Organisation (ILO) interpreted the COVID-19 stimulus packages as an opportunity to support the clean energy transition. However, akin to the financial crisis, Harsdorff warned that the governments could end up increasing emissions again. In order to avoid this, there needs to be cooperation and engagement with the gas industries and the ministers of finance and planning. Harsdorff highlighted that there is growing support for the clean energy transition with the public but not with the decision-makers, who are ultimately the stakeholders that are most important for achieving the goals. The ILO have produced a Green Jobs Assessment Model (GJAM) which provides

quantitative projections on policies' impact on social and job outcomes and economic environmental performance.



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

14:00 – 15:00 CET, 26 March 2020

Innovation in technological adoption and consumer behaviour, driven by digitalisation and decentralisation trends will change not only how energy is provided but the way that energy is consumed. This session discussed how the representation of these trends can be better reflected in LTES. It also discussed how LTES can help policy-makers consider highly uncertain impacts of systemic innovation.

The speakers outlined various emerging innovations and trends concerning the clean energy transition. The overarching consensus was on the role of electrification of end-use sectors but there was much uncertainty of the direction in which each sector will take towards this electrification, and the correct mix of technologies and solutions to achieve such a trend.

An in-depth discussion took place around uncertainty, especially surrounding the large-scale electrification of end-use energy demand, and how this uncertainty can be reflected in scenarios. NREL's Ron Benioff called for further studies on consumer acceptance and behaviour. He provided the example of the US, where there is a consensus on how the industry will respond, but within transport and buildings when consumer models come into play there is a need to delve deeper. One method is to examine early adopters of technologies, their experience and response. Alternatively, examine specific technologies, such as space heating, and the respective adoption curves.

Deger Saygin introduced SHURA Energy Transition Centre's study *'Transport sector transformation: Integrating Electric Vehicles into Turkey's Distribution Grids'*. Saygin echoed Benioff's concern with consumer reaction as a huge uncertainty; the results of the study pointed to uncertainty within the level of business models, this needs to be understood by the government planners who are interpreting the scenario results. The study also showed an importance in strategic planning of charging infrastructure, strategic choices of geographical places have a huge impact on peak load.

Klaus Willnow provided an overview of the approach taken by Siemens Gamesa Renewable Energy. They begin with a potential future with the time horizon of 2050, and then backcast to see the pathways that could achieve such a future. However, they also consider and incorporate the classical approach of looking at today's world and hypothesising realistic and likely pathways. From this activity, the required disruptions for a particular scenario can be determined. From this experience, Willnow summarised the lessons learnt for achieving a more robust approach is to continue to include new expert perspectives that reflect the fast-paced constantly evolving energy system.

Charlie Wilson summarised the Tyndall Centre's approach, using global integrated assessment modelling tools used to look at long-run climate mitigation scenarios. These global models are aggregated and coarse in detail. Therefore, in order to create a low-energy demand scenario, the Tyndall Centre did a lot of off-model work using scenario narratives for demand, decentralisation and digitalisation. This qualitative and quantitative modelling approach allowed for assessment of the impacts of innovation, in terms of energy intensity and emissions. Wilson also suggested the global models need to improve representation of consumer heterogeneity and social influence effects.

## Session 5: Robust and resilient LTES development processes

**15:10 – 16:10 CET, 26 March 2020**

Some governmental institutions adopt measures to ensure that their LTES are robust and resilient and that they are effectively used for policymaking. This session explored various approaches taken in this way, such as review processes and quality assurance mechanisms, to ensure that scenario development methodologies are robust. For the policymaking to be robust, LTES need to be based on robust methods and to produce results built on consensus.

Alec Waterhouse from the UK Department for Business, Energy and Industrial Strategy (BEIS), made a distinction between validation and verification; validation is whether the model is doing the right thing and verification is whether the model is doing so correctly. Waterhouse stressed that the scenario itself is part of a larger process of energy planning. Waterhouse gave a brief overview of the new and exciting calculator from BEIS. This calculator will harvest the scenarios built by the users and will provide an insight of how people view the future, this is an innovative way of stakeholder engagement and will serve to create more robust and resilient scenarios.

Vincent van Steenberghe from the Belgian Federal Public Service Health, Food chain safety and Environment, emphasised the necessity of participatory processes for robust and resilient views towards the future. Participatory processes aid the mapping of the various actors, which requires understanding the different concerns of different actors and being able to anticipate and reflect them within the model. Engaging policy makers in scenario modelling is extremely important, since policy is key for achieving the clean energy transition. Van Steenberghe stressed that the results of scenario modelling are for informing decisions; scenarios that provide a shared vision of the stakeholders are therefore in the interest of politicians.

Pieter Boot from PBL, stressed that to keep scenarios robust and resilient requires a continuous process of constant updating to keep up with the evolving systems. Boot also outlined a process of acknowledging mistakes, documenting them and correcting them in order to build trust in the processes and hence the results.

Uwe Remme from the International Energy Agency stated that robust and resilient scenarios require a network of experts and diverse modelling tools. It is useful to engage a broader group of models as well as modelling teams to gain a broader range of outcomes. Comparing outcomes allows scenario users to identify what is driving the models and the meaning of variations in results. Such a network of modellers and models will share the burden of quality control and stimulate improvements. Such an exercise is particularly valuable to developing countries, who can then learn and improve their scenario and modelling capacities towards robustness and resiliency. Remme also touched upon differentiating between models and the model generator itself, both must be robust and resilient in order to gain trust in the results.

Continuing the topic of developing countries, Boot emphasised that institutes in developing countries are heterogeneous in approaches, challenges and context, so to aid robust and resilient models in the developing world, institutions must understand what capacity is required. For institutions to understand the country's requirements, a participatory process must be undergone to learn what is needed, what is important and what must be achieved within the specific country context.

Waterhouse provided insight as advice for those that are starting from the beginning of building inhouse capacity: it is best to start small, start a calculator instead of a huge energy system optimisation model like TIMES. Governments who do not have capability can outsource, but first they need to understand what they are asking for. To build understanding development of partnerships with academic institutions for knowledge exchange should be endeavoured.

## Session 6: Risk and systemic innovation in long-term energy policymaking

**16:20 – 17:20 CET, 26 March 2020**

This session featured a panel of governmental energy policy-makers and planners, who will reflect on how LTES insights into systemic innovation can inform policymaking and aid in mitigating risk. Panellists were requested to provide insights into what challenges exist for effective long-term energy planning in government and insights into how risk and systemic innovation are perceived in the policymaking sphere.

Giovani Machado from EPE Brazil identified that investing in specific technologies routes which end up being less efficient and economic as others, could cause lock-in resulting in high costs of adjustments, so investing early in a specific route is risky. There is also the risk of leapfrogging, where a technology is invested in but eventually it is pushed out of the market by a new overarching technology. Technologies require a competitive market so that the ‘best’ technology can be determined. Machado also provided insight into the approach to Brazil’s National Energy Plan 2050. The strategy of the previous plan defined reference scenarios and alternative scenarios required scenarios to constantly be reworked due to the fast-evolving system. This time the plan used 80 simulations providing a range of possible worlds, dependent on assumptions.

Ruud Kempener from DG Energy of the European Commission identified a few challenges for using scenarios in policymaking, such as decentralisation and difference of opinion in how to reflect this within models. Building on Machado’s call for competitive markets, Kempener suggested that we need to invest in the infrastructure for the energy supply options we have, to provide the choices to the end consumer in order to create a truly competitive market. LTES need to play a role in order to overcome this challenge.

Kempener confirmed that the European Commission constantly updates their inputs for technology costs as innovation continues to improve, however they have been incapable of capturing innovation in the demand side. For example, the aviation sector is hard to decarbonise, but even now new innovations are emerging, and the question is how this will change the energy demand landscape. Kempener also suggested that the risk of systemic innovation must be compared with the risks of non-action on society, health and finance, so this risk also needs to be reflected in the model and guide policymakers’ decision. This call was echoed by Joana Portugal Pereira.

Joana Portugal Pereira from Federal University of Rio De Janeiro gave a perspective of the scientific community and pointed out the importance of an interface between the scientific community and the policymaking community. She confirmed strong synergies between short and long-term energy planning, the issue is short-term perspectives that miss the bigger pictures; the role of scenarios and scientists is to lengthen the timelines of policymaker perspectives in order to achieve this synergy. Pereira called for partnerships and improvement of communication abilities since the scenarios will not be achieved without the crucial actors being involved such as policymakers. Pereira also stressed that different actors

are far from being rational. Human behaviour is very different from least-cost options, she joined the many other speakers of today calling for an improvement in this representation.