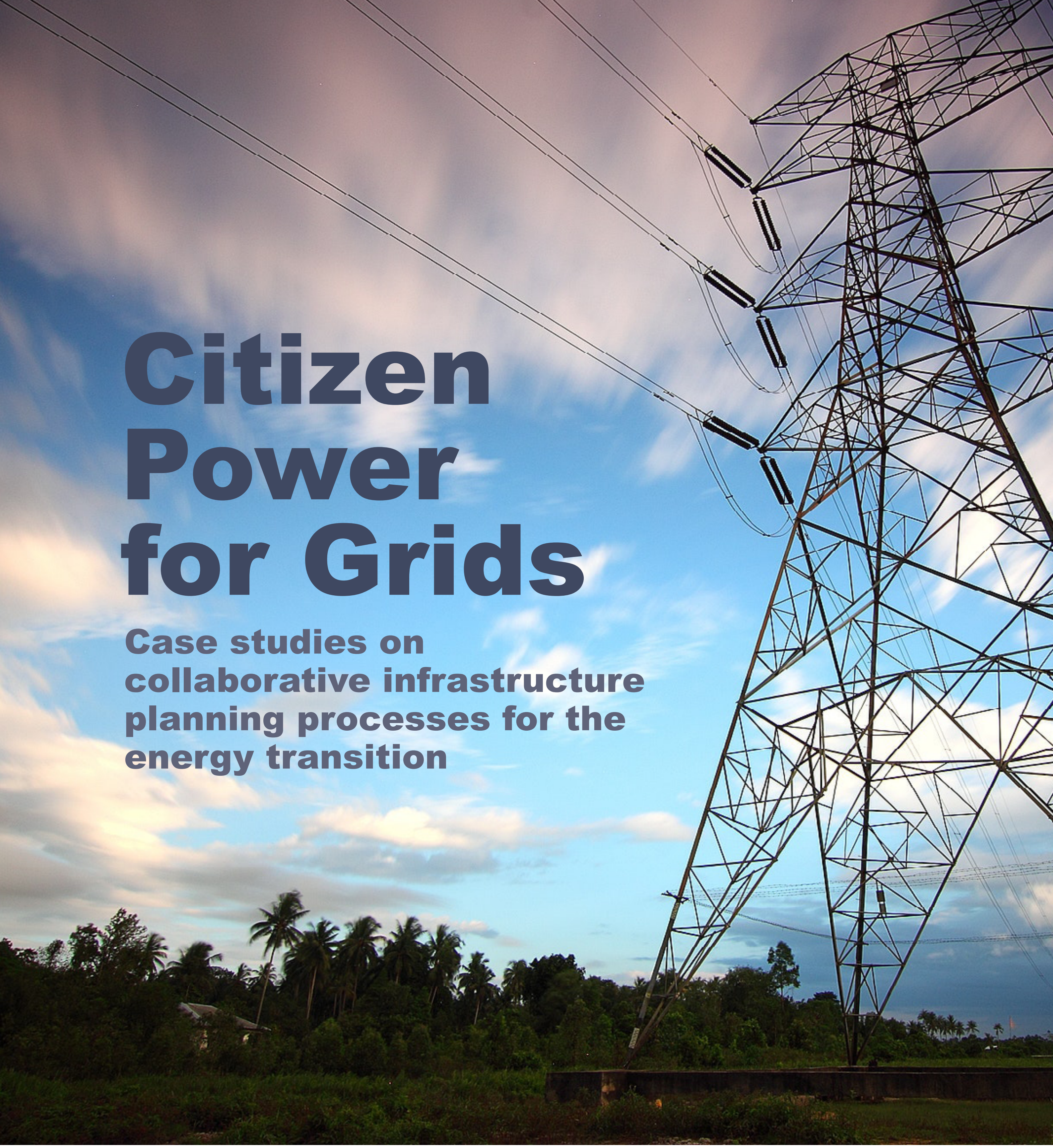

Citizen Power for Grids

Case studies on collaborative infrastructure planning processes for the energy transition

PAC Paris Agreement Compatible Scenarios for Energy Infrastructure

REN21 RENEWABLES NOW

EEB European Environmental Bureau

Renewables Grid Initiative

CAN CLIMATE ACTION NETWORK Europe

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Introduction

Renewable electricity, specifically wind power and solar photovoltaics (PV), has become the most economical sources of electricity in many parts of the world (REN21, 2020). Growing shares of variable generation in an increasing number of countries place a renewed focus on power grid planning and operations to realise the transition to a cost-effective and reliable system based on renewable energy. Civil society could play an influential and necessary role in these grid planning processes, however there are currently few examples of effective and comprehensive citizen engagement.

Grids are needed to transport renewable electricity

Achieving the central aim of the Paris Agreement will require a massive overhaul of the energy system (UNFCCC, 2015). To reach this decarbonisation goal, a network of diverse sources of centralised and distributed renewable energy power stations – such as rooftop solar PV, offshore and onshore wind power, hydropower, and geothermal power – can provide the backbone of a future electricity supply. A new geographical distribution of large and small variable renewable power plants would require a widespread adaptation and expansion of the existing electricity network.

Grids will play an important role in enabling higher shares of variable renewables in the system. They are needed to transport electricity from areas with large solar and wind resources to demand centres such as cities and industrial areas. In addition, it is cheaper to produce electricity from solar and wind power on these sites, largely due to land prices and economies of scale that are available in rural locations. Grids also can support rural communities in creating jobs and wealth by producing and exporting renewable electricity for urban areas.

Reliable and extensive grids also can smooth out variable electricity generation, ultimately facilitating the efficient and cost-effective operation of the whole system. For example, Germany frequently handles more than 40% of electricity from renewables in its system due in part to its strong interconnections with neighbouring countries.

Involving civil society in grid planning is key

Planning and construction of power grids takes place over long timescales and involves significant public investment. In addition, established processes for power grid planning are as diverse as the countries undertaking them. In most cases, however, stakeholder engagement of civil society is either limited or does not exist. Involvement of these actors in the grid development process is crucial, as they ensure that climate, environmental and societal constraints and interests are represented in different steps of the planning.

The first step of planning energy infrastructure is determining what future infrastructure is needed. An energy scenario is a starting point to assess whether or not the power grid needs to be expanded and how it must be adapted. The development of this shared energy vision provides the basic information for the entire grid planning process and answers the following questions, among others:

- How will future electricity demand develop?
- What are the key drivers of the changed electricity demand? What role will consumers play?
- What are the climate and environmental constraints that planners need to think about?
- What are the future power generation technologies? At what cost?

An energy scenario produced by governments, industry and civil society sets a common ground to work collaboratively on required additional power lines and, at a later stage, where to place them. Engaging civil society in the development these energy visions will make sure that the scenario's starting assumptions (e.g., future energy supply and demand) are in line with ambitious climate targets.

Beyond the scenarios, substantial changes to the existing grid will require public acceptance[1] of new energy infrastructure, notably power lines. A delay of crucial interconnections can result in bottlenecks for new power projects and can slow the overall uptake of renewable energy. However, power lines also can have negative environmental impacts, such as when power line corridors are routed through forests and other ecosystems, and can lead to fragmentation and habitat loss for flora and fauna. Citizens also often worry about landscape, real estate value or cultural significance when new infrastructure is being built. Involvement of civil society at this stage helps ensure that that climate, environmental and societal constraints and interests are represented in the spatial planning and permitting process, and that local expertise is considered. Overall, it is crucial to integrate civil society into the planning process from the very beginning.

Two relevant examples of stakeholder engagement are the European Ten-Year Network Development Plan (TYNDP) and the Australian Integrated System Plan (ISP), which involve civil society, academia and the (renewable) energy industry to develop a joint vision for future energy supply and demand to achieve consensus on new infrastructure (such as power grids). Failing to implement these stakeholder engagement processes could lead to lower public acceptance of required infrastructural changes, or may introduce changes that are not aligned with the objective of the Paris Agreement.

This publication seeks to shed light on the organisation of grid planning processes and civil society engagement in five countries. The case studies provided do not claim to present a comprehensive overview, but offer some diverse examples from which lessons can be drawn. The European TYNDP is the oldest and most established process. The Australian ISP, although relatively new, translates the regional model of the TYNDP to the national level. The example

[1] *REN21's Renewables 2020 Global Status Report provides more information on the general role of public support to renewable energy uptake (REN21, 2020).*

from Vietnam is state-driven but includes as a recommendation a variety of scenarios that have been developed from civil society and academia (but not as part of the planning commission). Japan's grid development process can be considered a mix of the Australian and Vietnamese examples, in which a committee is consulted on the scenario and on grid planning. Civil society is not directly involved but is indirectly consulted by two of the three sub-committees via specific submissions. In Chile, civil society is not involved in the scenario development, but provides inputs to the spatial planning process.

2

Power Grid Planning

Power grid planning procedures are complex and vary greatly depending on the respective national context. However, the processes follow similar steps and involve similar stakeholders. This section provides a high-level, schematic overview of the basic steps of network planning[2], detailing which interest groups must be involved in planning and which should be involved, as well as the different interests of all actors. Tables 1-3 are taken from the BESTGRID[3] initiative's publication Public Participation and Transparency in Power Grid Planning (BG-HB1, 2015) and are adapted to international circumstances.

Table 1 shows the tasks, research questions and specific planning focus of each step of the power grid planning process. Assumptions about drivers and development of electricity demand, future power generation technologies and the flexibilities in connecting generation and demand over space and time are described by scenarios. Market models conclude which generation is used to feed demand from a perspective of cost optimization. Grid models show where additional transport capacities are required for a given scenario hence delivering the grid development plan.

Table 1: Planning procedure for transmission lines

Tasks:	**Assessment of needs**		**Corridor and route planning**	
	Scenarios	**Grid development plan**	**Corridors**	**Detailed routes**
Research question:	What are the likely future developments of electricity generation and demand?	What projects are needed?	In which corridor should the power line be built?	Which route should be determined in detail? Where will pylons (or cables) be built?
Focus:	Energy planning	Assessment of current and future infrastructural requirements	Spatial planning	Route planning within the preselected corridor

Source: Germanwatch, based on BNetzA, 2015 and REN21 research.

[2] *More detailed information on power grid planning processes can be found in Renewables Grid Initiative, European Grid Report: Beyond Public Opposition – Lessons Learned from Europe (RGI, 2012).*

[3] *See Appendix for two examples of growing stakeholder engagement in grid projects in Europe and the United States.*

If the stakeholders agree on the future energy scenario, a common ground is set to work on the required additional power lines and where to place them.

Table 2 shows the stakeholders that have legal planning responsibilities in power grid planning, as well as their tasks and predominate areas of interest. The interests across all institutions are diverse and contain some (potentially) conflicting goals, e.g., security of supply, least-cost electricity supply and high environmental standards.

Table 2: Stakeholders with legal planning responsibility in power grid planning

Stakeholder	Task	Interest
Transmission system operator (TSO)	Responsibility for security of supply and power grid extension. In some countries: preparation of possible future electricity supply and demand scenarios and long-term grid development planning.	Operation of a stable power grid, security of supply, legal task of power grid planning and realisation.
Planning authority	Thorough examination of TSO project plans. Plan approval at the end of formal procedure, legally binding decision.	Consideration of principles and targets of spatial planning. Weighing of all legal interests.
Regulator	Cost regulation of power grid development.	Minimisation of costs.
International/Inter-regional power grid operator • **Regional power grids: across different countries and/or states** • **Interconnection of different power markets / market zones**	Regional planning. Co-ordination between TSOs.	Regional security of supply. Strengthening international/ national power markets by enhancing electricity interconnectors. Climate and energy targets.
Politicians • **Federal** • **State / province / territory**	Co-ordination of all involved ministries and government representatives.	Security of supply, tackling climate change, provision of good conditions for the national economy, re-election. Climate and energy targets.

Source: BG-HB1, 2015; REN21 research.

Table 3 summarises various other stakeholders in power grid planning that are not legally directly involved in grid planning, but that either have a financial interest or are impacted during the construction and operation of new power lines. Again, the conflicting goals across those stakeholders are significant. They range from economic interests in new power lines – such as the (renewable) power industry – to opposition to the project on the basis of environmental concerns (nature conservation) or economic concerns (for example, loss of property value). A well-planned stakeholder engagement process needs to take into account all positions and stakeholder groups, to access and build upon local knowledge and to seek common ground for the best possible outcome.

Table 3: Other stakeholders in power grid planning

Stakeholder	Interest
State, region, province, local politicians	Representation of national, regional, local interests.
National NGOs and groups focusing on global justice, climate change, nature conservation, mobility, landscape, health	Realisation of transition to renewable energy in a short time, bird and protected species protection, high standard of nature and/or landscape conservation, health protection.
Local NGOs and groups focusing on nature conservation and landscape conservation	Protection of local environment, landscape, decentralised electricity production, health protection.
Industry, including local economy, households, public institutions and services, society	Security of supply, low energy prices.
Farmers	Agriculture without disturbance from pylons and low-hanging power lines, construction works or operation of underground cables, compensation.
Power generators	Unlimited grid access or limited grid access for competitors.
Renewable power generators	Unlimited grid access, no feed-in restrictions to avoid financial losses, a level, market-based playing field.
Consumers, households	Reasonable electricity prices, financial participation in energy transition, sustainable energy.
Tourism	Beautiful landscape, recreational offers, good tourism infrastructure combined with reduced visibility of industrial infrastructure.
Land and property owners	No loss of value of property, comfortable living area.
Residents' and citizens' action groups	Protection of residential areas and landscape.

Source: BG-HB1, 2015

3

Case Studies

Experiences with energy infrastructure planning – both positive and negative – can provide important information for the optimisation of the future grid planning process. Learning from experience is of high value for all parties involved. Five very different examples are presented to document the experiences of countries with different economic and geographical situations.

- The European Ten-Year Network Development Plan (TYNDP) is the oldest (started in 2009) and most established collaborative grid planning process. The TYNDP is continuously being changed and enhanced, and represents a best practice example, even when the actual process still has room for improvement (e.g., include more opportunities for stakeholder engagement) and its findings are not mandatory.
- The Australian Integrated System Plan is younger than the European example and has been published twice, in 2018 and 2020. The consultation process is similar to the TYNDP but is modified to fit the national context. The plan is another good practice example for a comprehensive stakeholder engagement process.
- The examples of Vietnam, Japan and Chile are unique processes that are imbedded in their own national energy policy debates.

The structures and terminology in power system planning also differ between countries. In Europe, the operators of transmission lines are called transmission system operators (TSOs), whereas in Australia they are called transmission network service providers (TNSPs) (AMEC, 2013). This analysis focuses on the planning process for long-distance and high-voltage transmission lines and not for low-voltage distribution grids. Table 4 provides an overview of the selected countries and regions in the five case studies.

Table 4: Overview of five case studies in this report

Location	# of TSOs involved	Process name	Planning cycle	Established stakeholder engagement
Europe (35 countries)	42	Ten-Year-Network Development Plan (TNYDP)	10 years ahead – updated every 2 years	Yes
Australia	5 Transmission network service providers	Integrated System Plan (ISP)	20 years ahead – updated every 2 years	Yes
Vietnam	1	Power Development Plan (PDP)	Every 5 years	No
Japan	1	Organization for Cross-regional Coordination of Transmission Operators (OCCTO) Grid Masterplan 2021	On demand	Limited – dedicated committee
Chile	7	Transmission Planning Process	On demand	No

3.1 Europe – The Ten-Year Network Development Plan (TYNDP)

Process lead

The European Network of Transmission System Operators for Electricity (ENTSO-E) represents 42 electricity transmission system operators from 35 countries across Europe. ENTSO-E was established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009, which aims to further liberalise the gas and electricity markets in the EU (ENTSO-E, 2020).

The core activities of ENTSO-E are as follows:

- Policy: Development of a joint energy policy position for its members.
- Technical:
  - Drafting of network codes and contributing to their implementation.
  - Regional co-operation through the Regional Security Coordination Initiatives.
  - Technical co-operation between TSOs.
  - Co-ordination of research and development plans, innovation activities and participation in research programmes such as Horizon 2020 or formerly the 7th Framework Programme.
- Data: Publication of summer and winter outlook reports for electricity generation for the short-term system adequacy overview.
- Planning: Development of long-term pan-European network plans (TYNDPs).

Background: 10-Year-Network-Development-Plan (TYNDP)

The TYNDP is an ongoing planning instrument that has been published every two years, starting in 2011 (TYNDP 2010). The most recent plan is TYNDP 2018, which includes scenarios for the years 2025, 2030 and 2040 as well as regional investment plans. In 2018, for the first time, ENTSO-E developed a scenario in co-operation with the European Network of Transmission System Operators for Gas (ENTSOG) which was established at the same time and through the same process as ENTSO-E. The publication of the next plan (TYNDP 2020) is scheduled for March 2021 and, as of December 2020, was available for public consultation. However, scenarios for the projection of both electricity and gas have been already published (ENTSO-E and ENTSOG, 2020).

Public consultation

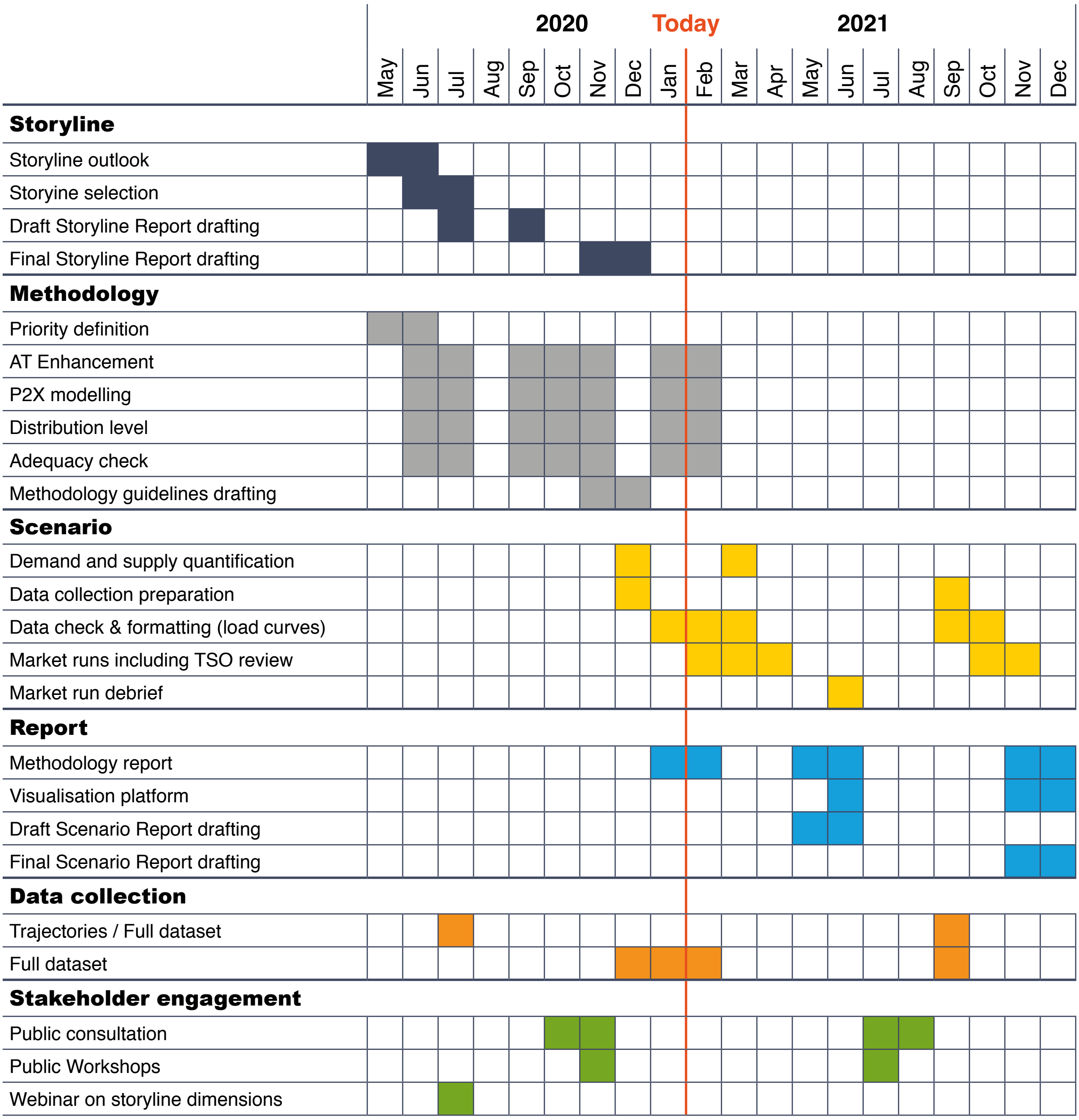
A credible and transparent process is key for any stakeholder consultation. Information must be accessible, and the scenario development process requires detailed discussion on the narratives, assumed cost developments and sectoral targets (renewables, energy efficiency) as well as the overall decarbonisation target(s). The key considerations for the stakeholder dialogue are (RGI, 2020):

- whether grid development contributes to the energy transition or instead is driven to strengthen the status quo;
- whether it is technically possible to build an electricity sector with a large share of variable renewables without losing out on security of supply; and
- whether individual projects could be avoided if a different future scenario were planned for (i.e., one that is more decentralised, more energy-efficient, deploys energy storage at a larger scale, and is "smarter").

Stakeholder engagement programme and timelines

Table 5 shows the timeline of the TYNDP 2020 and provides a good example of transparent and systematic stakeholder engagement. The storylines for scenario development and the methodology are discussed first, before the actual scenarios are calculated. All stakeholders – from the TSOs to civil society – can submit technical, economic and environmental data throughout the entire process. Interim results are published. At the end of the process, another public consultation process is organised that includes workshops and webinars.

Table 5: Timeline of the TYNDP 2020



The final TYNDP provides an input for future grid expansion and/or grid modification projects. The TYNDP is not legally binding, but it is the starting point for the selection of Projects of Common Interest. These projects receive a priority status under the European Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure.

While the TYNDP process and the involvement of civil society is advanced compared to other processes, there is still significant room for improvement. Two scenarios are presented as being 1.5 ˚C compatible, however include a relatively high carbon budget (48.5 Gt CO2eq) and rely on unproven technologies such as carbon capture and storage. Also, the consultation process for the scenario development could be strengthened, and stakeholders can only comment twice during the scenario development process. Resource constraints make the contribution to this technical process very challenging. In light of this, the PAC project (Paris Agreement Compatible Scenarios for Energy Infrastructure) was launched in 2018 to develop a civil society-led energy scenario for Europe as an input into the TYNDP process (PAC, 2020).

Table 6: Summary: Europe's TYNDP process

Organisation	**Stakeholder**				**Frequency**
	Number of TSOs involved	Governments	Academia	Civil society	
	42	European countries, provinces/states	Yes	Yes	Ongoing, every 2 years
Technical	**Geographic scope**	**Voltage level**	**Scenario driver**		
			Technical	**Economic**	**Climate and environment**
	35 countries	Transmission grid	Yes	Yes	Climate targets included for the first time in TYNDP 2020
Policy	**Role of TSOs**	**Role of policy makers**	**Role of civil society**	**Process result**	
	Leading the process	Commenting on the process, providing input	Commenting on the process, providing input	Non-binding; Used as input for selection of Projects of Common Interest	

3.2 Australia – The Integrated System Plan

Process lead

The Australian Energy Market Operator (AEMO) is a joint industry (40%) and government (60%) organisation. AEMO government members are all Australian state governments (Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, and Victoria, Western Australia) and the Commonwealth government. The industry members include all electricity and gas utilities and independent power producers as well as energy traders and financial institutions with investments in the energy sector.

In the AEMO constitution, as well as Australian energy laws such as the National Electricity Law and the National Gas Law, the roles and responsibilities of AEMO are defined as follows (AEMO, 2020a):

- maintain secure electricity and gas systems
- manage electricity and gas markets
- lead the design of Australia's future energy system.

Background: Integrated System Plan (ISP)

AEMO's Integrated System Plan (ISP) for Australia's future energy systems (AEMO, 2020b) was first published in 2018, and a second edition was released in July 2020. The ISP is planned to become an ongoing process and to be published every second year. According to AEMO, the publication of the 2020 ISP is "pursuant to its functions" as national transmission planner and to its obligation to maintain and improve power system security. In other words, the development and publication of an ISP is a legal requirement, which makes it an important and influential document.

The key results of Australia's ISP 2020 are (AEMO, 2020b):

- whole-of-system plan with the aim to optimise costs and security of supply;
- five scenarios that provide possible development pathways for the National Electricity Market, and that have been calculated with four discrete market event sensitivities and two additional sensitivities with materially different inputs;
- identification of necessary regulatory and energy market reforms;
- identification of required grid developments and of augmentations of the National Electricity Market transmission grid; and
- identification and forecast of needed investments in Australia's energy system, specifically:
    - distributed energy resources: rooftop solar PV, residential batteries and other load-controlled resources at the customer level,
    - variable renewable energy: solar, wind and other variable renewable energy resources at the utility level and
    - support for dispatchable resources and power system services.

Public consultation

The stakeholder engagement programme undertaken for the 2020 ISP has been documented in detail (AEMO, 2020c). The timeline of public engagements and consultations is summarised in Figures 1 and 2.

Figure 1: Stakeholder engagement and consultations for Australia's ISP in 2019

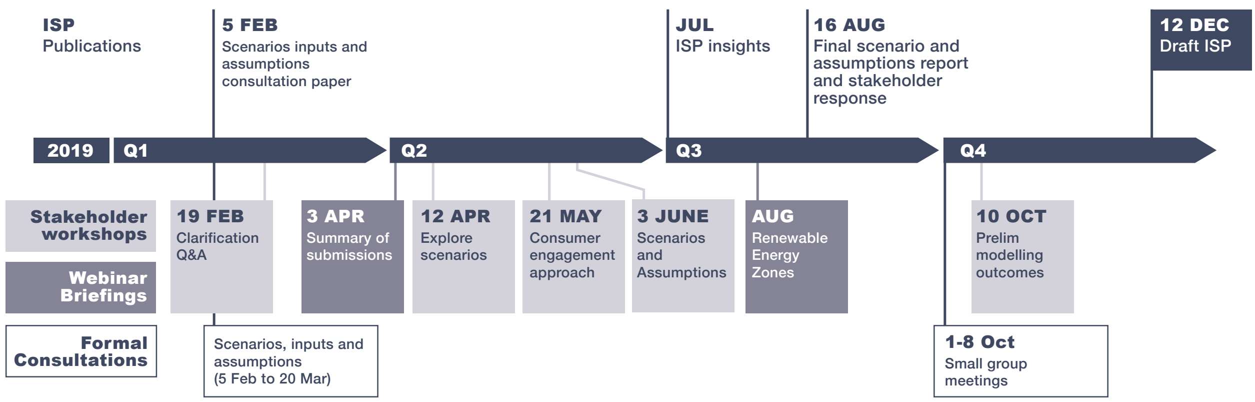
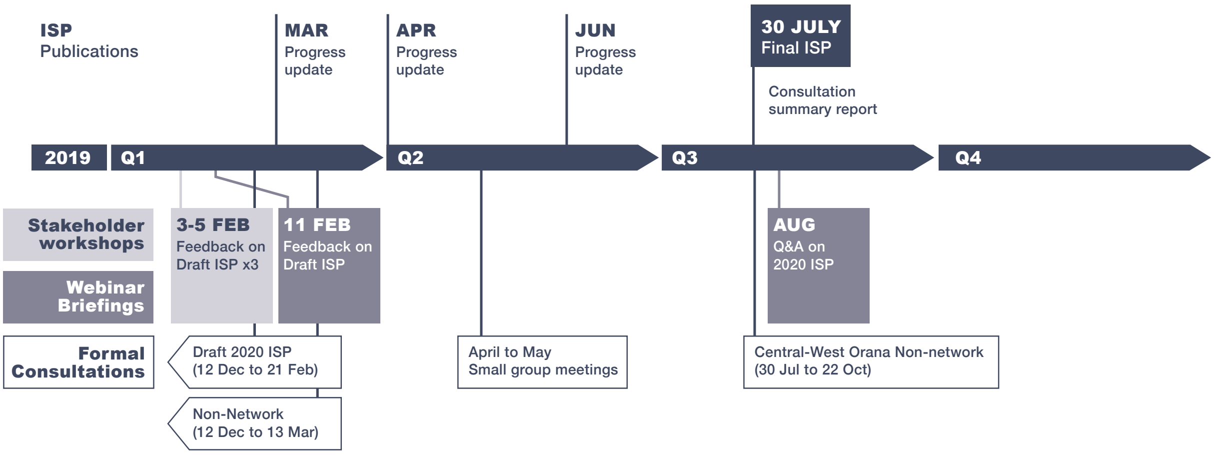


Figure 2: Stakeholder engagement and consultations for Australia's ISP in 2020



The public consultation and stakeholder process involved a series of consultations, workshops and webinars, as described below:

Consultations: Forecasting and planning consultations on the scenarios, inputs, assumptions and methodologies, the consultation on the draft 2020 ISP and the consultation on non-network options were organised in three different rounds in 2019 and 2020. Each round of consultations was open for 6-12 weeks.

Workshops: Seven workshops were held as part of the ISP process – four during 2019 and three in 2020. The outcomes of one workshop informed the different steps of the ISP development, and preliminary results were presented. Stakeholders were able to ask questions to the ISP modelling team face-to-face, to clarify understanding of the decision-making process, and to provide direct input to shaping and prioritising the remaining modelling tasks for the Final 2020 ISP.

Webinars: our webinars were held during the ISP 2020 process: the first gave a summary of submissions to the inputs, assumptions and methodology consultation, and the second described the process for development of Renewable Energy Zones (REZ). A third workshop was held as part of the consultation on the Draft 2020 ISP in February 2020 (organised for those unable to access the in-person workshops), and a fourth was conducted following the release of the 2020 ISP for a question-and-answer session.

Other engagements: In addition to the public engagements outlined above, AEMO has held multiple engagements with state and federal jurisdictions and transmission network service providers (as part of the joint planning process).

Stakeholder engagement programme and timelines

The documentation of the submissions to the written consultation on the Draft 2020 ISP divided the responses into themes, and tabulated the number of mentions of each theme as well as the level of consensus seen across the submissions (see Table 7). This is a particularly good example of transparent reporting.

Table 7: Summary of key themes from Draft ISP Consultation submissions

Themes	Number of stakeholders present	Consensus
Strategic roll-out of transmission and interconnection, to unlock renewable energy generation development, is widely supported.	23	High
There is general support for the role of the ISP in the transition under way in the NEM.	22	High
REZs are an effective way of co-ordinating strategic renewables development.	17	High
There needs to be a greater acknowledgement of the climate change challenge.	13	High
A more agnostic approach to storage technologies is desired.	13	High
Costing of the scenarios is complex, and further clarity is required on cost estimates for ISP projects.	6	High
The engagement process has improved; however, it can be further strengthened.	18	Medium
Technological solutions can support system security through the transition.	15	Medium
There are concerns about generation intermittency and the level of dispatchable capacity in the National Electricity Market.	13	Medium
The future role of distributed energy resources is widely contested.	14	Low

The final ISP provides the basis for future grid expansion and/or grid modification projects. While the ISP is not legally binding, projects identified as “actionable” will proceed into the Regulatory Investment Test for Transmission (RIT-T) as part of the regulatory approvals process.

Table 8: Summary: Australia's ISP process

<table>
<tr><th rowspan="3">Organisation</th><th colspan="4">Stakeholder</th><th rowspan="2">Frequency</th></tr>
<tr><th>Number of TSOs involved</th><th>Governments</th><th>Academia</th><th>Civil society</th></tr>
<tr><td>5 Transmission network service providers</td><td>5 states + Commonwealth Government</td><td>Yes</td><td>Yes</td><td>Ongoing, every 2 years</td></tr>
<tr><th rowspan="3">Technical</th><th rowspan="2">Geographic scope</th><th rowspan="2">Voltage level</th><th colspan="3">Scenario driver</th></tr>
<tr><th>Technical</th><th>Economic</th><th>Climate and environment</th></tr>
<tr><td>5 states</td><td>Transmission grid</td><td>Yes</td><td>Yes</td><td>Climate targets only in 2 out of 5 scenarios – medium priority</td></tr>
<tr><th rowspan="2">Policy</th><th>Role of TSOs</th><th>Role of policy makers</th><th>Role of civil society</th><th colspan="2">Process result</th></tr>
<tr><td>Leading the process</td><td>Commenting on the process, providing input</td><td>Commenting on the process, providing input</td><td colspan="2">Non-binding; Regulatory step</td></tr>
</table>

3.3 Vietnam – The Power Development Plan and Power Grid development

As Vietnam's energy market is controlled by the government, the electricity sector is organised more centrally than in Europe and in Australia. However, the country's processes for scenario development and related power grid planning provide interesting examples for this analysis.

Process lead

The government division in charge of power grid planning in Vietnam is the Electricity and Renewable Energy Authority (EREA), part of the Ministry of Industry and Trade. The accredited public technical research and consulting organisation that provides the analysis reports to EREA is the Institute of Energy.

For Vietnam's power sector the state-owned Vietnam Electricity Corporation (EVN) leads the implementation of all new high-voltage transmission projects and of a large share of new large generation projects. EVN was established in 1994 by the Prime Minister on the basis of the reorganisation of the units of the Ministry of Energy. In 2010, the Prime Minister announced the re-organisation of the Vietnam Electricity Group into the one-member limited liability company owned by the state. Since Vietnam is a market-based economy, the electricity sector is not exempt from the general policy to sell state-owned enterprises. However, power sector liberalisation and EVN restructuring are conducted at a slow pace.

EVN's core responsibilities are the production, transmission, distribution and trading of electricity; operation of electricity assets in the national power system; the import and export of electric power; investment and capital management in power projects; operation and maintenance of the equipment and control systems of electricity assets (EVN, 2020).

EVN is structured according to three major areas:

- **Power production:** Three power generation corporations (GENCO 1, 2 and 3) own and manage most (but not all) generation capacity of the group. All three operate all over the country, and hold a diversified portfolio of assets.
- **Power transmission:** As of 2020, EVN remains the sole buyer and transporter of power, via the National Power Transmission Corporation (EVNNPT).
- **Power distribution:** Five power corporations sell the electricity: Northern Power Corporation (EVNNPC), Central Power Corporation (EVNCPC), Southern Power Corporation (EVNSPC), Hanoi Power Corporation (EVNHANOI) and Ho Chi Minh City Power Corporation (EVNHCMC).

Background: Power Development Plan and related grid projects

The long-term development of Vietnam's future generation mix and the required power grid capacities are specified in the Power Development Plan (PDP). Plans are made for 10 years, with a mid-term adjustment. Currently the revised PDP 7 is in place which covers the period from 2016 to 2030. National and international energy experts provide input to possible scenarios – including the Asian Development Bank (ADB, 2018), the Danish Energy Agency (EREA/DEA, 2019), Germany's GIZ (GIZ, 2020) and the University of Technology Sydney (UTS/ISF, 2019), among others.

With regard to renewable energy, the Prime Minister and Vietnam's Ministry of Industry and Trade have so far approved the inclusion of 130 solar power projects with a total capacity of around 10,366 megawatts (MW) (more than 8,500 MW, a significant political outcome) and wind power projects with a total capacity of around 4,976 MW into the PDP (EREA/DEA, 2020).

Both wind and solar power projects are concentrated primarily in locations of low on-site load demand. Therefore, where utility-scale wind and solar power projects have been added, most of their generation capacity must be collected, grid-connected and transmitted to areas of high load demand. However, the 110-500 kilovolt (kV) grid infrastructures in these areas do not meet the requirements for transmitting this capacity from the new projects that have been added, despite recent upgrades. Based on EVN's calculation, the Ministry of Industry and Trade submitted a number of projects for 220-500 kV transmission lines in Binh Thuan and Ninh Thuan to the Prime Minister, who approved the incorporation of these projects into the PDP to help transport the generated electricity of renewable power projects. EVN is undertaking further research to propose new projects.

In late 2019, the Prime Minister approved the outline of the PDP 8, expected to be published in March 2021. The PDP 8 covers the period of 2021 to 2030 with a vision to 2045. It is based on Party guidelines formulated in Resolution 55-NQ-TW, which sets out renewable energy development and investment attraction in the key priorities of the energy sector (Minh Ha Duong, 2020).

In addition to developing the PDP 8, the Ministry of Industry and Trade submitted a proposal on 21 January 2020 that outlines a pilot programme on direct power purchase agreement mechanisms. The programme would allow energy producers to sell and deliver electricity to corporate consumers instead of going through a state-owned electric utility company. The proposal sets a two-year time frame for implementing the pilot programme and lays out the criteria for participating developers and private power consumers. It is expected to range between 400 MW and 1,000 MW and will be available nationwide (Vietnam Briefing, 2020).

Regulations for grid planning

Grid projects are planned by EVN's National Power Transmission Corporation and require submission of an Environmental Impact Assessment. This process involves multiple government agencies. For example, projects affecting natural forests must comply with the procedures stipulated by Directive 13 of the Secretariat and by Notice 191 of the Prime Minister. Environmental and social issues with resettlement problems have delayed grid construction projects.

The 2017 Law on Planning, which took force on January 1, 2019, changed the rules of the planning process. For example, it does not allow provincial-level sectoral plans, such as wind power development zones. In May 2019, the Elaboration of the Law of Planning was released in a 95-page decree No. 37/2019/ND-CP that provided further details on the process requirement for infrastructural projects – including power grids (Government of Vietnam, 2019).

Table 9: Summary: Vietnam's Power Development Plan

Organisation	**Stakeholder**				**Frequency**
	Number of TSOs involved	**Governments**	**Academia**	**Civil society**	
	1	Federal and regional/ provinces	Yes	No	PDP revised every 5 years
Technical	**Geographic scope**	**Voltage level**	**Scenario driver**		
			Technical	**Economic**	**Climate and environment**
	Country wide – 63 provinces	Transmission grid	Yes	Yes (focus)	National parks and environmental protection zones; Environmental Impact Assessment required; no climate targets
Policy	**Role of TSOs**	**Role of policy makers**	**Role of civil society**	**Process result**	
	Leading the process	Formulating targets for energy supply	Currently no role in the process	Binding	

3.4 Japan – THE OCCTO Grid MasterPlan

Japan's power sector was liberalised in 1995, when the national power market was divided into 10 regional power utilities that controlled generation transmission, distribution and retail and held the regional monopoly.

Between 2000 and 2005, the first step of liberalisation of the retail supply of electricity to all except low-voltage (below 200 kV) customers was implemented in stages. Policy on reform of the electricity system was adopted in April 2013, and in the first phase of reform, the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was established in April 2015.

In the second phase of liberalisation, the Electricity Market Surveillance Commission (now the Electricity and Gas Market Surveillance Commission) was established in September 2015 to strengthen oversight of the liberalised electric power market. Liberalisation of the power retailing and generation sectors was completed in April 2016.

In the third phase of liberalisation, legal separation of transmission and distribution from vertically integrated businesses was implemented in April 2020. Meanwhile, plans to abolish regulated electricity rates in April 2020 were delayed (JEPIC, 2020).

Energy policy

Under the philosophy of 3E+S (energy security, economic efficiency, and environment plus safety), the Japanese electricity sector aims to achieve a more balanced power generation mix by improving the efficiency of thermal power plants, reducing dependence on nuclear power and expanding the use of renewables.

As of August 2019, 15 nuclear reactors had been declared compliant with the new regulatory standards and were granted permission to have their installation licenses amended accordingly. Nine of these have already re-entered commercial service. The remaining 6 reactors that were confirmed compliant, and a further 21 that remained shut down or under construction, were expected to eventually start or restart operation. Japan's remaining 24 reactors were earmarked for decommissioning, including the reactors involved in the 2011 accident at Fukushima Daiichi Power Plant.

Japan's installed renewable power capacity has increased (especially solar, although the market has contracted in recent years) as a result of a feed-in tariff scheme. The government was considering overhauling the feed-in tariff scheme by the end of fiscal year 2020. Meanwhile, competition for customers has intensified as electricity retailers respond to the progressive termination of purchase periods from November 2019 by offering a variety of purchase price plans. In June 2019, the government proposed a long-term strategy for reducing emissions, setting a target for an 80% reduction in greenhouse gas emissions by 2050. It calls for innovation coupled with a virtuous circle of environmental and economic growth to solve environmental issues (JEPIC, 2020).

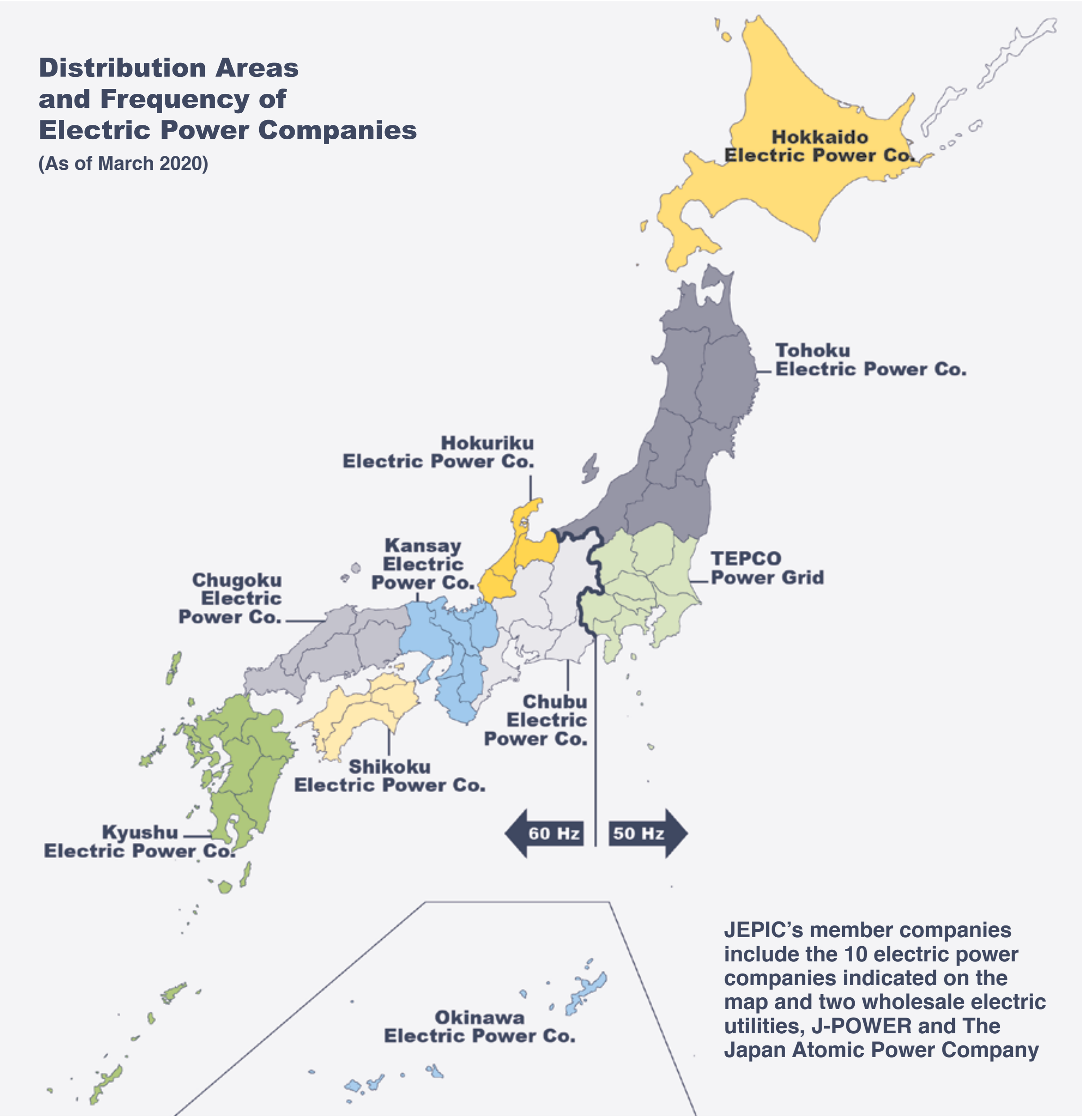
Process lead

Rather than being a regulatory authority, OCCTO is a legal entity authorised by law. It was established under the Electricity Business Act to operate a transmission grid across the utility companies' respective operational areas, to co-ordinate power supply and demand nationwide, and to promote construction of infrastructure for cross-area transmission. OCCTO began operations in April 2015, and the Electric Power System Council of Japan was dissolved (OCCTO, 2020a).

Background: OCCTO Grid Masterplan 2021

The development of the OCCTO Grid Masterplan started in August 2020 to increase the interconnection capacity between Japan's nine grid areas (see Figure 3; Okinawa in the far south is excluded due to the large geographical distance). The aim is to increase the interconnection capacity in order to enhance the demand and supply balance. This will benefit the distribution of renewable power generation, including for onshore and offshore wind and solar PV.

Figure 3: Japan's nine transmission system operators



Source: JEPIC, 2020

Part of this process is the establishment of regional renewable energy assessment in each of the grid areas to identify future renewable generation capacity on the basis of a cost-benefit analysis to develop a scenario. The first results of this analysis are scheduled for early 2021.

The focus of the Grid Masterplan 2021 is the increase of transmission grid capacities. This might include dedicated grid connection capacities for offshore wind, if this technology is identified as critical for the Masterplan. The Masterplan centres on the development of a cross-regional grid and the upper two voltage transmission lines. Specifics about the Masterplan process – including timelines – have not been published yet.

Stakeholder engagement

The OCCTO Grid Masterplan has no open stakeholder engagement process for civil society. The Masterplan is discussed with 20 representatives from the energy sector, academia and financial institutions in three different groups within OCCTO and the Ministry of Economy, Trade and Industry (METI). The three groups are:

- Masterplan committee (OCCTO, 2020b)
- Local transmission congestion study group (sub-committee of Masterplan committee) (OCCTO, 2020c)
- METI sub-committee on the large-scale introduction of renewable energy / next-generation power network (OCCTO, 2020d).

The decision-making process is was under development at the time of publication.

Table 10: Summary: Japan's OCCTO Grid Masterplan 2021

<table>
<tr><th rowspan="3">Organisation</th><th colspan="4">Stakeholder</th><th rowspan="2">Frequency</th></tr>
<tr><th>Number of TSOs involved</th><th>Governments</th><th>Academia</th><th>Civil society</th></tr>
<tr><td>10</td><td>Federal and regional/ provinces</td><td>Yes</td><td>No</td><td>On demand; no regular process</td></tr>
<tr><th rowspan="3">Technical</th><th rowspan="2">Geographic scope</th><th rowspan="2">Voltage level</th><th colspan="3">Scenario driver</th></tr>
<tr><th>Technical</th><th>Economic</th><th>Climate and environment</th></tr>
<tr><td>Countrywide – 10 utilities across 47 prefectures</td><td>Transmission grid</td><td>Yes</td><td>Yes (focus)</td><td>Renewable energy targets; no climate targets</td></tr>
<tr><th rowspan="2">Policy</th><th>Role of TSOs</th><th>Role of policy makers</th><th>Role of civil society</th><th colspan="2">Process result</th></tr>
<tr><td>Leading the process</td><td>Formulating targets for energy supply</td><td>Not part of the process</td><td colspan="2">Possibly binding (waiting on final decision)</td></tr>
</table>

3.5 Chile – The Transmission Planning Process

Chile's energy sector was privatised in the late 1980s and is divided into three segments: generation, transmission and distribution. All three electricity segments were unbundled in the early 2000s. The majority of Chile's power generation comes from five international and national companies: Enel Generación (Italy), Engie (France), EDF (France), Colbún (Chile) and AES Gener (Chile) (Jiménez et al., 2020). There are seven Transmission System Operators (TSO) in Chile.

Chile's electricity generation mix is very diverse and includes 10% solar, 7% wind power and 28% hydropower, with the rest based on coal (22%), gas (20%) and diesel (MOE/GIZ, 2018). In 2007, a reform to the General Law on Electricity Services (Electricity Law) was approved, aimed at promoting the use of non-conventional renewable energy. A target was set for 10% non-conventional renewable electricity by 2024, which was increased in 2013 to 20% by 2025. Chile reached this target six years early: by 2019, the electricity share from wind and solar (including concentrating solar thermal power) was already at 20.8% (Djunisic, 2019).

Energy policy: Regulatory framework and authorities

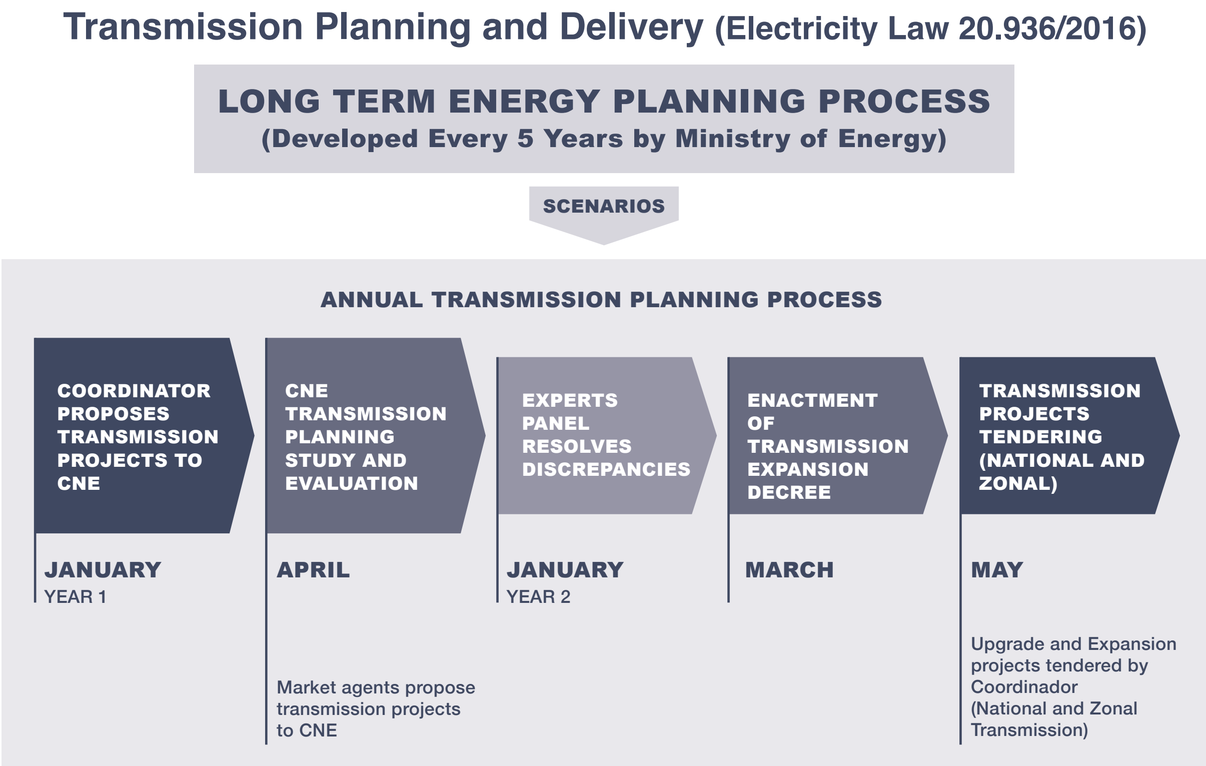
The Electricity Law, enacted in 1982, regulates the electricity market in Chile and has been amended several times since. The most relevant electricity market regulators in Chile are the following:

- **Ministry of Energy:** Prepares and co-ordinates national energy plans, policies and regulations for the development of the energy sector.
- **National Energy Commission:** Analyses energy prices, tariffs and technical norms for all companies that produce, generate, transport and distribute energy; also calculates transmission and distribution tariffs.
- **Superintendence of Electricity and Fuels:** Controls compliance with legal provisions on generation, transmission, distribution, storage of liquid fuels, gas and electricity, including quality of services and safety of activities.
- **Independent National Electricity Co-ordinator:** Independent legal entity established by law with the main purpose of co-ordinating the operation of all national electricity system facilities in an efficient and safe way.

Background: Chile's transmission planning process

The process starts with the Ministry of Energy developing a long-term energy planning every five years that results in scenario inputs for the future development (expansion) of the electricity matrix (see Figure 4). With the energy planning, the National Energy Commission (NEC) performs the transmission expansion planning considering the next 30 years. In doing so, the NEC asks the market operator ("Co-ordinator") for proposed transmission projects. In parallel, companies also propose transmission projects to the NEC. After studying the different proposals, the NEC optimises the network expansion for the next 30 years and delivers a report where the transmission lines defined to be built in the next five years are the ones chosen to be tendered. This tender is performed by the Co-ordinator.

Figure 4: Chile's long-term energy planning process



Source: Araneda, 2018

Stakeholder engagement

New Transmission Planning Criteria were introduced with the Electricity Law 20.936 in 2016 and aim to minimise supply risk with regard to a cost increase or unavailability of fuels, delays or unavailability of energy infrastructure, and possible impacts of natural disasters such as earthquakes and floods. The criteria also allow open access to the grid for all market players to promote and facilitate competition to achieve a minimum price for all consumers.

An important part of the new law is how power transmission grids are planned. The law identifies the following key points for the planning process (Araneda, 2018):

- Anticipatory planning: making decisions under uncertainties
- Stripes for new transmission lines with Strategic Environmental Evaluation: this includes significant participation of civil society in relation to the use of land
- Roominess in the design of new transmission infrastructure
- Upgrading and uprating of existing lines and substations
- Zonal transmission:
  - Access to cities and towns
  - Decentralised renewable energy (distributed energy resources)
- Design of resilient transmission infrastructure.

Figure 5 shows the four technical stages of the transmission grid planning process. Civil society is not involved in development of the electricity scenarios, but has a significant role the evaluation of the Transmission Planning Study. The transmission planning process is focused on technical and economical optimisation, although renewable electricity generation plays a major role.

Figure 5: Transmission planning process in Chile

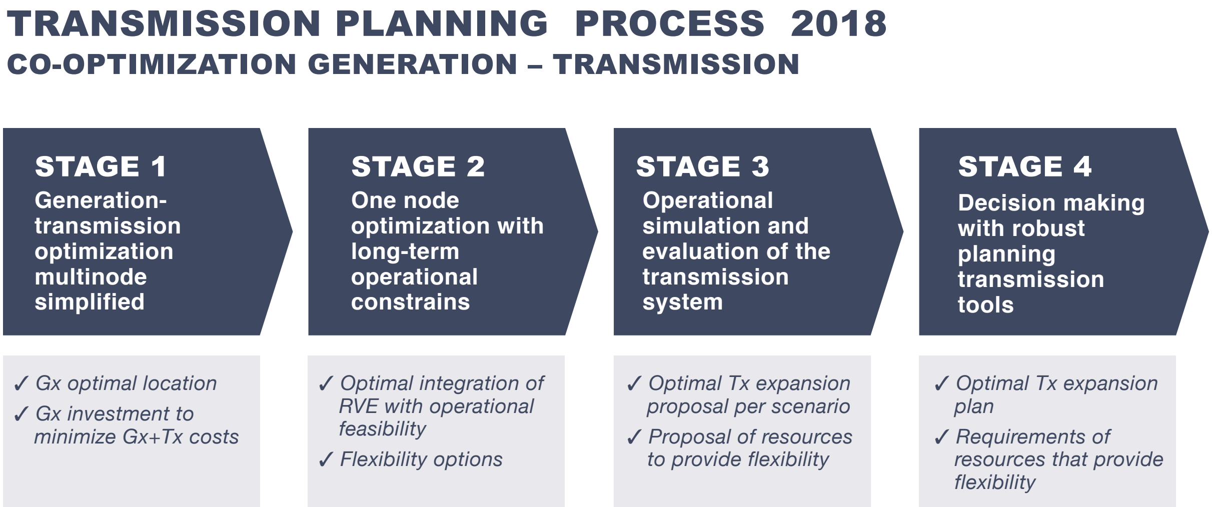


Table 11: Summary: Chile's transmission network planning

Organisation	**Stakeholder**				**Frequency**
	Number of TSOs involved	Governments	Academia	Civil society	
	7	Federal and regional/ provinces	Yes	No	On demand; no regular process
Technical	**Geographic scope**	**Voltage level**	**Scenario driver**		
			Technical	Economic	Climate and environment
	Countrywide – 16 regions, 7 TSOs	Transmission grid (66-500 kV)	Yes	Yes	Renewable energy targets; no climate targets
Policy	**Role of TSOs**	**Role of policy makers**	**Role of civil society**	**Process result**	
	Leading technical process	Leading overall process and formulating targets for energy supply	Not part of the process	New grid project will be tendered	

4

Conclusions

All five of the case studies presented in this report focus on high-voltage transmission lines to deliver electricity over large distances. While all analysed documents highlight the importance of distribution power grids in the context of increased levels of distributed renewable electricity and local electricity demand (e.g., higher levels of electric heating and electric vehicle charging), the planning processes for distribution and transmission grids are not closely linked.

The planning horizons vary between 10 and 20 years, with a typical frequency of 2 years except in the case of the Vietnamese plan, which is revised every 5 years. In practice, stakeholder engagement processes need between one and two years in order to organise public hearings and provide enough time for reviews and input.

In three of the case studies – Europe, Australia and Japan – the energy industry (power grid companies) leads the process, and academia is involved mainly in scenario and grid modelling, though its participation in the European process is informal and limited to the public consultation step. Governments play more of an observational role in these cases, whereas they are the lead in Vietnam and Chile. Civil society is directly involved in scenario development in Europe and Australia, and it engages in the geographic planning process in Chile. Vietnam and Japan allow indirect involvement of civil society via submissions of academic papers.

Remarkably, in the processes that involve civil society (in Europe and Australia), the outcomes are not legally binding, whereas the outcomes are binding in Vietnam and Chile. The process in Japan is not yet decided.

The main drivers for the grid planning process are security of supply and electricity generation costs, while environmental and climate targets are only secondary.

Table 12 provides a comparison of the five case studies. However, it omits one of the major results of this research: the absence of collaborative power grid planning in most countries. The analysis found that the majority of countries have no standardized process for the actual construction of power lines at all, besides the usual application process. At that stage, the decision to build a power line has been made without consultation of civil society. The construction of new power lines generally takes years and frequently sparks resistance. With earlier and more comprehensive stakeholder engagement, this might be avoidable.

Table 12: Comparison of the five case studies

		Stakeholder				Frequency
		Number of TSOs involved	Governments	Academia	Civil society	
Organisation	Europe: Ten-Year-Network Development Plan (TNYDP)	42	European countries, provinces/states	Yes	Yes	Ongoing, every 2 years; projects 10 years ahead
Organisation	Australia: Integrated System Plan (ISP)	5 Transmission network service providers	5 states + Commonwealth Government	Yes	Yes	Ongoing, every 2 years; projects 20 years ahead
Organisation	Vietnam: Power Development Plan (PDP)	1	Federal and regional/ provinces	Yes	No	Ongoing – revised every 5 years; projects 15 years ahead
Organisation	Japan: OCCTO Grid Masterplan 2021	10	Federal and regional/ provinces	Yes	No	On demand; no regular process; currently planned for 2 years.
Organisation	Chile: Transmission Planning Process	7	Federal, regional and provinces	Yes	No	Ongoing, every 5 years; projects 30 years ahead

		Geographic scope	Voltage level	Scenario driven	Eco-nomic	Climate and environment
Technical	Europe: Ten-Year-Network Development Plan (TNYDP)	35 countries	Transmission grid	Yes	Yes	Climate targets included for the first time in TYNDP 2020
Technical	Australia: Integrated System Plan (ISP)	5 states	Transmission grid	Yes	Yes	Climate targets only in 2 out of 5 scenarios – medium priority
Technical	Vietnam: Power Development Plan (PDP)	Countrywide – 63 provinces	Transmission grid	Yes	Yes (focus)	National parks and environmental protection zones; Environmental Impact Assessment required; no climate targets
Technical	Japan: OCCTO Grid Masterplan 2021	Countrywide – 10 utilities across 47 prefectures	Transmission grid	Yes	Yes (focus)	Renewable energy targets; no climate targets
Technical	Chile: Transmission Planning Process	Countrywide – 16 regions, 7 TSOs	Transmission grid	Yes	Yes	Ambitious renewable electricity targets

		Role of TSOs	Role of policy makers	Role of civil society	Process result
Policy	Europe: Ten-Year-Network Development Plan (TNYDP)	Leading the process	Commenting on the process, providing input	Commenting on process, providing input	Non-binding; Used as input for selection of Projects of Common Interest
Policy	Australia: Integrated System Plan (ISP)	Leading the process	Commenting on the process, providing input	Commenting on process, providing input	Non-binding; Regulatory step
Policy	Vietnam: Power Development Plan (PDP)	Leading the process	Formulating targets for energy supply	Not part of the process	Binding
Policy	Japan: OCCTO Grid Masterplan 2021	Leading the process	Formulating targets for energy supply	Not part of the process	Possibly binding (Waiting on final decision)
Policy	Chile: Transmission Planning Process	Leading the technical process	Leading the overall process, setting energy targets	Not part of the process	Binding: New projects are put out for tender

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Appendix

Examples of projects focusing on increasing stakeholder engagement

The European BESTGRID project – joint initiative of grid operators and environmental NGOs

The BESTGRID Project invited environmental non-governmental organisations (NGOs) to develop grid project plans in co-operation with transmission grid operators (BG-HB2, 2015). The aim of the initiative was to increase the dialogue and to engage with environmental stakeholders. As a result, a handbook on planning criteria and best practice planning projects was published in 2015. The handbook summarises the effects of transmission lines on bird populations and provides an overview of planning regulations and the national policies of European countries as well as international laws such as the United Nations Convention on Biological Diversity and the European Birds and Habitats Directives. Furthermore, the BESTGRID initiative works on various pilot projects in Europe that have varying foci (Germanwatch, 2020).

The Macro Grid Initiative – United States

The American Council on Renewable Energy (ACORE) and Americans for a Clean Energy Grid (ACEG) – in addition to research and academic partners – launched the Macro Grid Initiative in June 2020 as a means to expand and upgrade the US transmission network (ACEG, 2020). The aim is to connect centres that have high renewable resources to centres with high electricity demand, to enhance grid resiliency and to dramatically reduce carbon emissions, through a transmission Macro Grid.

The goals of the Macro Grid Initiative are to (ACORE, 2020):

- expand and upgrade inter-regional transmission lines to help electric utilities, corporate and institutional buyers, and other consumers meet carbon and clean energy goals by affordably and reliably integrating low-cost renewable resources, and to facilitate increased electrification and ensure grid reliability in the face of new patterns of electricity demand;
- increase transmission development at the "seams" between regions to save consumers up to USD 47 billion annually and return more than USD 2.50 for every dollar invested; and
- create a nationwide, high-voltage direct current network – optimised for the nation's best wind and solar resources – that could deliver 80% carbon emission reductions from the grid by 2030 without adding costs to consumers' electric bills.

The Macro Grid Initiative seeks to build public and policymaker support for a new policy and regulatory environment that recognises the substantial nationwide benefits of new regional and interregional transmission. Priority areas include:

- an expanded nationwide and eastern grid with a focus on the regions of the Midcontinent Independent System Operator (MISO), the PJM regional transmission organisation and the Southwest Power Pool (SPP);
- the next round of regional and interregional transmission planning;
- a fully planned and integrated nationwide transmission system; and
- a new Federal Energy Regulatory Commission transmission planning rule

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