Paris Agreement Compatible Scenarios for Energy Infrastructure

Paris Agreement Compatible Scenarios for Energy Infrastructure

Co-creation report

REN21 EEB European Environmental Bureau Renewables Grid Initiative CAN Europe

1. Background to the PAC project

1.1. How it all began

For more than a decade, European TSOs and NGOs collaborating under the umbrella of the Renewables Grid Initiative have been collaborating on increasing the acceptance of grid projects for the energy transition. One key element is to enable actors with a multiplier role for civil society to form their own opinion on the necessity of grid expansion measures. NGOs are crucial multipliers. For many years, European NGOs have requested the European Networks of Transmission System Operators to adapt the Ten Year Network Development Plan (TYNDP) scenarios as these are the basis to assess European infrastructure investment priorities: Only scenarios that are compatible with the Paris Agreement can count on the support of European NGOs; at least one TYNDP scenario should be a reflection of what civil society envisages as a plausible and desirable energy future for Europe. In this context, TYNDP scenario development needs to be done across sectors and society, involving a multitude of different actors.

Since November 2018, the German Federal Ministry of Economics and Energy (BMWi) is providing funds for the PAC project - Paris Agreement Compatible Scenarios for Energy Infrastructure.[1] The project consortium consists of the two European NGO umbrella organisations Climate Action Network Europe and the European Environmental Bureau, the global renewable energy community REN21 and the Renewables Grid Initiative (RGI), a collaboration of transmission system operators and NGOs.

Project objectives were to review the TYNDP scenarios regarding their compatibility with the Paris Agreement, to develop a scenario narrative which is supported by a broad alliance of civil society, to facilitate an exchange within the modelling community on how to better reflect the increasing complexity of the energy system in modelling, capacity and coalition building on the topic of necessary European infrastructure for system transformation, communication and European and global dissemination.

[1] The official project title is “Paris-konformes Szenario für den TYNDP” – the title PAC has been created for communication purposes. (Dokument REN21 an BMWi)

As part of this, it was an objective to learn how scenario development can become a more collaborative process involving actors who usually do not work closely on the topic despite having important expertise, and how to organise the exchange of parties that can benefit from each other's knowledge but are not engaged in a regular exchange.

1.2. Partners involved

Climate Action Network Europe (CAN Europe) Climate Action Network (CAN) Europe is the leading European NGO coalition fighting climate change. CAN Europe has 170 member organisations active in 38 European countries, representing over 1.500 NGOs and more than 47million citns. CAN Europe promotes sustainable climate, energy and development policies throughout Europe. CAN Europe advised the European Network of Transmission System Operators for Electricity on considering the climate impact of TYNDP scenarios.In a tandem with the European Environmental Bureau, CAN Europe developed the PAC scenario and took a strong role in its dissemination at the EU level.

European Environmental Bureau (EEB) is Europe's largest network of environmental citns' organisations. It brings together over 160 civil society organisations from more than 35 European countries and stands for sustainable development, environmental justice & participatory democracy. In a tandem with CAN Europe, the European Environmental Bureau developed the PAC scenario and took a strong role in its dissemination at the EU level.

REN21 is the only global renewable energy community of actors from science, governments, NGOs and industry. It provides up-to-date and peer-reviewed facts, figures and analysis of global developments in technology, policies and markets and wants to enable decision-makers to make the shift to renewable energy happen. REN21 led the global dissemination of the project, focusing on capacity building on the importance of grids, scenarios and scenario development as a multi-stakeholder exercise for the energy transition.

The Renewables Grid Initiative (RGI) is a collaboration of NGOs and TSOs from across Europe engaging in an 'energy transition ecosystem-of-actors'. It promotes fair, transparent, sustainable grid development to enable the growth of renewables to achieve full decarbonisation in line with the Paris Agreement. RGI acted as overall manager of the project, led the coalition building and project communication and

dissemination work package and contributed to the global dissemination. RGI furthermore organised the Modellers' Exchange Workshops.

ENTSO-E and ENTSOG as special stakeholders: While the ENTSOs were not members of the PAC project consortium, they were special stakeholders insofar as this project helped to establish a new level of engagement of the NGO community with one of the main products of the ENTSOs – the TYNDP scenarios. Members of the scenario working group of both ENTSO-E and ENTSOG were regularly present at the workshops organised by this project. A regular Jour Fix was established with ENTSO-E additionally.

2. Collaboration under the PAC umbrella

2.1. Why collaboration is important in the context of energy scenarios

To decarbonise our energy system, both the way we generate and the way we consume energy have to undergo fundamental changes. Furthermore, the way energy is being transported from production to consumption requires massive adjustments.

Energy infrastructure such as gas pipelines, electricity grids and heat networks form the backbone of the energy system. The way how this energy infrastructure is planned and built strongly determines the EU's energy supply. As the lifetime of energy infrastructure mostly spans several decades, today's planning has an impact on the energy landscape at least until the middle of the century.

Energy scenarios are the best tool we have to develop an understanding of how a decarbonised energy system may function. Scenarios are no prediction of the future, but they help to understand better the technical needs, the benefits and costs of different potential pathways.

Scenarios are also the starting point to determine the infrastructure needs of possible pathways. Poor work on scenarios can lead to stranded investments, fossil-lock-in, using up more space and natural resources than what is needed. If the scenarios from which new infrastructure investment is derived are not perceived as plausible or desirable, this opens the door for strong public opposition once new infrastructure shall be built.

Scenarios are a 'combination' of assumptions about the future. These assumptions have to cover a very wide range of different topics. Costs and efficiencies of future technologies such as electrolysers are as important as understanding how we will live, work and travel in the future or how much sustainable biomass we can reasonably assume will be available for energy production. These are a few examples; the list of relevant questions is much longer.

Work on scenarios as a collaboration of a multitude of different disciplines across different groups of society is indispensable: First, to secure the 'best available knowledge' on different assumptions is being built upon and second, to allow for a cross-societal exchange on the extent to which different scenarios are considered both plausible and desirable from the perspective of different actors.

2.2. Collaboration during the PAC project

2.2.1. Passing climate knowledge to ENTSOs

Challenge

Although the EU has endorsed the Paris Agreement with the aim of limiting global temperature rise to 1.5°C in 2015, energy infrastructure planning does not yet reflect this challenge. The scenarios underpinning the TYNDPs integrate important shares of fossil fuels until 2050. Implementing these scenarios would keep the EU at a high level of greenhouse gas emissions that is neither compatible with the objective of the Paris Agreement nor with the EU's own target of reaching carbon neutrality by 2050.

Against this backdrop, CAN Europe reached out to ENTSO-E and ENTSOG in autumn 2018 to discuss how future TYNDPs could become compatible with the level of ambition requested by the Paris Agreement. CAN Europe suggested to apply a carbon budget approach to the TYNDP scenarios to operationalise this. The approach would set a fixed cap on the amount of greenhouse gas emissions that the EU still could emit without putting its commitment under the Paris Agreement at risk. The modelling of TYNDP scenarios then would respect the carbon budget by aligning the evolution of the energy system, resulting in net zero emissions latest by 2050. This would imply that TYNDP scenarios foresee a more efficient and 100% renewable energy based system to reach the necessary emission cuts.

What happened thanks to the PAC project?

CAN Europe discussed with ENTSO-E and ENTSOG modellers the potential key principles for the application of the carbon budget. CAN Europe supported ENTSO-E and ENTSOG in developing a consistent methodology for calculating EU carbon budget data. By doing so, CAN Europe helped to build a bridge from climate science to electricity and gas market modellers who were not familiar with the details and the state of discussions in climate science. This allowed for an enriching exchange about the carbon budget concept, integrating also the expertise on climate and development challenges from the CAN Europe member organisations.

ENTSO-E and ENTSOG in February 2019 presented to the PAC project consortium their proposals for a carbon budget to be integrated into the upcoming TYNDP 2020. CAN Europe further accompanied the implementation of the ENTSOs' carbon budget concept. No further changes however were made. The ENTSOs presented their carbon budget as the key innovation of their TYNDP 2020 as published in November 2019. CAN Europe welcomed that ENTSOs in principle were willing to integrate the carbon budget approach into their scenario building for the first time. CAN Europe however also explained at several occasions in bilateral meetings and at public events to what extent the chosen carbon budget did not reflect the key principles prioritised by NGOs.

Current status/Way forward

The carbon budget approach as integrated by the ENTSOs into their TYNDP 2020 is not sufficient to respect the Paris Agreement:

1. As all the three TYNDP 2020 scenarios still entail a relatively high share of fossil fuels until 2040/2050, cumulative emissions reach 62.6 to 63.5 Gt CO_2 in 2050. This leaves an important gap compared to the targeted 48.5 Gt CO_2 carbon budget. Huge parts of the needed emission reductions potentially would come too late between 2050 and 2100. Because of limited domestic action, Europe would need to secure imports of renewable or so-called decarbonised energy carriers and/or international carbon offsets as the helping hand.

2. Expectations on up to 17.4 Gt CO_2 of removals from Land Use, Land Use Change and Forestry (LULUCF), from carbon capture and storage (CCS), bioenergy with CCS (BECCS) and direct air capture (DAC) technologies after 2050 are built on sand. CCS, BECCS and DAC are not yet available at market scale – if ever. Important concerns about their environmental harm are not solved.

3. CAN Europe also raised doubts with regards to the generously high carbon budget as such. CAN Europe advocated for an equity approach instead of a per capita

calculation of the EU's carbon budget. The per capita approach ignores the EU's historic responsibility for global emissions. It suggests EU citizens are on par with citizens of the Global South when it comes to burden sharing in emission reductions.

ENTSO-E and ENTSOG are currently not planning to revise their carbon budget approach as presented in February 2019.

2.2.2. Enabling civil society community to scrutinise TYNDP scenarios

Challenge

The TYNDP scenario building process as a recurring exercise enshrined in EU legislation is highly technical. The modelling executed by the ENTSOs is very complex. Understanding and commenting the results requires a certain level of expertise that cannot necessarily be provided by every non-profit civil society organisation. For this reason, NGOs' engagement in the TYNDP process was relatively limited in terms of capacity and depth of the feedback provided. Interaction mostly was limited to submissions to the public consultation processes organised by the ENTSOs.

Against this backdrop, the role of NGOs in the formal EU energy infrastructure planning was not very prominent. Moreover, one can describe the EU energy infrastructure planning as being biased because of its institutional setting. ENTSOs did not always prioritise civil society engagement. The organisation of the ENTSOs' stakeholder engagement process was not very well aligned with NGOs' potential for feedback. It was thus difficult for independent civil society voices to be heard. This is even more obvious in comparison to the established grid operators and utilities that deal with energy infrastructure planning on a daily base with much bigger resources, driven by strong commercial interests.

What happened thanks to the PAC project?

The PAC project allowed the EEB and CAN Europe to dedicate more time to capacity building on energy infrastructure challenges. The positions created under the PAC project within the EEB and CAN Europe secretariats ensured that infrastructure topics were integrated as cross-cutting issues into the different work areas of the two NGO networks. The EEB and CAN Europe communicated regularly about the TYNDP process to its members and other stakeholders, using established channels such as their newsletters, internal mailing lists, meetings and direct personal contacts. NGO

staff members across different thematic teams regularly were briefed on PAC project activities in order to mainstream energy infrastructure and scenario building aspects.

Thanks to this capacity building and with the help of the series of PAC scenario workshops and webinars (see chapter 2.2.3), CAN Europe and EEB were able to create a European-wide community of NGO staff. More than 150 contacts from the membership were actively involved at least at one point in time into the PAC project. Staff from several member organisations started to follow energy infrastructure planning more in detail. Project activities horizontally cross-fertilised the work strands of the two secretariats as well as the member organisations. For instance, CAN Europe's engagement on the fossil gas phase-out, its work on the Projects of Common Interest or EEB's research activities under the LOCOMOTION project, as well as its engagement on the circular economy-industry-energy-climate interface, on agriculture, on the EU Budget and Next Generation EU, and EEB advice to the EU Presidencies have all benefitted from the PAC work.. The PAC project's input complemented these work strands by substantiating infrastructure needs.

The EEB and CAN Europe closely followed the scenario building process of ENTSO-E and ENTSOG in view of the TYNDP 2020 and the launch of the TYNDP 2022 process. During the project period, CAN Europe submitted detailed feedback to all public consultations and surveys related to the TYNDP process, the scenario building and ENTSOs' work plans. These submissions were developed in close exchange with CAN Europe members. The EEB provided input to a joint opinion together with CAN Europe on the TYNDP 2020 and submitted its feedback to the ENTSOs' consultation on the TYNDP 2020 scenarios.

In public events and in personal meetings with policy makers and grid operators, CAN Europe and the EEB regularly suggested their PAC scenario (see chapter 2.2.3) as a potential alternative storyline for the upcoming TYNDP 2022 storyline selection process. Being one of its founding members, CAN Europe also continued to collaborate to ENTSO-E's independent advisory council.

Current status

It is likely that the stronger involvement of the CAN Europe and the EEB networks contributed to the doubling of submissions to the public consultation on the TYNDP 2020 scenarios in January 2020. In addition, ENTSO-E staff repeatedly welcomed the increased quality of submissions as well as the valuable input from CAN Europe and the EEB in view of optimising the TYNDP scenario building.

The ENTSOs partly integrated feedback from CAN Europe and the EEB into their updated TYNDP 2020 scenario report. Following the criticism on the high shares of fossil gas and the potentially unsustainable use of huge amounts of biomass, one of the three scenarios under the TYNDP 2020 ("Distributed Energy") was only slightly updated in view of the 2040 horizon. Assumptions in the other scenarios and before 2040 were left unchanged. CAN Europe criticised the updated TYNDP scenarios in a press release in July 2020 as being still not compatible with the Paris Agreement.

The experience of the PAC project has shown that NGOs' active involvement into the TYNDP process requires additional staff capacities. It otherwise would not be possible to analyse and comment on energy infrastructure planning. Given its technical complexity, the ENTSOs' TYNDP scenarios still are far from being a priority for environmental and development NGOs. Despite the strong engagement of CAN Europe's and EEB's member organisations in the successful PAC scenario building (see chapter 2.2.3), their capacities for continuous work on the TYNDP remain limited. Without any dedicated staff in the CAN Europe and EEB secretariats, it will be difficult to ensure the intensity and the quality of feedback provided to the TYNDP process during the project period.

2.2.3.Coordinating civil society to deliver its own scenario

Challenge

The TYNDP scenarios developed by now by ENTSOs are very problematic. They do not suggest realistic pathways to reach the Paris Agreement's 1.5°C target. They are neither in line with the promises of the European Green Deal nor with a net zero emissions Europe in 2050. Renewable energy uptake and energy efficiency progress are limited while all scenarios presuppose a high level of fossil gas demand.

Due to the high level of emissions caused by this energy mix, the TYNDP scenarios foresee important efforts for carbon removals after 2050, betting on large-scale deployment of uncertain technologies such as CCS, BECCS and DAC (see chapter 2.2.1). All scenarios project a strong uptake of biomethane, synthetic methane, hydrogen and other so-called decarbonised gases, despite the lack of a sound assessment of their costs and sustainability. Given the dominant role of gaseous energy carriers, benefits of sector integration are barely explored. Independent researchers and regulators confirm this criticism and highlight the lack of plausibility: The scenarios show little variation. They largely neglect demand side alternatives. Neither the distribution grid level nor the potentials of district heating are covered.

What happened thanks to the PAC project

CAN Europe and the EEB analysed and collected the deficiencies of the TYNDP scenarios. In several submissions to consultations as well as in letters to policy makers and advocacy meetings, CAN Europe and the EEB asked for a revision of the TYNDP scenarios to make them compatible with the Paris Agreement. In position papers, op-eds, blog articles and through social media, both networks continuously explained the urgency of reforming the TYNDP scenario building.

The PAC project initially foresaw that CAN Europe and the EEB write a short storyline document describing potential elements of a Paris Agreement compatible scenario for the TYNDP by the end of the PAC project. CAN Europe and the EEB went beyond this deliverable. They elaborated on the top of the above mentioned storyline a fully-fledged quantified own energy scenario, the PAC scenario, published in June 2020.

Both organisations jointly developed the key assumptions for a European-wide energy scenario that is aligned with the objective to limit global warming to 1.5°C degree. In view of this goal, the PAC scenario embodies the policy demands of the civil society. It suggests a trajectory with at least 65% greenhouse gas emission reductions by the year 2030 and net-zero emissions in a 100% renewable energy system by 2040.

The PAC scenario building process was a bottom-up collective research exercise. EEB and CAN Europe started to gather feedback on key assumptions in spring 2019 through a series of five workshops, two webinars and an online survey. More than 150 different stakeholders from member organisations, science and industry were involved in the scenario building process, be it through joining these events or bilateral exchanges. The collected feedback helped to better substantiate civil society's vision of Europe's future energy system: Which technologies are relevant for reaching a 100% renewable energy supply by 2040? Which trends are desirable in view of achieving net-zero emissions in Europe by 2040? How should trajectories evolve in order to reduce the EU's greenhouse gas emission by 65% in the year 2030?

CAN Europe and the EEB did not commission external energy modelling. They based the PAC scenario on literature review comparing and adopting elements of a multitude of existing studies and models and delivered a yearly equilibrium between energy demand and supply at EU-28 level in five year steps from 2015 to 2050. RGI afterwards commissioned the Öko-Institut to run its PowerFlex European electricity market model with PAC scenario data for the year 2030. Guest speakers from science and industry as well as ENTSOs were invited to present at the PAC scenario workshops. The PAC scenario thus should be seen as the summary of an open learning process. It reflects

NGOs' priorities for an ambitious yet credible pathway towards the 1.5°C target of the Paris Agreement.

The PAC scenario was presented to ENTSO-E and ENTSOG experts and discussed at several occasions with grid operators' staff. CAN Europe and the EEB suggested it as one of the three storylines for the TYNDP 2022.

Current status

On the EU level as well as on the national level, the PAC scenario has been acknowledged as civil society's vision for the EU's energy transition. Besides strong interest from member organisations, many scientists, policy makers and industry stakeholders contacted CAN Europe and EEB. Since its publication, the PAC scenario was presented at ca. 50 conferences and meetings to a broad range of participants.

CAN Europe and EEB use the PAC scenario to illustrate that a higher level of ambition is feasible, in energy infrastructure planning but also more generally in view of the EU's 2030 climate target.

CAN Europe and EEB are aware that the PAC scenario leaves many questions unanswered, such as the macro-economic costs and benefits of its implementation. Surveys were organised amongst participants of the PAC scenario workshop on 15 October 2020 and at the General Assembly of CAN Europe member organisations. Respondents indicated their priorities. The most importants one are country-specific scenarios. While the PAC scenario presents only data on an aggregated EU level, member organisations highlighted the need to derive national PAC scenarios as a benchmarking tool for national climate and energy policies.

CAN Europe and EEB plan to continue the dissemination of the PAC scenario findings. They are also willing to continue discussions on how to improve EU energy infrastructure planning on this base. In their TYNDP 2022 draft storylines report published in November 2020, ENTSO-E and ENTSOG did not integrate the PAC scenario but confirmed the key characteristics of the scenarios from the previous TYNDP 2020. While a few parameters in the draft storylines for the TYNDP 2022 appear to be updated towards the level of ambition of the PAC scenario, the latter one is not referenced.

2.2.4. Working with an open data license

Challenge

Studies on the transformation of the energy system are often very intransparent: nobody can inspect the data and assumptions that go into them. Important variables that strongly affect the results (e.g. uptake of electric vehicles, discount rates, cost decreases for solar) are not disclosed.

As a consequence, the results are not verifiable and can easily be dismissed as mere claims. Only when assumptions and results are comprehensible it is possible for third parties to review and suggest improvements. If data sets are made publicly accessible again after use by third parties, they can be kept up to date. By using the same data set, the generated results are compatible with each other, existing work results can be used as a basis and these can be supplemented. Only through this approach, complex structures such as a cross-sectoral energy system can be mapped and broken down in a manageable period of time. Climate modelling is a good example of this. Both the original creator and the subsequent users benefit, as they can build on each other's work. This is an enormous advantage when data sets grow rapidly, and results have to be generated ever faster. Since most research projects are financed in some way by public funds, it is obvious that open data licenses should be used as this is the only way to achieve a high cost-efficiency of the funds used.

The disclosure of the data is however only part of the solution, because full transparency can only be achieved when the source codes of the models are public. If models and model building blocks also have suitable interfaces, it becomes possible to combine them and together achieve a model depth and quality that could not be achieved by individual organisations. Open models can also be easily adapted by other countries that do not currently have qualified models for planning their energy infrastructure.

What happened thanks to the PAC project

The EEB and CAN Europe both support the open source modelling community and decided to publish the PAC scenario under an open data license. After publication, the data was immediately taken up by different research institutions.

The first study results comparing the PAC scenario data are already available. A joint study by the TU Berlin/ DIW 2was able to show the macroeconomic benefits of the decarbonisation path described in the PAC scenario, make statements about total emissions up to 2050 and prove that a stable energy supply with the generation mix assumed in the PAC scenario and with the inclusion of flexible consumers is possible even in extreme situations. The researchers also highlighted their interest in comparing PAC scenario findings with ongoing scenario building for 100% renewable energy systems as well as potentially feeding PAC scenario data into their GENeSYS-MOD modelling suite.

In another project, the Karlsruhe Institute of Technology and Aarhus University have worked with the PAC scenarios by feeding the PAC scenario data into their open source model PyPSA-Eur-Sec. This has provided new insights into the reliability of supply at country level, intra-European energy flows on an hourly basis and the optimal balance between renewables energy supply, storage, electrolysers and other loads.

Current status

In full awareness, that many open questions remain, the PAC consortium invites modellers to use the data-set and to reach out to discuss findings. Possibly, the Horizon 2020 financed SENTINEL project is considering to use the scenario as part of its upcoming modelling activities.

2.2.5. Providing a space for exchange of the modelling community

Challenge

Models should not only depict the existing energy supply system but also look far into the future to enable efficient planning of the energy infrastructure. Modellers are thus faced with an enormous task: on the one hand, they must try to depict new applications and their usage behaviour in mathematical models. On the other hand, the amount of data to be processed is increasing dramatically due to decentralised generation structures and sector coupling. In addition, future political and regulatory framework conditions as well as the behaviour of end consumers (prosumers), industry and trade, future land use and the interaction with global markets must be estimated.

[2] ("Make the European Green Deal Real"Hainsch, et al. 2020)

Against this background, it is not surprising that there is a great need to exchange ideas with other modellers and experts in individual technologies, agriculture, industry or social sciences.

What happened thanks to the PAC project

The PAC project has taken this up and organised a series of four Modellers' Exchange workshops on topics that the modellers have identified as particularly urgent: 1) Power-to-gas; 2) The role of gas in the energy system of the future; 3)How can we better model flexibility?; 4) Looking into the future of subordinate network levels. The events were attended by experts from research institutes, grid operators, NGOs, energy suppliers, consultancies and think tanks. Events were organised as a mixture of impulse presentations and open conversations between the participants. Discussions covered a wide variety of questions ranging from technological, regulatory to societal matters, e.g. How does an electrolyser behave? How does it act on the market? What installed capacity can be expected? Where will these electrolysers be located? How will the prices for electrolysers develop? Will they have storage facilities? Who will have what capacity? Questions of this kind must be answered not only for one technology but for the whole system.

Current status

Even though the topics could only be touched upon due to their complexity, the open exchange and networking of participants was felt to be very important and helpful and there is a great interest to continue and if possible to intensify this workshop series.

Since all topics discussed so far are developing dynamically and have not yet been dealt with conclusively from a model point of view, it would be worthwhile to repeat the corresponding workshops on a continuous basis. In addition to this, further worthwhile topics to look into could be:

- Effects of industrial decarbonisation on the energy supply system

- Interaction of different heat supply and heat storage systems with the system

- Adaptation of agriculture to climate change and drought stress, possible scenarios regarding agro-PV and energy crops and implications for land-use, land-use change and forestry (LULUCF)

2.2.6. Exchange with ENTSOs

Both ENTSO-E and ENTSOG as the owners of the TYNDP scenarios process from the beginning were considered 'special' stakeholders to the PAC project – this was underlined by the joint collaboration launch event which was organised in December 2018 in Katowice during the United Nations Climate Change Conference (COP24). Throughout the project time, both organisations were present in the different types of workshops organised by the PAC project, confirming that the PAC project provided access to actors and expertise beyond what they are able to reach by themselves.

A regular monthly exchange was established with ENTSO-E. Electricity TSO members of RGI are also members of ENTSO-E and in 2016, both organisations had signed an Memorandum of Understanding for long-term collaboration. In this context, it was easy to agree on a regular monthly Jour Fix call to keep each other updated about the proceedings of the project. These exchanges also allowed to regularly check with ENTSO-E whether they had specific topic interests to look into, especially for the Modellers' Exchange Workshops so that these reflected also the needs and interests of ENTSO-E.

Furthermore, ENTSO-E played a decisive role in helping the project consortium understand necessary details of the TYNDP scenario building and scenario modelling process. Thanks to this, the PAC scenario has been designed in a structure which – in principle – could be comparatively easily integrated into the official TYNDP scenario portfolio.

2.2.7.Collaboration with the international community

International (beyond the EU) collaboration in the PAC project was carried out in three ways: outreach through website and newsletters; research and publication of an international case study report on grid planning; online workshop on citizen engagement in grid planning.

Distributed quarterly, REN21's newsletter has a reach of 11,000 subscribers around the world. These community members are from varied sectors: some are renewable energy professionals or work in energy ministries within certain countries, others are employees of environmental non-profits or think tanks that focus on the entire energy sector. Announcements related to the PAC project, including its objectives and launch of the PAC scenario, were disseminated in REN21's newsletters in October 2019 and June 2020. In addition, the PAC website added a section "Global Outreach" which has been collecting comments on grid planning and civil society engagement from external

stakeholders. These efforts lead to collaboration opportunities and further outreach with new contacts from Indonesia, Morocco and Nigeria.

One major outcome of the PAC project's international work was the case study report published in December 2020, Citizen Power for Grids: Case studies on collaborative infrastructure planning processes for the energy transition. Publication of this report relied on the collaboration with grid planning and stakeholder management experts in Australia, Chile, Japan and Vietnam.

The research and subsequent collaboration with these international stakeholders informed the online workshop Engaging Civil Society in the Energy Transition: The Role of Grids. The event was held on 3 November at 09:00 CET and 16:00 CET; each session welcomed around 40 participants. During both sessions, the global civil society community was invited to hear presentations from the aforementioned international experts and discuss the role of citizens and grid planning. The workshop discussion centered around the question, "What is needed to increase civil society engagement in grid planning?" Participants from around the world took part in the workshop and expressed interest in the scenario development and civil society work of the PAC project.

The PAC Consortium also has published an international outreach flyer, "The road to 100% renewables needs power grids", which explains the importance of stakeholder (especially civil society) engagement in scenario development and grid planning for a non-expert audience. Overall, these activities have successfully laid the groundwork for future outreach on this topic.

3. Way forward

The first phase of the PAC project ends with December 2020. In a second phase, the PAC consortium hopes to realise the following further activities:

- To extend the scenario analysis and to deduce country-specific PAC scenario key data for EU28 + TYNDP countries
- To investigate with a number of actors including TSOs, industry and civil society what are the challenges in implementing the PAC scenario

- To engage with European policy making to create the necessary political framework which promotes the uptake of the PAC scenario
- To engage with European grid planning actors to share insights on relevant political, technological and societal developments that confirm the importance of working with a very ambitious scenario in planning exercises
- To build upon this work for national-level and international dissemination.

Fundraising for a PAC 2.0 is ongoing at the time of writing this report.

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For more information about the PAC project, see https://www.pac-scenarios.eu.

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