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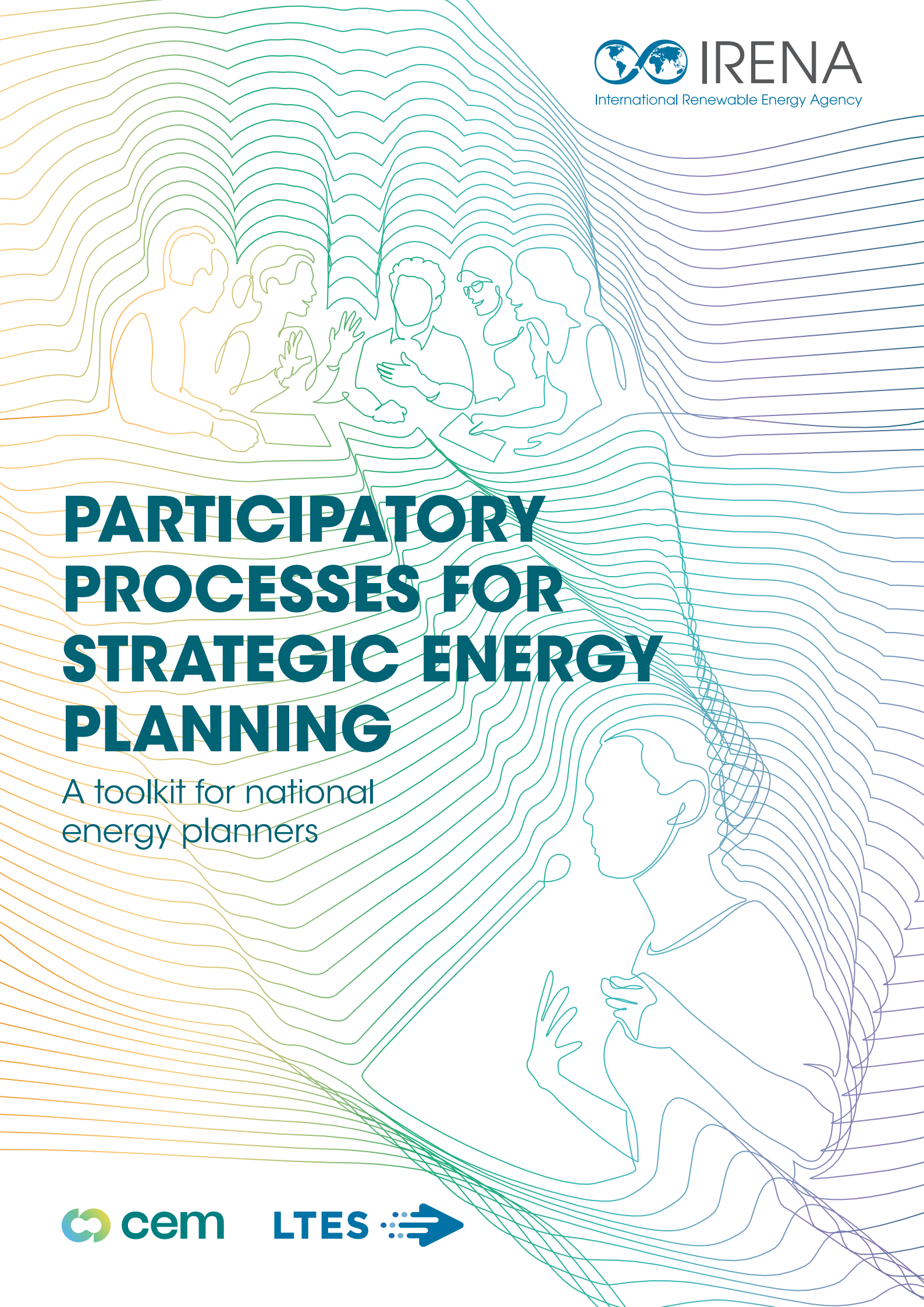

PARTICIPATORY PROCESSES FOR STRATEGIC ENERGY PLANNING

A toolkit for national energy planners

cem LTES

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ABBREVIATIONS

CEBRI	Centro Brasileiro de Relações Internacionais (Brazilian Centre for International Relations)
CSO	civil society organisation
DSO	distribution system operator
EMH	Energy Modelling Hub (Canada)
EPE	Empresa de Pesquisa Energética (Energy Research Office) (Brazil)
IDB	Inter-American Development Bank
IRENA	International Renewable Energy Agency
KCERT	Kenya Carbon Emission Reduction Tool
LT-LEDS	long-term low emission development strategies
LTES	long-term energy scenarios
NECP	National Energy and Climate Plan
NGO	non-governmental organisation
NLP	natural language processing
NRCan	Natural Resources Canada
PAC	Paris Agreement Compatible (scenario consortium)
PELP	Planificación Energética de Largo Plazo (Long-Term Energy Planning in Chile)
PNE	Plano Nacional de Energia (National Energy Plan in Brazil)
PTE	Energy Transition Programme (Brazil)
REN21	Renewable Energy Policy Network for the 21st Century
RGI	Renewables Grid Initiative
TEAM	Technical Economic Analysis Model (Finland)
TSO	transmission system operator
TYNDP	Ten-Year Network Development Plan (European electricity grid planning)
UAE	United Arab Emirates
UPME	Mining Energy Planning Unit (Colombia)
VRE	variable renewable energy
WEC	World Energy Council

EXECUTIVE SUMMARY

The global energy transition requires unprecedented co-ordination across all sectors of society. As countries accelerate their shift toward renewable energy systems, the complexity and scale of the transformation demands inclusive planning processes that engage diverse stakeholders and build broad consensus for ambitious climate and energy goals. This toolkit, developed through IRENA's Long-Term Energy Scenarios (LTES) Network, provides government energy planners with practical guidance for implementing effective participatory processes in national energy scenario development.

The expanding stakeholder landscape

The energy transition has fundamentally expanded the landscape of stakeholders involved in energy systems. Beyond traditional utilities and fossil fuel companies, energy planning now encompasses prosumers, energy co-operatives, local communities, indigenous groups, civil society organisations and businesses across all economic sectors. Despite widespread recognition of the importance of participatory processes, comprehensive guidance has been lacking on approaches and best practices for national-level energy planning. This toolkit addresses this gap by synthesising experiences from government planning institutions worldwide.

Key benefits of participatory energy planning

Evidence from IRENA's LTES Network shows that effective stakeholder engagement can lead to multiple benefits:

- **Building consensus and trust:** Participatory processes foster stakeholder ownership and social acceptance by involving diverse voices in scenario development. Countries have shown how inclusive engagement builds legitimacy for energy plans while identifying potential risks and conflicts early.
- **Gathering diverse inputs:** Stakeholder participation helps identify planning blind spots and improve the extent to which scenarios reflect real-world conditions. Engagement with at-risk communities, for instance, brings essential perspectives on energy access that might otherwise be overlooked.
- **Enhancing implementation:** Scenarios developed through participatory processes are more likely to be accepted by policy makers and society. Early involvement of key stakeholders ensures energy plans align with institutional capacities and political realities.
- **Building energy literacy:** Engagement activities enhance understanding of energy systems across stakeholder groups, creating more informed participants who can contribute meaningfully to energy transition discussions and decisions.

Strategic framework

The toolkit presents a comprehensive framework organised around three core categories of participatory approaches:

Knowledge gathering includes workshops, surveys, public consultations and expert interviews designed to collect diverse perspectives from stakeholders across sectors.

Co-creation encompasses steering committees, working groups and network structures that enable stakeholders to actively participate in shaping scenarios and building consensus.

Knowledge dissemination focuses on presentations, reports, visualisation tools and interactive platforms that communicate complex energy concepts to various audiences.

Stakeholder engagement strategies

The toolkit identifies seven key stakeholder groups often considered important for comprehensive energy planning: policy makers and regulators, grid operators, industry representatives, the general public and local communities, civil society organisations, scientific institutions, and financial institutions. Successful engagement requires tailored approaches that recognise different stakeholders' capacities, interests and constraints.

Global evidence and lessons

Thirteen detailed case studies from a range of countries and international organisations illustrate diverse approaches to participatory energy planning, ranging from Chile's comprehensive consultation framework to Canada's Energy Modelling Hub. Key lessons include the importance of clear governance structures, sustained funding commitments, skilled facilitation and transparent communication about how stakeholder inputs influence final outcomes.

The path forward

This toolkit serves as both a reference guide for immediate application and a foundation for continued innovation in participatory energy planning. By adapting these proven approaches to their specific contexts, government energy planners can foster more inclusive, transparent and effective processes that accelerate the clean energy transition while ensuring no one is left behind. The experiences documented demonstrate that meaningful stakeholder engagement is essential for planning and achieving ambitious energy and climate goals.

1. INTRODUCTION

The transition to a more sustainable and cleaner energy future requires strategic energy planning and informed decision making. Energy scenarios are a critical aspect of this planning process, enabling governments to prepare for future socio-technical changes and lifestyles, identify risks and opportunities, and shape effective policies. Scenarios can also be used as tools to engage with a wide range of stakeholders, from industry experts to the general public, and can become a tool for enhancing the legitimacy of and buy-in to the planning process (IRENA, 2020).

Since 2018 IRENA has operated the Long-Term Energy Scenarios (LTES) Network, where government planning institutions across the world have shared their experiences and practices in developing and using long-term energy scenarios for clean energy policy making and its associated challenges. Within the LTES Network, members and partners have continuously highlighted participatory processes in scenario development as a priority topic for accelerating the clean energy transition.

The accelerated uptake of renewable energy and energy system innovation around it has brought many new players into the energy landscape. The extent of the energy transition goes far beyond the traditional power generation and transmission dynamics and incumbent (mainly fossil fuel) providers and companies. The range of stakeholders who are involved and affected has increased to include energy prosumers,[1] energy co-operatives, local communities, indigenous and minority groups, and businesses, bringing the importance of energy to the foreground of people's day-to-day lives, and increasing their interest in participating in energy-related planning and decision making (Wahlund and Palm, 2022; Dawson, 2020). And while interest in participatory energy planning continues to grow, meaningful participation remains a challenge that requires deliberate effort (Knudsen *et al.*, 2015). Energy planning experts have stressed

[1] *Individuals or entities that both produce and consume energy, for instance through solar panels. Excess energy is then potentially fed back into the grid, making them participants in the broader power system.*

the importance of including the values and insights of different stakeholders in their short- and long-term planning processes to be able to represent the true complexity of an energy system in transition.[2]

Participatory processes have thus been implemented in many countries' energy and climate planning strategies. IRENA analysis of energy and climate planning alignment has shown that a majority of both energy plans and long-term low emission development strategies (LT-LEDS) have involved participatory processes as part of their development. These activities have ranged from simple surveys and interviews to years-long agendas that involve workshops, committees and other interactive activities aimed at a wide range of stakeholders.

The findings of this toolkit stem from a collaborative process, using experience-sharing activities and practitioner insights from around the world. Despite the prevalence of these participatory processes, a comprehensive overview of approaches and best practices at the national energy planning level is lacking. Following this introductory chapter, Chapter 2 introduces the concepts of energy planning, energy scenarios and how participatory processes are used to support planning processes. Chapter 3 outlines possible stakeholder groups with whom to engage and the benefits of collaborating with each group, and Chapter 4 delves deeper into tools and methods used in participatory activities, and how they can be applied in the context of an energy planning cycle. Chapter 5 highlights case studies where countries and other institutions have used one or more types of activities in their energy planning process to engage and involve stakeholders. Chapter 6 concludes the report by tying these concepts together and posing questions for upcoming work.

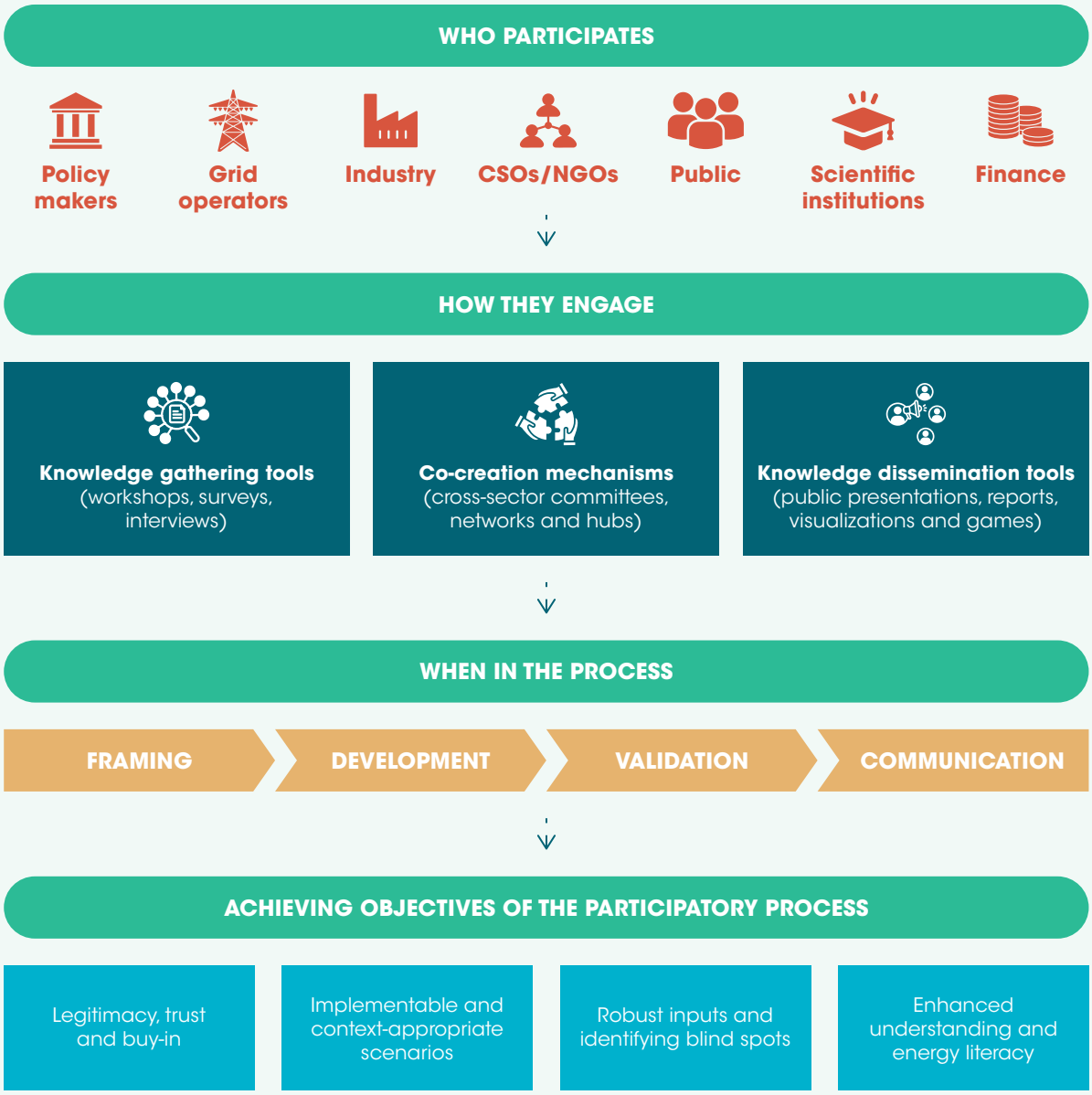
1.1 OBJECTIVE OF THE PUBLICATION

This toolkit is aimed at scenario practitioners and energy planners in government planning institutions, and establishes the importance of participatory processes in energy planning, especially in the context of the energy transition. It offers a comprehensive and practical resource for incorporating participatory processes by showcasing country, regional and global experiences. Building on previously published resources on the topic of participatory policy making, community engagement and communication in various fields of planning and project implementation (see Chapter 7), this publication is intended for national-level energy planners, especially at a time when there is growing emphasis on involving stakeholders in shaping future pathways for a just transition. It features a chapter with detailed case studies, illustrating how participatory processes can be effectively implemented (see Chapter 5).

Figure 1 below highlights the contents of this toolkit. At its core, it highlights the importance of participatory energy planning. It then proposes different lessons, tools and stakeholders that can be engaged at the different stages, providing practical recommendations for maximising the results of these participatory approaches.

[2] *(Göke et al., 2023; Howells et al., 2021; IRENA, 2020b; McGookin et al., 2024; Waisman, 2018).*

Figure 1 Overview and objectives of the participatory energy planning process



1.2 HOW THE TOOLKIT WAS DEVELOPED

This toolkit has been developed on the basis of collective experiences and participatory processes observed within the LTES Network since 2018. The activities that have provided the content of this report emphasised engagement and collaboration, key to understanding and improving participatory processes in LTES planning processes. A variety of thematic workshops, webinars and events facilitated engagement with crucial stakeholders for understanding the landscape of this topic for this report, involving over 50 speakers and 300 participants in meaningful discussions on participatory processes and public engagement in energy planning, which can be explored in the Appendix. These interactions were enriched by the guidance of a scientific advisory committee, which influenced the report's structure and content. The development of this report included interactive sessions, literature reviews and expert interviews, ensuring a comprehensive understanding of effective participatory practices in LTES development within governmental and non-governmental settings. This methodology, centred on active participation and expert guidance, has been instrumental in shaping a toolkit that reflects the current good practices and innovative strategies in facilitating inclusive participatory processes in LTES.

1.3 HOW TO USE THIS TOOLKIT

This toolkit aims to both showcase the relevance of participatory energy planning for a clean and just transition, and provide resources for national government energy planners (and other planners more broadly) to refer to as they design participatory activities for their planning process. This toolkit was developed in a modular fashion so that different chapters can be used individually for the different elements of a participatory energy planning strategy. Planners can use the toolkit in the following way:

1. Identify approaches that match your planning context

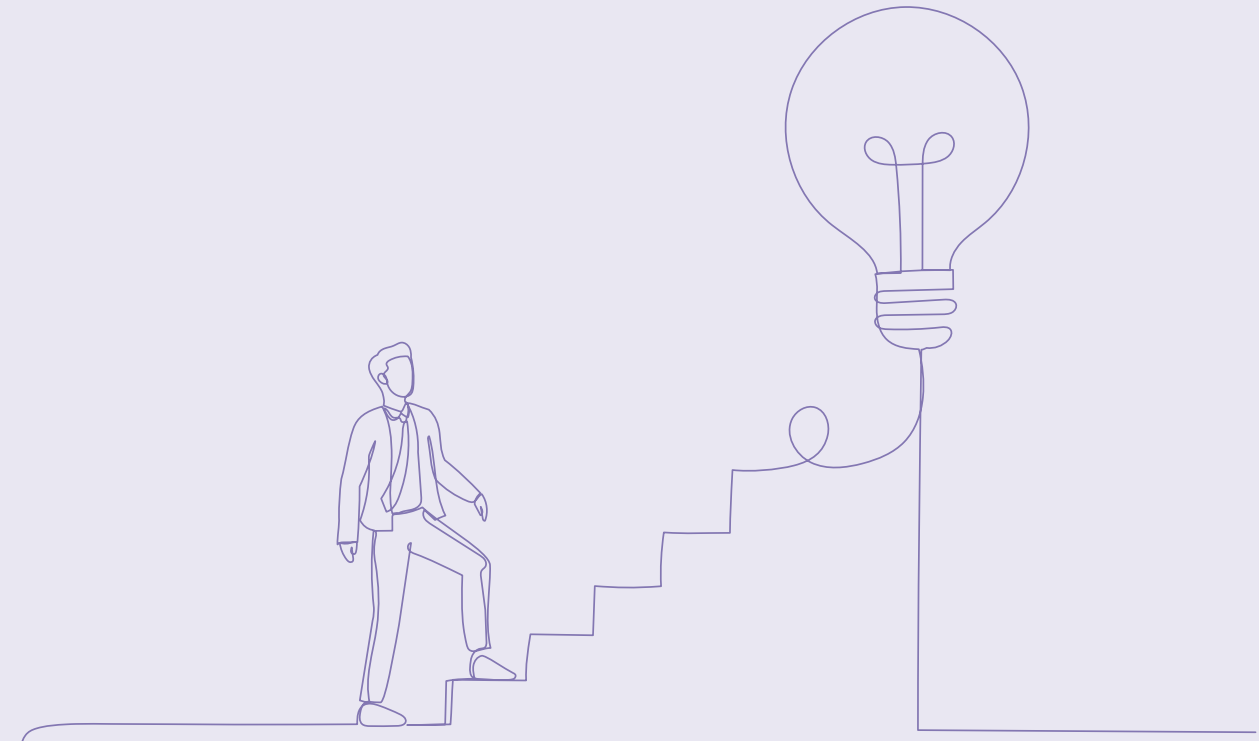
- ☑ Review the case studies in Chapter 5 to find examples from countries with similar challenges or objectives.
- ☑ Use the stakeholder mapping guidance in Chapter 3 to identify and determine which stakeholder groups are most critical for your planning process and stage.
- ☑ Consider your objectives, available resources and institutional capacity when selecting tools from Chapter 4.

2. Design your participation strategy

- ☑ Begin with the framework in Chapter 2 to understand which benefits of stakeholder participation align with your planning objectives.
- ☑ Use the stakeholder analysis in Chapter 3 to develop targeted engagement approaches.
- ☑ Select appropriate tools from Chapter 4 based on your planning stage and specific needs.

3. Implement effectively

- ☑ Draw on the practical lessons from case studies in Chapter 5 to anticipate challenges.
- ☑ Adapt the approaches to your institutional context and available resources.
- ☑ Utilise the additional resources in Chapter 7 for detailed implementation guidance.



2. THE IMPORTANCE OF PARTICIPATORY PROCESSES IN NATIONAL LONG-TERM ENERGY PLANNING

The clean energy transition requires a comprehensive change in policy making and the way investment is channelled. Long-term international and national targets need robust long-term planning that addresses short-, medium- and long-term policy needs, aligned with climate and development strategies, with stakeholders on board to support the smoother and more urgent implementation of measures to reach energy and climate targets. This chapter introduces the concepts of long-term energy planning and scenario development, a general definition of participatory processes in the context of energy planning, and the objectives and benefits of utilising participatory processes to achieve a faster and more equitable energy transition.

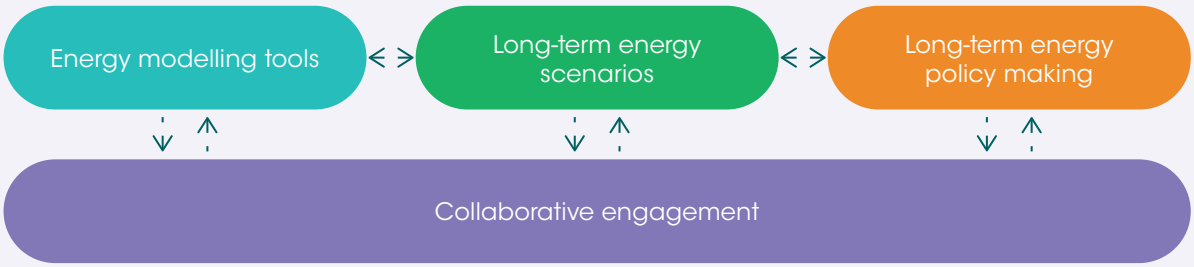
2.1 DEFINING THE SCOPE OF ENERGY PLANNING

Within the context of this report, long-term energy planning is defined as a process that involves the formulation of national or regional energy strategies and investments, guided by quantitative energy sector scenarios, often aided by energy system modelling. Such approaches can be supported by

qualitative scenario-building, and vice versa. This evidence-based process has proven vital for energy policy development globally, supporting investment decisions in the energy sector (Luscombe *et al.*, 2024). The process, especially when institutionalised and supported with strong governance, involves analytical rigour and effective scenario communication, all of which are being reassessed due to the ongoing energy transition. Scenario planning enhances policy clarity by translating qualitative aspirations into quantitative pathways and policy options, helping stakeholders to confront trade-offs and negotiate feasible pathways. Scenario-based planning requires concrete numerical inputs – preventing unrealistic expectations where every technology and policy can dominate simultaneously and ambiguously. By structuring discussions around measurable outcomes, it ensures that stakeholders move beyond vague consensus to a clearer, more actionable vision, fostering alignment and realism in decision-making.

Long-term energy scenarios (LTES), projecting over two decades or more, have been a pivotal tool for stimulating policy discussions and shaping informed long-term visions and energy policies. Insights from LTES can help prepare governments and other actors for future policy interventions, highlight immediate challenges and opportunities, inform sectoral policies and guide investment directions. Energy modelling tools can be used to formulate LTES by quantifying technological pathways, enhancing the understanding of energy system complexities and interdependencies. At times, they also reveal the need for new tools to be adopted. The framework (Figure 2) shows the basic mental model used in the LTES Network to frame how LTES are utilised to inform policy makers, with bidirectional and iterative interaction happening at different stages of the energy planning process, where stakeholders can actively collaborate and engage throughout.

Figure 2 Mental model of a stakeholder-led energy planning process

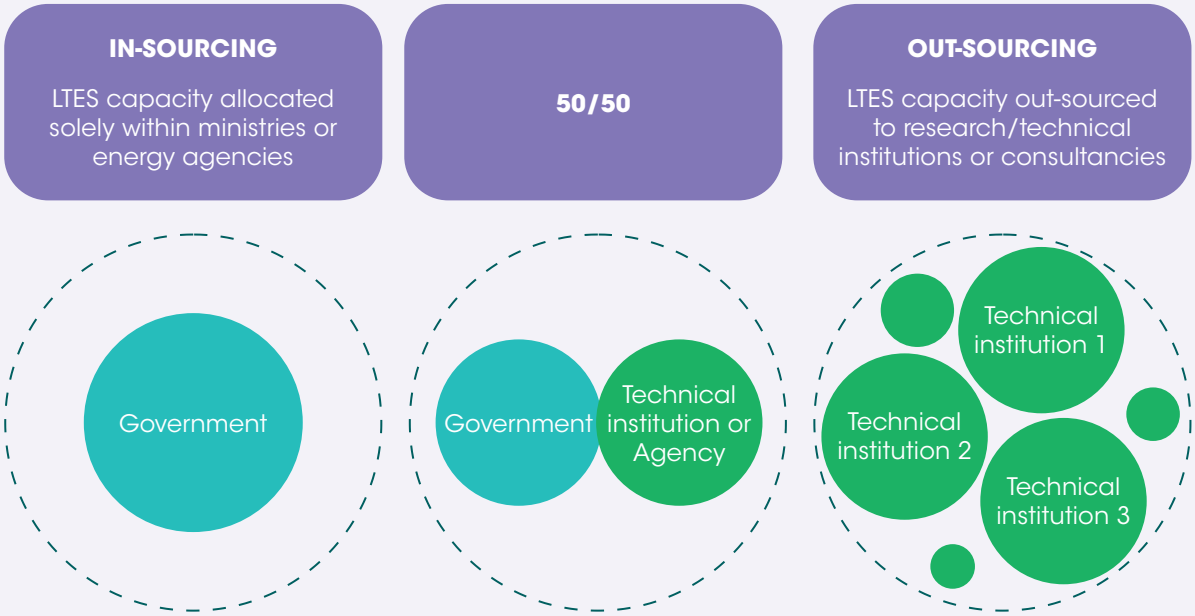


2.2 WHO IS RESPONSIBLE FOR ENERGY PLANNING IN GOVERNMENTS?

When discussing energy planning in the context of government, various actors are involved in shaping energy policies and strategies. The primary energy planners are typically government officials and policy makers within energy ministries or specialised energy agencies. For instance, in Chile, the Ministry of Energy plays a leading role in long-term energy planning, including developing energy scenarios and preparing energy planning documents. Similarly, the Danish Energy Agency, under the Ministry of Climate, Energy and Utilities, is responsible for informing the policy-making process through energy and climate outlooks based on long-term energy scenarios. These government entities often use dedicated in-house teams or agencies with expertise in energy modelling and scenario-building. This internal capacity is crucial for ensuring that policy makers can effectively understand and utilise scenario insights to inform policy and investment decisions.

While in-house capacity is essential, governments may also utilise external organisations in the energy planning process. This outsourcing approach aims to gather diverse perspectives and expertise, ultimately fostering a more comprehensive and robust planning process. Examples of these organisations include research institutions and consultancies. A third model also exists, which is a combination of the two, where governments and external institutions work hand-in-hand on energy planning to provide different types of expertise. For example, in Germany, while the Ministry for Economic Affairs and Climate Action possesses strong internal scenario development capacity, independent research institutions contribute to scenario studies, providing a broader range of insights. The key benefits, challenges and considerations for the different models are discussed in a previous publication (IRENA, 2020). The model is shown in Figure 3.

Figure 3 Allocation of energy planning capacity in the national context



Source: (IRENA, 2020).

It is worth noting that energy planning involves multiple actors beyond central government. This includes regulatory bodies, transmission system operators (TSOs) and distribution system operators (DSOs), research institutions, local governments and other institutions with planning responsibilities and possibly their own scenario development exercises. While the allocation of responsibilities varies significantly between countries depending on governance structures, institutional traditions and available resources, effective collaboration among these various entities is essential for coherent energy planning. The participatory processes described in this toolkit are relevant across these different models, though they may need to be adapted to specific institutional contexts.

2.3 WHAT ARE PARTICIPATORY PROCESSES IN THE CONTEXT OF ENERGY PLANNING?

Participatory energy planning processes include a set of activities designed to define, design, influence and validate energy plans and their implementation in a collaborative manner. Participatory processes may also be used to gauge the social acceptance of potential energy sector developments. This can take the shape of knowledge gathering, co-creation and dissemination activities involving the various stakeholder groups participating in the clean energy transition at the various stages of the energy planning process, including policy framing, scenario development, validation and communication. These are further discussed in Chapter 4.

Governments developing national energy strategies and roadmaps have long employed various types of participatory activities, ranging from interviews with certain stakeholders to public hearings, surveys, workshops, online public consultations and validation of results. The specific choice of tools and approaches depends on the planning stage, the stakeholder groups involved and the available resources.

2.4 HOW DO PARTICIPATORY PROCESSES SUPPORT ENERGY PLANNING?

Participatory processes have multiple possible objectives when organised by governments and can bring numerous benefits to the energy planning process itself, as well as to the participants. Some of the objectives identified from case studies shared throughout the LTES Network's activities include:

1. Building consensus, trust and stakeholder ownership

Long-term scenarios, by their data-driven and quantitative nature, face the challenge of reflecting the views of diverse societies, where citizens, public and private entities, policy makers and civil society organisations have various and sometimes conflicting priorities, concerns and beliefs.

While scenarios produced within a ministry or planning agency could be developed with a robust methodology, they may not represent the views of society at large, or even be considered acceptable to most. As highlighted in the Chilean case study (see Chapter 5), bringing in stakeholders as part of the scenario development process can be an effective method of building consensus among stakeholders of the energy transition, while identifying divergences and potential risks. It enables stakeholders to understand how plans are created and the trade-offs involved, as well as the views and insights of their counterparts (IRENA, 2023a). Engaging stakeholders as active participants in the process not only cultivates a sense of ownership, enhancing their support for the scenarios, but also promotes transparency and credibility by visibly incorporating their input. Furthermore, this collaborative method fosters trust and mutual understanding among stakeholders, essential for the smooth implementation of energy plans and mitigating potential conflicts. This process helps involve stakeholders as drivers of the clean transition through the collective shaping of national plans, rather than as observers on the sidelines.

Countries have acknowledged the value of participatory scenario development in generating credible and widely supported energy scenarios, emphasising the collective wisdom of diverse stakeholders for creating realistic and socially resonant scenarios (IRENA, 2023a). This approach ensures technical robustness while aligning with societal values and concerns, thereby increasing the scenarios' legitimacy (Ernst *et al.*, 2018) and accountability to entities responsible for scenario-building.

2. Gathering diverse inputs and identifying planning blind spots

Scenario-building requires input from a wide range of stakeholders, including sector and industry experts (power, transport, heating and cooling, agriculture, and other energy and non-energy sectors), policy makers, civil society organisations and the public (IRENA, 2020). Inputs can be categorised into two types: quantitative data, which encompass a variety of metrics from energy supply characteristics to demand profiles, including behavioural habits, and qualitative data, which involve insights such as social acceptance of technologies and socio-political issues.[3] These inputs are essential for creating scenarios that closely align with real-world socio-economic and political conditions, as well as for envisioning the transition to future systems and their alternatives.

The participatory process in energy planning can be a valuable method for gathering these data and formulating scenario narratives and storylines, ensuring scenarios are as representative as possible (while acknowledging the limitations of mathematical models and scenarios as forecasting tools), and can accurately incorporate future technologies, business models and lifestyles. This makes stakeholder inclusion vital to avoid missing key insights and knowledge (IRENA, 2022). The case studies from Panama and Colombia shown in this toolkit highlight how countries engage with indigenous communities to develop their national grid modernisation and energy access strategies.

Some experts have highlighted that the techno-economic focus of most power and energy system tools used in energy planning means that the key concerns and priorities of different stakeholders might not be captured in scenarios, either due to technical limitations or due to "blind spots" (IRENA, 2023a; McGookin *et al.*, 2021). A just energy transition, however, is deeply rooted in social, procedural and distributional justice (IRENA & IEECP, 2023). Engaging stakeholders could bring to light these concerns, which may galvanise either support for or opposition to energy and infrastructure projects. Decisions can then be made on how these issues should feature in strategies and scenarios, either quantitatively or qualitatively (Lonergan *et al.*, 2023a). For instance, IRENA's analysis in 2023 showed that factors such as job creation, health and behavioural change often featured more qualitatively in energy and climate strategies, as opposed to quantitatively (IRENA, 2023b). This finding suggests that more work is needed to model and highlight evidence-based energy policies that can be beneficial in those areas (*e.g.* how improving air quality by reducing fossil fuel consumption can have positive health outcomes).

3. Developing more implementable[4] and context-appropriate scenarios

Scenarios are an important source of data-driven policy advice. Policy decisions, however, are largely determined by the will of policy makers and their constituents, as well as the capacity and resources of the country. Experts have highlighted that the early involvement of policy makers and citizens, as well as other public establishments (such as the ministries of finance, as highlighted by Cyprus [see Chapter 5]), could define scenarios that are relevant to their context, either economically, socially or politically (IRENA, 2022). This can help scenario developers focus on scenarios that can more easily be accepted and adopted by legislators, policy makers, investors and technology developers (IRENA, 2021) and which also reflect local realities (as highlighted by Colombia in Chapter 5).

[3] *For further discussion see: Freeman, 2021; Schmid et al., 2011; Steg, 2023; Süsser et al., 2022; Venturini et al., 2019; Wüstenhagen et al., 2007.*

[4] *Energy planning and scenario development inevitably intersect with political realities and perspectives. What constitutes a "realistic" or "implementable" scenario is often influenced by political judgments rather than technical feasibility alone. As energy transitions accelerate and gain prominence in public discourse, scenarios may face challenges based on political perceptions of "realism" rather than technical analysis. Stakeholder engagement processes provide valuable opportunities to address these political dimensions by surfacing concerns about equity, financial impacts, and perceived winners and losers in transition pathways.*

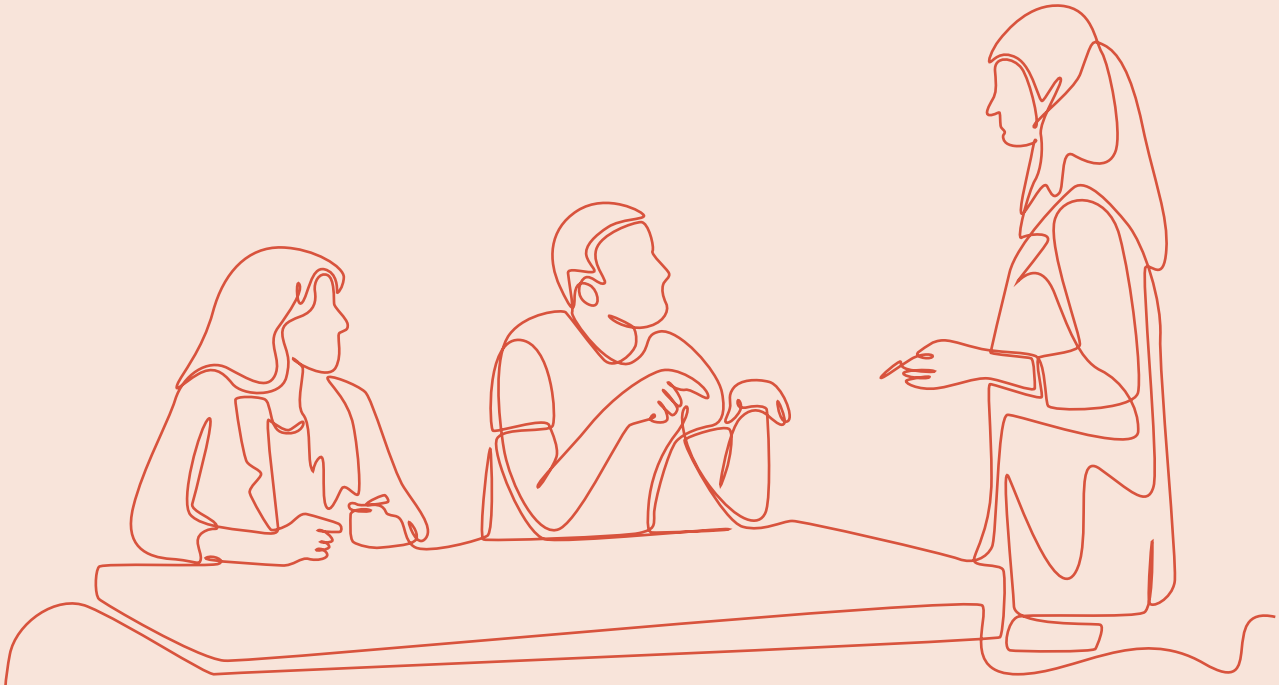
However, scenario development is not restricted to considering only "plausible" or "realistic" scenarios. Exploratory scenarios, including "what if" scenarios and alternative imagined futures, can play an important role in raising ambitions and driving lifestyle and policy changes (IRENA, 2020). These "what if" scenarios are crucial to understanding the robustness of energy scenarios against various factors and in highlighting the range of possible futures. Participatory processes can support both the development of such scenarios, as well as the communication of these futures to stakeholders.

4. Enhancing energy literacy and system understanding across stakeholders

Experts underscore the critical role of stakeholder engagement in energy scenario planning as a means to facilitate dialogue, foster a common understanding and simplify complex energy concepts (IRENA, 2022). The interaction can help stakeholders grasp the nuances of energy systems and plans, their associated uncertainties and the objectives of the energy transition. The tools used in many instances of energy planning are technically complex, and their assumptions and outputs need to be carefully communicated, rather than limiting engagement due to perceived complexity.

Information exchange can be structured to help participants build their foundational knowledge about energy systems, such as through workshops and the use of interactive tools and simulations. Such interactive experiences additionally enhance the quality of stakeholder contributions and allows them to envisage different futures (Ketonen-Oksi and Vigren, 2024), which can spur different stakeholders to action or increase their acceptance of these pathways.

Stakeholder contributions to the planning process also benefit from spontaneous information sharing among stakeholders, which broadens each participant's understanding by exposing them to new viewpoints and expertise. This interaction not only enriches the collective knowledge base, but also ensures a more comprehensive representation of the energy ecosystem in scenario planning. This iterative communication loop, where feedback from participants informs ongoing discussions and scenario refinements, is crucial for the evolution of effective energy strategies (IRENA, 2022).



3. STAKEHOLDERS IN THE NATIONAL SCENARIO DEVELOPMENT PROCESS

This chapter outlines the different stakeholder groups identified throughout this project with whom it is crucial for national energy planning teams to engage during the scenario development process. This chapter discusses the objectives of engaging these stakeholders, the challenges, good practices in overcoming these challenges, and the benefits for the stakeholders themselves for engaging in national energy planning. Challenges and good practices in this chapter are sourced from the various interactions within LTES Network activities, and from discussions with experts.

The following stakeholder list represents the groups present and discussed broadly during the preparatory activities to this report. However, each planning activity should examine their context to identify whether additional or other relevant stakeholders or categorization would be utilized.[5]

[5] *Fair and comprehensive stakeholder mapping is critical for successful engagement but requires its own methodology beyond the scope of this toolkit. Key considerations include using systematic approaches rather than ad-hoc methods, employing multiple identification techniques to reduce bias, ensuring representation of vulnerable groups, validating through feedback channels, and potentially involving third parties for enhanced credibility. Some examples of mapping techniques can be found here: https://simplystakeholders.com/stakeholder-mapping/*

3.1 POLICY MAKERS, ADMINISTRATORS AND REGULATORS

Who are they? Government officials responsible for laws, policies and regulations and their implementation across sectors, including energy, transport, industry, environment, research and development, agriculture and climate-focused departments.

Why engage them? In policy planning contexts, scenarios are developed to guide policy and strategic decisions at national and sub-national levels. The active involvement of policy makers throughout the scenario development process helps to keep scenarios relevant, realistic and aligned with policy needs. The participation of policy makers and regulators with the energy planning teams can range from initial discussions to define critical policy questions to collaborative formulation of scenarios that reflect grounded assumptions, and ultimately to clear communication of results to inform policy. Effective cross-sectoral co-ordination among policy makers also supports various data-sharing efforts and the alignment of investment and strategies across a highly interconnected energy system.

What is the benefit for them? Understanding the process and limitations of scenario development and trade-offs between scenarios can help decision making, including through assessment of the implications and impacts of policy measures.

Challenges in engaging with this stakeholder

- **Limited understanding of scenario concept:** Purpose and limitations of scenario analysis as a forecasting, predictive or exploratory tool may not be clear, which may affect policy makers' expectations for the use of the scenarios.
- **Political perspective:** Balancing different political visions, priorities and insights might prove challenging.
- **Knowledge gaps:** Many policy makers and sector experts who influence energy policy are not necessarily specialists in energy systems. Bridging this gap through education - or less technical communication - can help ensure more informed decision making.
- **Time constraints:** Most policy makers have busy schedules and might not have the ability to engage in long participatory processes or read long reports.

Good practices collected

- Preparing succinct briefs and visuals that can address policy makers' direct concerns and priorities.
- Explaining what modelling tools can and cannot do, and which concerns can be addressed within these tools.
- Using non-biased intermediaries to facilitate discussion with diverse groups of policy makers to avoid perceived bias.
- Conducting capacity-building exercises for policy makers and their staff to help guide decision making.

3.2 GRID OPERATORS

Who are they? Grid system operators refer to the entities responsible for operating and often developing power and gas networks (both transmission and distribution).

Why engage them? Engaging both electricity and gas grid operators is crucial because of their deep understanding of grid dynamics, infrastructure limitations and the operational challenges posed by the energy transition. Their technical expertise, historical and real-time data, and future expansion plans make them key players in ensuring grid stability and security as energy systems evolve towards a higher share of variable renewable energy (VRE). By aligning their scenarios with national energy plans and involving them in public engagement, grid operators help ensure a co-ordinated and resilient transition, particularly as the integration of renewables and decarbonised gases reshapes both power and gas networks.

What is the benefit for them? Ensuring their development plans and other procedures are considered in the country's long-term plans (and vice versa), and that national plans are consistent and consider infrastructural developments and upgrades as needed.

Challenges in engaging with this stakeholder

- **Established plans:** System operators have existing mid-term plans for grid expansion and upgrades that might necessitate adjustments to wider long-term energy plans. Gas grids may need to accommodate decarbonised gases, requiring infrastructure investment.
- **Collaboration across voltage levels and energy vectors:** Collaboration mechanisms across different voltage levels or energy vectors (power and gas) might be weak or non-existent, especially with distribution-level operators who could provide robust demand data.
- **Policy maker awareness and perception:** Electricity and gas grids' pivotal role in the energy transition is often underestimated by policy makers, who have only recently begun to prioritise it, viewing it more as an obstacle to renewables than an enabler. Although infrastructure lock-ins are possible, gas infrastructure could also play a role in transporting decarbonised gases and balancing renewable energy supply.
- **Compatibility of plans:** In countries with many TSOs and DSOs, reconciling plans for different regions, sectors and jurisdictions might be a complex task (IRENA, 2020).

Good practices collected

- Engaging early with grid operators to incorporate existing plans and limitations into the planning process.
- Engaging with distribution-level operators to ensure compatibility with local conditions and identify any vital issues (*e.g.* technical) that might affect planning.
- Including regulators responsible for issuing permits to grid operators ensures that the energy system's legal and regulatory framework aligns with national scenarios and transition goals. This approach also aids in streamlining approvals for necessary infrastructure upgrades and expansions.
- Involving grid operators can help to ensure that the most cost-efficient solutions will be prioritised, reducing the costs of the energy system at large.

3.3 INDUSTRY AND BUSINESS REPRESENTATIVES

Who are they? A diverse set of stakeholders spanning multiple sectors of the economy encompassing both established players and new entrants, including energy-intensive industries, manufacturers, logistics companies, small- and medium-sized enterprises (SMEs), renewable energy developers, energy efficiency solution providers, and carbon capture technology companies, as well as non-energy sectors.

Why engage them? Industry players are central to achieving the energy transition because of their significant energy use, emissions footprint and innovation potential. Their technical expertise and practical experience in implementing low-carbon technologies provide crucial insights into decarbonisation barriers and opportunities. Technology developers contribute detailed knowledge about costs, scalability challenges and technology readiness, enabling the creation of more comprehensive and realistic transition scenarios that reflect their future pathways and strategies. Sectors such as shipping, logistics, aviation, agriculture and automotive provide essential perspectives on sector-specific changes in energy use and technological possibilities, helping to shape more robust energy plans and pathways. Their understanding of supply chains and market dynamics is vital for identifying intervention points for emissions reduction. Countries have also engaged with industry players to develop consensus on national plans and understand the vision of various sectors for incorporation within these strategies.

What is the benefit for them? Engagement helps them preserve their business interests and adjust their business models as necessary. Companies can better position themselves competitively by anticipating and preparing for strengthening climate policies and changing market demands. Climate-related financial disclosures could also be supported by aligning business and national targets and plans.

Challenges in engaging with this stakeholder

- **Diverse interests and priorities:** Different industrial sectors have varied priorities and challenges, making it difficult to develop a one-size-fits-all approach to the scenario process.
- **Confidentiality concerns:** Industries may be reluctant to share proprietary or sensitive information that could be crucial for accurate scenario modelling.
- **Balancing economic and environmental goals:** Balancing industrial growth and competitiveness with sustainability goals is challenging, especially in fossil-fuel–reliant sectors, compromising buy-in.
- **Communication gap:** Energy experts may lack knowledge of business specificities, while industry may lack understanding of the broader energy system.
- **Balancing national and international goals:** Companies bound by foreign parent company targets may struggle to align with national government objectives.
- **Different time horizons:** The private sector typically has a shorter planning time horizon and may not see value in long-term planning.

Good practices collected

- Conducting thorough stakeholder mapping to identify relevant stakeholders needed at the different stages.
- Co-developing sector scenarios with associations to incorporate findings into national planning.
- Placing limits on lobbying influence and balancing views appropriately to avoid unbalanced power dynamics.

3.4 GENERAL PUBLIC AND LOCAL COMMUNITIES

Who are they? The general public, or sometimes leaders or representatives of communities based on locality, identity (*e.g.* indigenous groups) or other means of demographic classification (*e.g.* age group or income level), who usually represent their group's interest.

Why engage them? Planning for a just energy transition requires a collective effort that is led by the public while also paying attention to the most vulnerable in society. Social acceptance by communities, for instance, is vital for renewables and accompanying infrastructure project development. Energy efficiency, technology adoption and change in consumer behaviour patterns are also key to reaching sectoral targets in the residential and transport sectors. The transition will also have effects that must be communicated to citizens, such as price changes and other policy shifts. They may also be voters who can indirectly or directly affect policy decisions.

What is the benefit for them? Local communities and the public at large can help shape a just transition that considers citizens' needs and concerns, allowing them to learn about their role in facilitating this transition.

Challenges in engaging with this stakeholder

- **Generating interest:** Scenario development processes are unfamiliar to the public and inviting participants requires a clear framing of the objectives of such projects.
- **Knowledge gaps:** Technical concepts found in energy system analysis might not be familiar to most, and such gaps might affect the quality of participation in the process.
- **Time constraints:** Jobs, childcare and other responsibilities may limit the time that members of the public can afford for these processes, especially affecting the most vulnerable.
- **Ensuring inclusivity:** Certain members of the public (*e.g.* those with more time available) might be more likely to join, creating an unbalanced snapshot of societal perspectives.

Good practices collected

- Starting discussions from perceived existing issues and concerns, as opposed to simply attempting to visualise a perfectly just scenario.
- Leveraging existing engagement platforms (local town halls or community spaces) to secure stakeholder participation in a familiar environment.
- Identifying and training members of planning staff from local communities to act as focal points to enable continuous dialogue and address community concerns.
- Keeping registries to maintain communication with interested participants and monitor inclusivity and the diversity of representatives.
- Including decentralised actors, such as community energy projects, in the public engagement.
- Publishing plans online to broaden consultation possibilities for the general public.
- Allocating the necessary time to ensure effective engagement with local communities.
- Offering online and in-person options to participate in participatory activities.

3.5 CIVIL SOCIETY ORGANISATIONS AND NON-GOVERNMENTAL ORGANISATIONS

Who are they? Civil society organisations (CSOs) and non-governmental organisations (NGOs) typically denote different types of non-profit institutions such as trade unions, environmental advocacy groups, humanitarian organisations, charities and others.

Why engage them? CSOs and NGOs typically form a crucial role in representing various interests held by the public. For example, trade unions can represent workers from different sectors, many of which will be affected by the energy transition, and thus have a critical stake in delivering the insights of their constituents to the energy planning process to ensure a just transition. Similarly, environmental and humanitarian advocacy groups can present evidence-based research and analysis to highlight issues, benefits and impacts that should be accounted for in long-term national energy plan.

What is the benefit for them? They can ensure the collective representation of the concerns arising from their social and environmental mandates, to help shape a just and sustainable transition.

Challenges in engaging with this stakeholder

- **Diverse perspectives:** The wide array of represented viewpoints can lead to conflicting interests and priorities, making consensus-building a complex task.
- **Resource constraints:** Many CSOs and NGOs operate with limited resources, which might restrict their ability to participate effectively in lengthy or demanding processes.
- **Communication barriers:** Effective communication between technical experts and representatives can be challenging due to differences in expertise and focus areas.
- **Inclusivity and representation:** Ensuring that all relevant voices, especially those from underrepresented groups, are included in the participatory process can be challenging.

Good practices collected

- Ensuring transparent and consistent communications from the outset over time to build trust, including explaining how inputs are incorporated into the results.
- Maintaining political neutrality in activities to avoid alienating different groups.
- Providing technical knowledge through preparatory courses or briefing to allow for more meaningful engagement.
- Conducting thorough stakeholder mapping to ensure affected stakeholders are engaged.
- Communicating clearly how inputs will be taken or not taken in the plans.

3.6 SCIENTIFIC INSTITUTIONS

Who are they? Members of the scientific community, including researchers and experts working at universities and research institutions. They could include energy and power system experts, economists and natural scientists, as well as researchers in the social sciences.

Why engage them? Scientific institutions play an important role in many national energy planning processes, whether through building modelling capacity, conducting the modelling, or providing system-specific expertise, data and feedback throughout the process, leading to an expansion of the scope of discussion. Stronger systemic engagement with the scientific community can enable more robust scenarios through rigorous scientific methodologies and quality assurance, promote inter-institutional knowledge exchange, and provide key contributions from interdisciplinary experts who can facilitate the inclusion of qualitative socio-political and environmental insights in these scenarios.

What is the benefit for them? They are able to leverage their subject matter expertise and research to contribute to energy planning and create social and policy impact. It also enables them to access funding opportunities, strengthen reputations in action-oriented research, possibly access real-time data and enhance partnerships with decision makers.

Challenges in engaging with this stakeholder

- **Professional constraints:** Engaging in stakeholder consultations might be a time-consuming activity that takes time away from research, teaching and other professional engagements.
- **Balancing independence:** Academics value their independence. They might be cautious about engaging in processes that appear to be politically influenced.
- **Lack of funding:** Scientists may face a lack of funding for activities not related to some of their main research grants and, as such, may find it difficult to prioritise attending such national planning-related engagements if alternative funding is unavailable.

Good practices collected

- Establishing and providing resources as a mechanism for continuous engagement with the scientific community (see section 5.3 case study).
- Promoting transparency and open-source data in scenario modelling, enabling academia, research institutes and other independent experts to review, validate and contribute evidence-based feedback that strengthens the national planning process and informs decision making.
- Promoting independent scientific institutions as a conduit for wider stakeholder engagement to increase trust and avoid perception of political bias.
- Providing funding through grants and tenders to ensure continuous and consistent academic engagement.

3.7 FINANCIAL INSTITUTIONS

Who are they? The finance sector includes a wide range of stakeholders, such as public finance ministries, national and international financial institutions, commercial and development banks, investment funds, insurers and reinsurers, and other financial entities engaged in funding and investing activities.

Why engage them? Financial organisations play a pivotal role in the energy transition due to their capacity to mobilise funds and invest in sustainable energy projects and initiatives. Their involvement is crucial for injecting the necessary capital into energy transition projects, such as renewable energy deployment, energy efficiency improvements, infrastructure upgrades and new technology deployment. Involving banks and insurers is critical for understanding the de-risking options, which may be particularly important when developing new technologies or pursuing system development in countries facing multiple endemic risks (Lonergan *et al.*, 2023b; Steckel and Jakob, 2018). Public finance entities, such as finance ministries, play a pivotal role in aligning national budgetary policy with energy transition goals, while private financial institutions can drive investment in innovative technologies and sustainable projects.

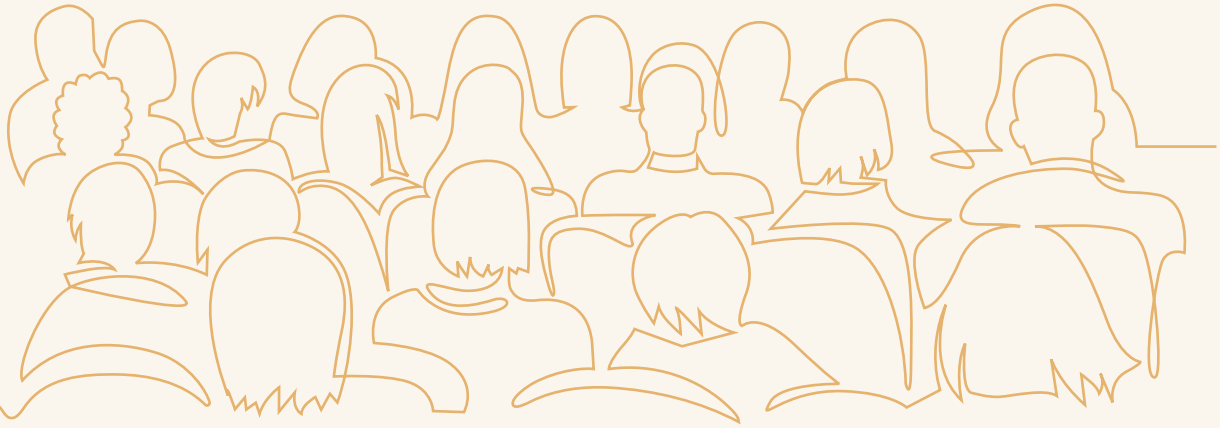
What is the benefit for them? Involving financial institutions early in energy transition planning ensures they understand the challenges, risks, pathways and opportunities, increasing their willingness to contribute and finance projects. Their input in the context of macroeconomics, project feasibility and risk helps refine the plan, making it attractive to investors and minimising transition risks.

Challenges in engaging with this stakeholder

- **Aversion to political processes:** Financial institutions may be reluctant to engage in processes that appear political, and they might be unwilling to co-create scenarios with national energy planners, fearing potential reputational risks.
- **Diverse mechanisms and interests:** Financial entities have varied investment strategies and risk appetites, which may make the alignment of priorities challenging for energy planners.

Good practices collected

- Involving key finance departments early in energy planning ensures effective integration of financial and energy policies. This approach facilitates streamlined communication and strategic alignment.
- Engaging financial institutions early allows the examination of limitations, blind spots and opportunities in supporting low-carbon development.
- There is benefit in working together on specialised tools to communicate the financial implications of energy transitions to financial entities, investors and policy makers outside the planning team (see section 4.3.2).



4. ENGAGEMENT TOOLS AND ACTIVITIES

This chapter outlines the different tools and activities that government planners can utilise when engaging stakeholders in energy planning processes, with many of them used in the case studies in Chapter 5. These tools fulfil different purposes in the planning process: some help to collect stakeholder perspectives and feedback, others are oriented towards the dissemination of information and fostering understanding within the target audience, while some can be used for both purposes. The following sections outline these tools and their use cases, advantages and challenges, while also addressing resources and good practices.

The tools can be categorised into three main types according to the level of engagement and how the information flows between planners and stakeholders:

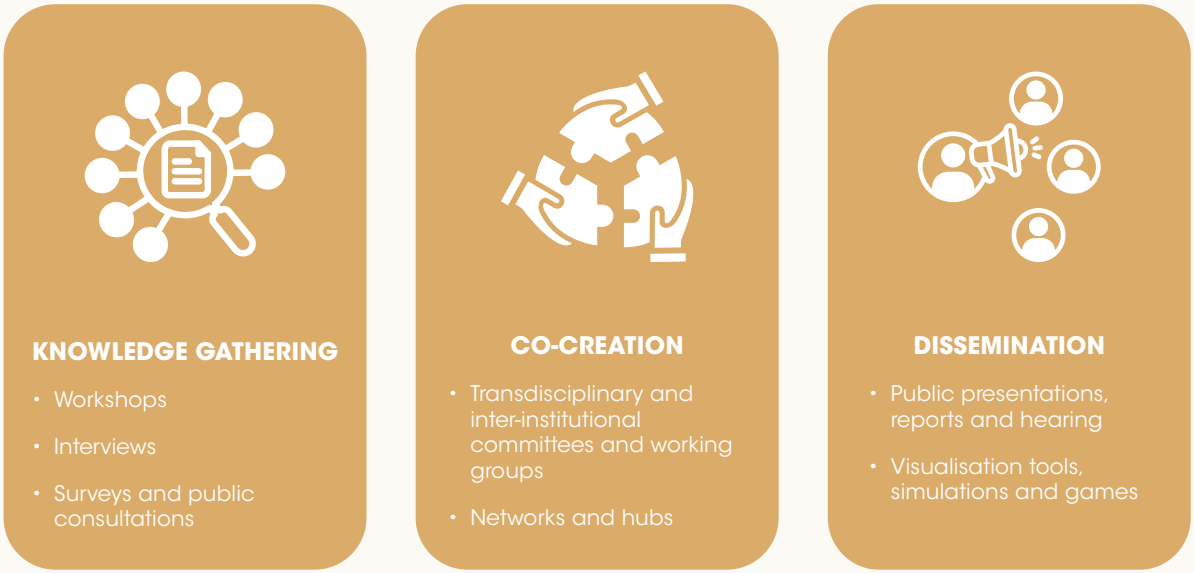
Knowledge-gathering tools and activities are primarily designed to collect insights, perspectives and information from stakeholders. These approaches enable planners to access diverse knowledge and viewpoints that enhance the quality and relevance of energy scenarios. While their primary purpose is input collection, these tools and activities often have the secondary benefit of building stakeholder understanding through the engagement process.

Co-creation tools and activities take engagement further by enabling stakeholders to actively participate in shaping the planning process and its outcomes. These approaches establish collaborative environments where stakeholders work alongside planners to develop scenarios, explore trade-offs and build consensus on potential pathways. Co-creation fosters deeper ownership and commitment to the resulting plans.

Knowledge dissemination tools and activities focus on communicating energy planning concepts, scenarios and implications to various audiences. These approaches transform complex technical information into accessible formats tailored to different stakeholder needs. Effective knowledge dissemination builds energy literacy, supports informed dialogue and strengthens the foundation for broader participation.

Within this chapter, tools are categorised as illustrated in Figure 4, and are accompanied by an explanation and discussion of their application in alignment with specific objectives.

Figure 4 Categorisation of engagement tools and activities



Each tool description in this chapter covers the following dimensions:

Implementation stage

Each tool can be strategically used in one or several stages of the planning process:

- **Policy framing:** This stage initiates the process by defining policy questions and clear objectives, outlining methodologies, and assembling initial data as critical inputs to scenario design.
- **Scenario development:** Methodologies are put into action, essential information is defined and collected , including assumptions and input data, and narratives and scenarios are created (sometimes through the use of modelling tools).
- **Validation:** After the formulation of energy scenarios and potential policies, the validation stage follows. This might be before publication or at the point of a draft publication. Stakeholder inputs are valuable for feedback at this stage.
- **Communication:** Outcomes derived from the scenario-building require effective communication. The communication stage involves sharing the results with stakeholders.

Under this dimension, energy planners will find guidance on how and when to use each tool during the planning cycle.

Resource requirements

This dimension provides insights into the resources needed to implement each tool effectively:

- Human expertise.
- Financial and time allocations.
- Technological infrastructure.

Prerequisites

This dimension addresses the essential conditions for achieving the objectives and desired outcomes by implementing the tool.

Practical considerations

Based on the experiences collected, this dimension provides insights into:

- Strengths: The activity's advantages.
- Challenges: Potential obstacles or complexities that might arise in employing this tool.
- Limitations: The inherent boundaries or weaknesses that shape the tool's application.

Implementation example or evidence

This dimension provides concrete examples and learnings from real case studies, highlighting specific outcomes achieved, key lesson, success factors or common pitfalls observed.

TOOL SELECTION DECISION FRAMEWORK

With numerous participatory tools available for energy planning, selecting the right approaches can be challenging. This framework provides a flexible method to choose the most appropriate tools based on your planning objectives, stakeholder priorities and available resources.

The six-step process below helps you navigate from your initial planning goals through to practical tool selection and evaluation, ensuring your participatory activities are both strategically aligned and feasible within your constraints.

STEP 1: Define your planning objective and phase

Framing → **Development** → **Validation** → **Communication**

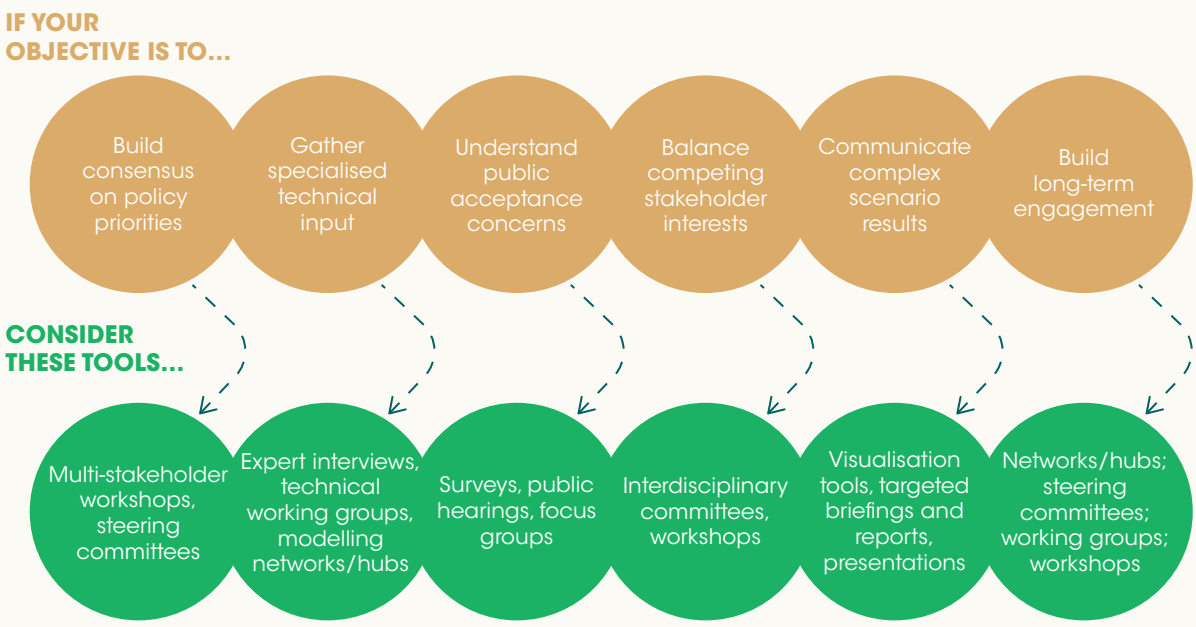
STEP 2: Identify priority stakeholders

For each planning phase, identify which stakeholder groups are most critical.

STEP 3: Assess available resources

Evaluate the resources you can commit to participatory tools and activities.

STEP 4: Select appropriate tools



STEP 5: Adapt to limitations and constraints

Explore good practices and prerequisites identified in each tool's subsection.

STEP 6: Evaluate the benefits of the selection

Develop and compare indicators to help measure the success of the choice to the planning process.

4.1 KNOWLEDGE GATHERING

4.1.1 WORKSHOPS

Workshops provide structured environments for energy planners to facilitate engagement with many different types of stakeholders, to share information, foster discussions and collect feedback. Workshops help identify and map divergences and convergences between stakeholder groups. For example, Brazil used virtual debates to identify key disagreements and develop scenarios that reflected different perspectives. Finland used workshops to foster collaboration and transparency in their carbon neutrality scenarios. Brazil also held workshops to present their National Energy Plan 2050, while Cyprus used workshops to communicate scenario results to policy makers.

Implementation stage

Framing	Development	Validation	Communication
Co-define policy questions and targets	Co-develop narratives and define assumptions	Present preliminary results and encourage feedback for reiteration	Present results and communicate policy outcomes

Resource requirements and prerequisites

Workshops require dedicated, skilled facilitators with expertise in energy scenario development. Adequate financial resources are also needed to cover logistics for stakeholder gatherings, including location, technology, facilitation and possibly funding for attendance and related *per diem* payments. Access to technology may also be necessary, depending on the format of the workshop. As demonstrated in the case studies, the ideal format varies by setting. In some cases, physical meetings may be the most effective way to facilitate participatory processes, fostering transparency and building trust in the process, as was the case for developing the Ghanaian National Energy Plan. Other instances, like Chile's long-term energy planning , made use of a variety of online tools and platforms to engage stakeholders at different stages of the energy planning process. In some instances, countries like Brazil employed a hybrid approach, utilising both online and in-person workshops.

In all cases, it is important to map the required stakeholders depending on the workshop's objectives, and determine the format most appropriate for the stakeholders invited and the desired outcomes. Ensuring confidentiality when necessary is also vital for building trust in the process. A preliminary engagement phase may be useful for non-expert audiences, to build foundational knowledge and enhance participant involvement through courses, tutorials, interviews or a combination of them. This also informs workshop design and potential sources of tension.

Practical considerations

Strengths: Workshops are adaptable and flexible, allowing for diverse formats to meet specific needs. Their interactive nature encourages active participation and may foster social acceptance. They engage a wide range of stakeholders and promote social learning. In-person workshops can also foster informal exchanges and relationships between participants, adding potential value for possible collaborations.

Limitations: It might be difficult to translate qualitative discussions into quantitative inputs for scenario development, risking the loss of key data that shape the produced scenarios. Expert participation can be limited by time and availability, while resource constraints can also pose challenges.

Challenges: Workshops may risk allowing misinformation, manipulation or reinforcement of biases (echo chambers). Public settings might discourage marginalised voices from speaking up. Addressing these challenges requires careful facilitation and inclusivity.

Implementation evidence

Numerous case studies illustrate how workshops have been used in participatory processes for energy planning. These workshops varied in format, attendees and content. In Finland, VTT's workshops focused on vision and storyline development, using creative methods and formats. Participants, including national industrial federations, contributed low-carbon sectoral roadmaps that fed into the national energy strategy. Canada's Energy Modelling Hub hosted workshops for energy modellers, policy makers, regulators and system operators to facilitate discussions on planning for clean energy policies. In Colombia, multisector dialogue forums were held that effectively brought together various departments under a regional context. The World Energy Council held global scenario-weaving workshops, gathering stakeholders from academia, government, industry and start-ups to co-create socio-political narratives for global energy scenarios. Similarly, the Paris Agreement Compatible (PAC) project organised several workshops with CSOs, technical experts and TSOs to develop a Paris-compatible energy scenario for Europe, but also to facilitate exchange of knowledge, discuss methodologies and data, and compare the results of different modelling exercises.

Some workshops addressed specific thematic areas, such as the Cyprus case, where academia, financial institutions and the Ministry of Energy collaborated to prepare sector-specific policy briefs, including on the job impacts of the energy transition. In the Chilean case, regional workshops and seminars engaged with a wide range of stakeholders to discuss the outcomes of the national energy planning process. In one project in Ireland, the researcher-led Deliberative Futures Workshops employed creative exercises like community mapping and storyboarding, paired with expert-led presentations on climate issues, to foster informed discussions and scenario creation over two weekends (LTES Network, 2022; Revez *et al.*, 2021).

Box 1 Ideas for interactive workshops

World Café: Participants discuss topics at rotating café-style tables, with hosts summarising previous conversations. This process fosters diverse insights, collaboration and the identification of effective actions.

Transition simulator: Groups simulate different stakeholders and propose actions in response to various scenarios. Used by the World Energy Council, it helps stakeholders plan actions to meet targets, such as net zero, while balancing their own interests.

Me-We-Us: This method starts with individual work, moves to group discussions, and ends with a collective conversation, promoting equal participation and improving engagement, as shown in Finland's case study.

Futures Wheel: Ideal for complex issues, this involves critical analysis, envisioning potential futures and assessing the practicality of ideas. It promotes social learning and helps drive change, as seen in Finland's energy transition workshops.

Narrative workshop: A foresight lab blending scientific, artistic and social elements, this workshop uses storytelling to reimagine energy futures, encouraging participants to integrate personal stories into scenario planning.

4.1.2 SURVEYS AND PUBLIC CONSULTATIONS

Surveys provide a structured method for national energy planners to gather standardised information and perspectives from a wide range of stakeholders. They offer a means of understanding public opinion, collecting quantitative and qualitative data, and receiving feedback on energy plans and scenarios. For example, Finland's VTT employed large-scale surveys, including consumer surveys, as part of their engagement activities for developing their carbon neutrality scenarios. The Chilean team also utilised surveys to gather feedback on their energy planning process, aiming to incorporate diverse stakeholder perspectives. The Ghanian Energy Planning Committee, similarly, leveraged surveys to inform their energy transition planning, focusing on understanding stakeholder opinions and preferences.

Implementation stage

Framing	Development	Validation	Communication
Co-define policy questions, priorities and targets	Data gathering	Gathering feedback on results and draft plans	Gathering feedback on final plan

Resource requirements and prerequisites

To conduct surveys effectively, specialists with expertise in energy scenario development and data collection are essential to define survey questions and guide the design process. Financial resources are required to facilitate the surveys, particularly for in-person surveys. Online surveys may offer a lower-cost option, as many surveying tools are free, and can help reach a more geographically dispersed set of stakeholders than who would otherwise be available to attend in-person sessions. However, facilitating online surveys still requires expertise in survey design, must be mindful of data protection law, and depends upon internet access. The preparation phase should include defining the survey's main objectives and identifying the target audience, whether citizens or expert stakeholders, and ensuring this selection constitutes a representative sample. Thoughtful planning of the survey format (fully online, in-person gatherings, hybrid or by telephone) and method (group discussions or individual responses) will help ensure engagement and relevance. To maximise the impact of the survey results, planners should also consider how participants will be involved in subsequent stages of energy scenario development.

Practical considerations

Strengths: Surveys can engage a diverse group of stakeholders, making them effective for gathering a wide range of perspectives. They can be tailored to collect valuable data that inform energy scenario modelling, and there are methodologies suited to various formats and contexts to ensure flexibility in approach.

Limitations: Accessibility can be an issue, especially for certain citizen groups who may lack access to the necessary technology or resources to respond to these surveys. Additionally, some topics may need to be simplified, which might exclude certain complexities from the energy modelling discussions.

Challenges: Gaining meaningful inputs within a limited interaction period is a core challenge, as is defining a sample that is representative of the broader population, especially if faced with limited participant recruitment. Surveys may face sampling and framing biases, which could impact the representativeness

of the data. Crafting surveys that accommodate different levels of knowledge, especially for non-expert participants, is essential to gather comprehensive and inclusive feedback. Longer surveys can help planning teams develop deeper insights, but may be off-putting to respondents. Survey design must therefore balance the need for data collection against the desirability of concise, targeted surveys or identifying specific audiences to ensure effective engagement and accurate data collection.

Implementation evidence

Numerous case studies illustrate how surveys have been applied in participatory processes for energy planning. These surveys varied in format, focus and target respondents. In Brazil, online surveys were integrated into the National Energy Plan (PNE) 2050 through a three-month public consultation hosted on the Ministry of Mines and Energy website. This survey invited feedback on the national energy planning agenda, projections and governance issues, helping guide Brazil's long-term energy strategy. The Brazilian team also used surveys to collect feedback on draft energy scenarios, reaching a broad audience beyond workshop participants. By gathering diverse perspectives through surveys, they ensured that the energy planning process was more inclusive and reflective of stakeholder priorities. In Finland, survey questions were designed to capture energy consumption patterns, preferences for energy sources and public acceptance of emerging policies. In Ghana, surveys were employed to understand stakeholder preferences and attitudes towards the energy transition.

Box 2 Examples of survey formats

Online surveys: This option can be distinct in its type and audience. Online surveys may be used for the collection of feedback with mass outreach in public consultations, or to reach certain stakeholders in geographically dispersed locations. Their low-cost nature makes them widely used.

Deliberative survey: These aim to involve participants in an informed and structured dialogue on a specific topic. This approach encourages discussion, the exchange of ideas and the thorough consideration of diverse perspectives before reaching conclusions. They are utilised to foster thoughtful discussions and informed deliberations among participants.

Delphi panels: An iterative method of conducting surveys, Delphi panels are structured surveying techniques that allows for reconsidering survey responses through different rounds of surveys. This can facilitate social learning and a common understanding of convergences and divergences by experts and policy makers.

Polls and ballots: These can be quick and convenient methods to gauge participants' preferences and priorities, without being too time-consuming or requiring details, and can be done either virtually or in-person.

4.1.3 INTERVIEWS

Interviews offer energy planners a focused method to deeply explore participants' perspectives, opinions and experiences in mostly one-on-one settings. They provide a platform for gaining detailed qualitative insights, fostering a richer understanding of individual motivations and viewpoints, and uncovering nuances that may inform energy plans and scenarios. The interview format is usually used to engage industry or expert stakeholders as opposed to the general public due to being time-consuming. The World Energy Council and Finnish energy planning processes both used interviews to understand stakeholder preferences and to draft scenario narratives.

Implementation stage

Framing	Development	Validation	Communication
Co-define in-depth policy questions, priorities and targets	Data gathering, narrative co-creation	Feedback gathering and refinement	Gathering feedback on final plan

Resource requirements and prerequisites

Conducting interviews requires expert support to design the structure and define questions that align with the study's objectives. Interviewers play a critical role in guiding dialogue, ensuring constructive dialogue and keeping participants focused on the objectives of the discussion. In the preparation phase, the primary goals of the interview must be clearly defined and the target groups identified – whether they are citizens, stakeholders or subject matter experts. Careful planning of the interview approach, including whether it will be structured, semi-structured or informal, is essential to ensure relevance and engagement. Additionally, it is important to consider how participants' input will feed into subsequent stages of energy scenario development. Confidentiality measures should also be established to create a safe and open environment for participants, particularly when sensitive topics are discussed.

Practical considerations

Strengths: Interviews allow stakeholders to express their individual views in detail, making them particularly effective for gathering qualitative and descriptive data. This format fosters meaningful conversations, enabling participants to articulate their motivations and identify potential divergences. By offering a space for focused discussion, interviews can generate in-depth insights that are valuable for understanding complex issues in energy scenario planning.

Limitations: One major limitation of interviews is the small number of participants typically involved, which can limit the diversity of perspectives captured. Interviews are also time-intensive, both in conducting and analysing the discussions, which can strain resources. Additionally, interviews lack the group dynamics that can reveal new information, help build consensus or evolve collective opinions, potentially leaving gaps in understanding.

Challenges: Interpreting and translating interview findings into actionable insights for quantitative energy scenarios can be complex. Ensuring balance between diverse opinions within the same stakeholder group is another challenge.

Implementation evidence

Interviews are a powerful method for collecting qualitative data and gaining in-depth insights. Several countries and organisations incorporate them into participatory processes for developing scenarios. For instance, the United Arab Emirates uses bilateral interviews and discussions to ensure alignment between national long-term energy plans and the mid-term strategies of regional utilities. Finland's VTT leverages interviews to capture individual stakeholder perspectives, opinions and experiences. Similarly, the World Energy Council employs interviews to craft narratives for their energy scenarios.

Box 3 Types of interviews

Structured interviews:	Semi-structured interviews:	Unstructured interviews:
These are more rigid, with prepared questions, and can target a specific topic or issue. They are useful for collecting consistent and comparable qualitative data, and in some cases structured information can be quantified to support scenario development (Ribeiro *et al.*, 2011).	This approach involves following an interview protocol with some prepared questions, and can be more flexible to allow for probing. They are useful for flexible and in-depth exploration of complex issues and assumptions in energy scenarios, barriers to technologies and refinement of models (Fallde *et al.*, 2017; Kurniawan *et al.*, 2022).	By not following prepared interview questions, this approach can be flexible, although it might allow for drifting to different topics. It is useful for collecting qualitative data, opinions and narratives at the beginning of scenario processes.

4.2 CO-CREATION

4.2.1 INTER-INSTITUTIONAL STEERING COMMITTEES, TASK FORCES AND WORKING GROUPS

Several countries co-ordinate their energy planning through inter-institutional committees (including public and non-public organisations) to bring their unique expertise, data and viewpoints to the table. Working together helps create a more comprehensive, aligned and interconnected understanding of the long-term energy scenarios, which supports the quantification of socio-political insights and their inclusion in energy scenarios and planning. Many of these examples are outlined in previous reports (on Africa, Latin America and Asia), as well as in the case studies in this toolkit. Also, the PAC consortium established an advisory committee consisting of sector experts, which accompanied the project and scenario development and provided commentary, challenged the results and enriched the work with further insights.

Implementation stage

Framing	Development	Validation	Communication
Co-define policy questions, priorities and targets	Data gathering, narrative co-creation	Feedback gathering	Co-created outputs such as policy briefs or results

Resource requirements and prerequisites

Effective inter-institutional planning committees and working groups require dedicated institutional resources to ensure sustained engagement for operational activities and other extraordinary needs. To function effectively, the planning committee requires: a well-structured core team with clear leadership; secure participation of key ministries, such as energy or environment; and strategic engagement with external technical expertise. Formalising the committee along with the associated roles, responsibilities, objectives, resources and constraints is crucial to achieving legitimacy and longevity. Participants should commit to the process for its duration.

Practical considerations

Strengths: Committees bring together diverse expertise (Figure 5), making them well-suited to addressing complex issues critical to the energy transition. Committees' collaborative nature enables the integration of multiple perspectives, which can foster stronger consensus-building and more comprehensive solutions. They also have a clear mandate, enhancing communication, reduce the risk of conflicting policies and build a strong case for implementation and funding allocation.

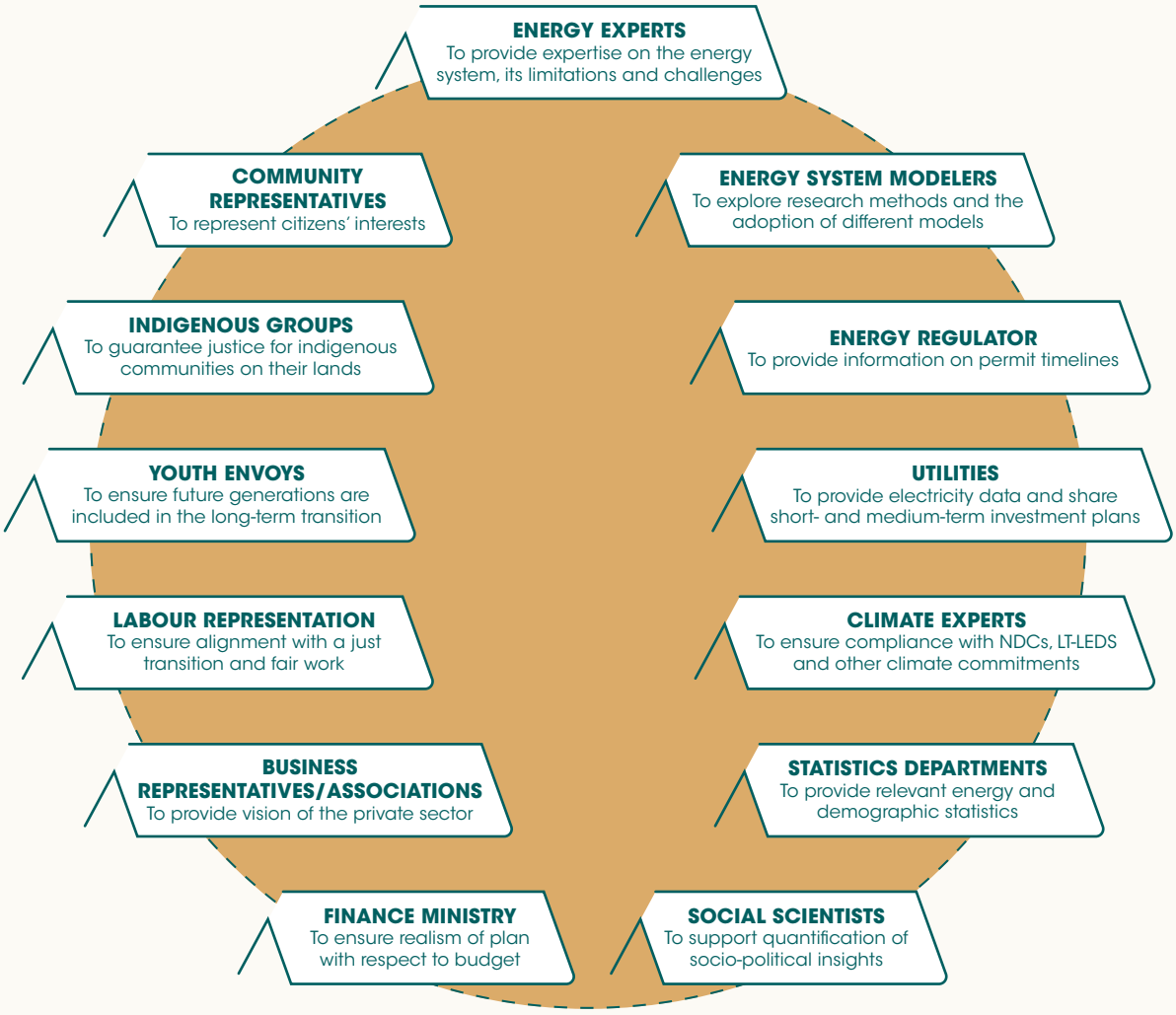
Challenges: Committees may have slow decision-making processes with limited flexibility, and can be resource intensive. The efficiency and effectiveness of committees may suffer due to internal power dynamics or a lack of mutual understanding among members, which can hinder collaboration. Sustaining enthusiasm and commitment over a prolonged period is another common challenge. Additionally, the prioritisation of certain disciplines, sectors or policies over others can reflect self-interest, potentially skewing the outcomes.

Limitations: Large committees or those with disproportionate representation from different energy sectors can limit effectiveness by slowing decision making, narrowing perspectives or creating imbalances in stakeholder influence. Differences in participants' knowledge of energy scenario development can also create disparities in contributions. Impartiality may also be compromised, depending on the leadership and mandate guiding the committee's work.

Implementation evidence

Countries worldwide have adopted various approaches to structuring transdisciplinary, cross-sectoral and cross-ministerial committees and working groups to promote participatory energy planning. For instance, Cyprus employs a hierarchical system of technical committees feeding into ministerial decision making, ensuring that insights from diverse domains inform policy. Ghana's Energy Planning Committee integrates multiple economic sectors, underscoring a holistic approach. In another case study presented in LTES activities, Botswana presented a multi-sectoral steering committee, including members from the power utility, environment ministry and private sector, to oversee long-term energy scenario development (IRENA, 2023c). These examples highlight the significance of inter-sectoral collaboration in crafting effective energy plans.

Figure 5 Possible participants in a working group or steering committee



Notes: LT-LEDS = Long-Term Low Emission Development Strategies; NDC = Nationally Determined Contribution.

4.2.2 NETWORK/HUBS

Establishing a network or hub involves the creation of a temporary or permanent structure to co-ordinate activities, share knowledge and build a modelling ecosystem. Canada leverages its Energy Modelling Hub (EMH), a university-based structure, to connect modelling experts with clean energy policy makers. This hub fosters dialogue among energy modellers, policy makers and other stakeholders through various engagement activities, including an annual forum, regional and modelling workshops, and thematic committees.

Implementation stage

Framing	Development	Validation	Communication
Co-development of policy questions and discussion about assumptions	Creation of open-source data platforms Co-development of modelling tools	Expert peer review and scrutiny in an environment that allows for continuous feedback loops	Presenting scenarios to experts and modellers Modellers scrutinise policies and scenarios (bilateral)

Resource requirements and prerequisites

Establishing and maintaining collaborative networks requires sustained funding to support both permanent and temporary staff, as well as activities such as workshops and meetings. Adequate technology infrastructure, including software for online engagement and shared databases, tools or models, is essential for effective co-ordination and collaboration. A strong governance structure with expertise in relevant topics is necessary to steer activities and provide vision, while open communication channels enable co-ordination and networking among participants. Political will at various levels is critical to foster connections and ensure alignment with broader goals. Additionally, recognising and accommodating resource disparities among network members helps maintain inclusivity and balance. A robust monitoring and evaluation mechanism is also required to assess progress and ensure network/hub objectives are met.

Practical considerations

Strengths: Collaborative networks provide a platform for regular interaction among technical civil servants, policy makers and academics, fostering alignment and avoiding duplication of efforts. These networks leverage the diverse capacities, strengths and scrutiny of participating institutions, enabling more relevant and impactful contributions to energy planning.

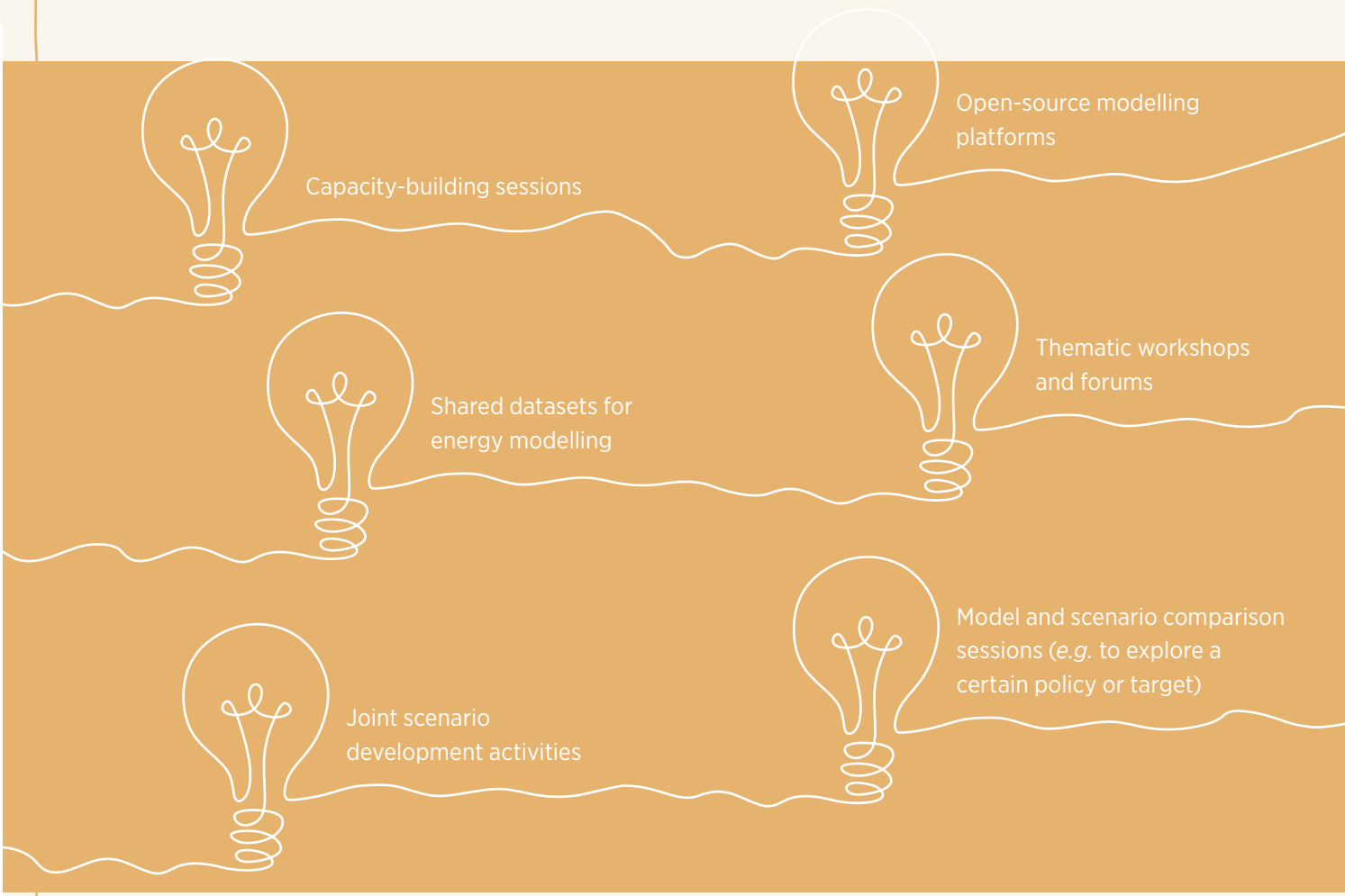
Challenges: Sustained funding requirements can be substantial, posing a barrier to long-term operation. Differing institutional priorities may complicate co-ordination and alignment of objectives. Political will is a crucial factor in ensuring the network's outputs contribute effectively to governmental goals and visions.

Limitations: These networks are best suited for ongoing collaboration rather than singular projects. The success of formalised networks and hubs relies heavily on the sustained commitment of a broad and diverse group of members, making continuity a potential vulnerability.

Implementation evidence

Canada, the World Energy Council and the PAC consortium all use networks and hubs to support their energy scenario development and communication processes. Canada's Energy Modelling Hub (EMH), a university-based network, connects modelling experts with policy makers and stakeholders to build a shared understanding of sustainable energy systems. This collaborative approach, featuring an annual forum and thematic committees, fosters dialogue and knowledge exchange among a wide range of participants and informs national and provincial energy planning and policy making directly. The World Energy Council applies a different approach, using its country committees to organise activities and tools to engage stakeholders in interactive simulations and discussions. These activities allow participants from business, civil society, government and investment sectors to explore different pathways to the energy transition, fostering a shared understanding of the challenges and opportunities involved, showcased in their World Energy Scenarios. The PAC, focused on a Paris-compatible energy scenario for Europe, leverages its consortium structure, which includes prominent environmental NGOs and TSOs. This network facilitates knowledge exchange among modellers and system planning experts and empowers civil society organisations to influence policy discussions through developing ambitious Europe-wide net-zero scenarios.

Box 4 Possible activities and outputs



4.3 DISSEMINATION

4.3.1 PUBLIC PRESENTATIONS AND REPORTS

Scenario practitioners use public presentations as a strategic tool throughout the energy scenario development process to inform, engage and, in many cases, gather feedback from stakeholders. These presentations, public hearings and reports typically include introductory sessions to outline the process, updates during intermediate stages to share progress and solicit input, and discussions of partial or final outcomes to present findings and encourage dialogue. Public presentations are essential for effectively communicating with non-expert audiences and fostering broader stakeholder buy-in.

Implementation stage

Framing	Development	Validation	Communication
Present aims and objectives, timelines, etc.	Present policy questions and other information to stakeholders	Present draft results	Present scenarios to all types of stakeholders

Resource requirements and prerequisites

Conducting presentations requires planning teams to deliver clear and engaging content, and calls for skilled communication, possibly through dedicated communication and external relations teams. Technological support may also be necessary to enhance presentations, especially for online formats. Specific objectives should be outlined in advance, including introducing the participatory process for energy scenario development, presenting progress, gathering feedback on preliminary results and communicating final outcomes. Additionally, a well-defined methodology for collecting and incorporating audience feedback is essential to improve the energy scenarios being developed.

Practical considerations

Strengths: Presentations provide an opportunity to educate non-expert groups about energy scenario development, fostering greater understanding and engagement. They also serve as a platform to gather feedback from a broad audience, including stakeholders who might otherwise not participate. Online presentations, in particular, offer a highly efficient way to reach even larger and more diverse audiences.

Challenges: Crafting an appropriate narrative is key to effectively describing the energy scenario modelling process and its outcomes, especially for non-expert audiences. Presenters must employ non-technical language and ensure clarity to communicate complex ideas in an accessible manner.

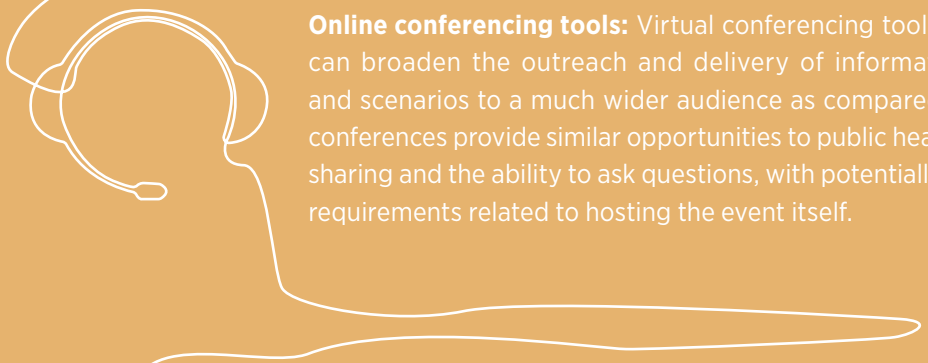
Limitations: Due to the nature of public presentations and the diverse audience, it may be necessary to limit the depth and complexity of the content. Additionally, the time available for presenting extensive results or content or answering questions can be constrained, potentially limiting the scope of the discussion.

Implementation evidence

Dissemination is a common feature across all case studies, but it is important to note the variation in how countries strategically combined different tools to effectively engage stakeholders. These tools were tailored to target specific audiences and achieve their objectives while integrating methods such as the workshops, surveys and public consultations discussed earlier. For example, Cyprus prepared concise policy briefs tailored for ministries and national authorities, as well as sector-specific briefs addressing topics such as employment policy and energy transition impacts. Brazil leveraged virtual debates during the development of its National Energy Plan 2050 to highlight diverse perspectives and build consensus through participatory processes such as workshops and public consultations. Additionally, Chile held various public hearings to ensure broad stakeholder engagement.

Box 5 Tools for publicly presenting and discussing scenarios

Public hearings: Formal gatherings provide a platform for government agencies or other project/scenario developers to present information and proposals related to energy plans or policies to the public. These hearings are also an opportunity for the public to give feedback, express concerns and ask questions. The hearings can also be easily advertised on social media.



Online conferencing tools: Virtual conferencing tools, such as webinar platforms, can broaden the outreach and delivery of information regarding energy plans and scenarios to a much wider audience as compared to in-person events. Online conferences provide similar opportunities to public hearings with regard to feedback sharing and the ability to ask questions, with potentially lower financial and resource requirements related to hosting the event itself.

Reports and publications: Written publications can deliver highly detailed information about energy plans and scenarios, providing full narratives, details about the assumptions and data, and visualisations showcasing different scenarios and results. Such reports can be highly useful for stakeholders with the required technical knowledge, and can provide a clear reference for building on this work if needed.

4.3.2 VISUALISATION TOOLS, GAMES AND SIMULATIONS

Detailed energy system plans can be data-heavy and difficult to interpret for non-experts due to the highly technical nature of energy system planning. Countries have highlighted that visualising data, pathways and results can be vital to communicating complex ideas, policy-making implications and investment needs. This can be achieved through a variety of methods, including public-oriented charts and graphs, interactive dashboards, and simulations and games.

Implementation stage

Framing	Development	Validation	Communication
Present data on current statistics and existing scenarios/policies	Test and visualise early results and scenarios	Present draft results	Set up dashboards and interactive tools to increase outreach

Resource requirements and prerequisites

Developing and utilising interactive visualisations requires access to appropriate technology, including necessary licences and subscriptions, as well as sufficient knowledge and capacity to create and interpret the tools. To ensure successful engagement, clear instructions should be provided to the audience on how to interpret and interact with the tools. It is also essential to define key concepts related to energy scenarios and to highlight the information most relevant to different stakeholder groups. For example, stakeholders interested in affordability may benefit from having scenario results presented in terms of energy prices and how different scenario developments would affect the average household cost of energy in the short, medium and long term.

Practical considerations

Strengths: Interactive visualisations complement and enhance storytelling, capturing the audience's interest through engaging and dynamic presentations. They provide an effective way to reach a broader audience, particularly non-expert groups, by making complex information more accessible and interactive.

Challenges: Creating effective visualisations requires dedicated training and expertise, which may not always be available within the planning team. Alternatively, outsourcing the task to specialised contractors incurs additional financial cost. Ensuring high-quality visualisation while balancing these personnel and financial constraints can be challenging.

Limitations: Interactive visualisations depend on reliable internet access and may require accompanying educational resources, as seen in the Belgian case for the "My2050" app. Furthermore, as a one-way communication tool, they may not fully address audience questions or provide opportunities for dialogue, limiting their explanatory potential.

Implementation evidence

It is important to tailor the visualisation of energy scenarios to the objectives and the needs of the target stakeholders. While experts, academics and financial institutions might benefit from detailed charts with downloadable data for in-depth analysis, non-expert audiences such as students and the general public often find game-like tools and interactive calculators more engaging and accessible. This flexibility ensures that scenario communication is both effective and inclusive.

For example, most countries employ simple, clear graphs to illustrate the impacts of energy scenarios on factors such as renewable energy share and electricity costs, making the information accessible to a broad audience. The calculators used by Belgium and Kenya take an interactive approach, enabling users to manipulate variables and assumptions, demonstrating how different inputs influence emissions and energy outcomes. This hands-on interaction fosters a deeper understanding of energy plans and policies.[6]

Some countries have gone further by "gamifying" scenario communication. The International Energy Agency (IEA) in collaboration with the Financial Times has developed a climate role-playing online game, while activities like the COP Simulations allow participants to explore different policies and behaviours interactively and in-person. The United Arab Emirates also built an interactive board game to communicate scenario results to high-level policy makers (IRENA, 2020). These gamified tools simplify complex technical concepts, making them more engaging and understandable, especially for non-expert audiences. By presenting the energy transition in an interactive and experiential format, they help demystify intricate processes and foster broader engagement.

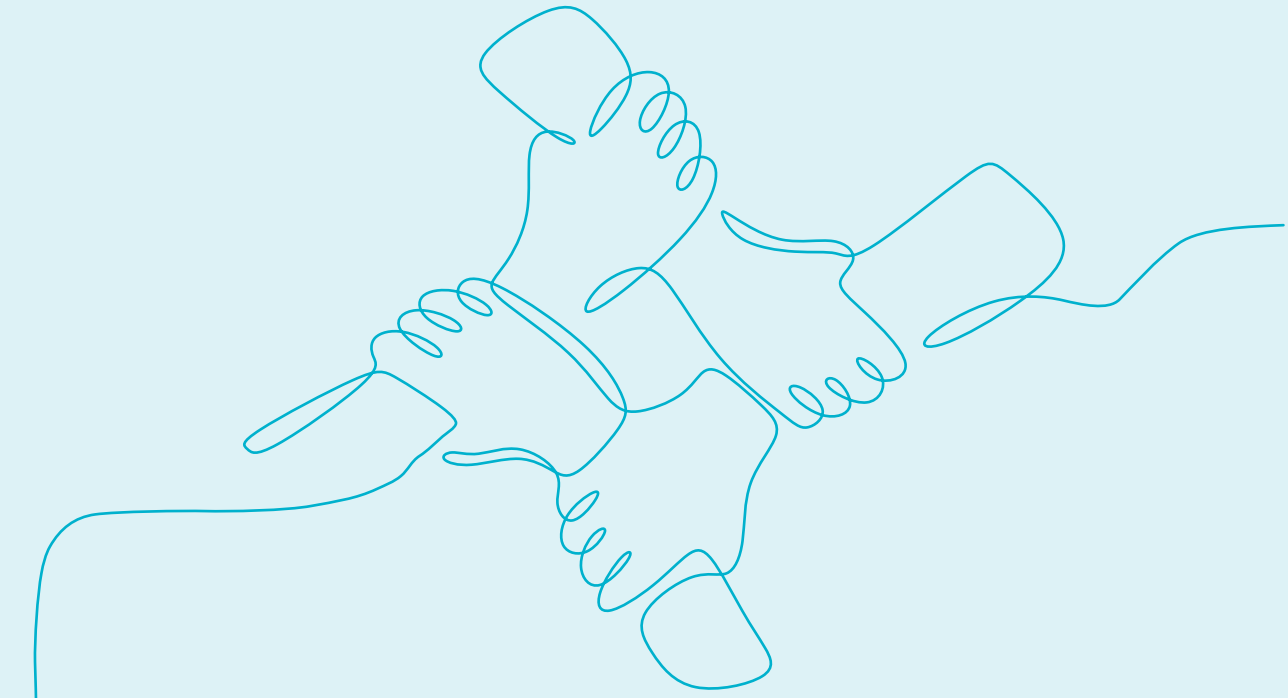
Box 6 Tools for visualising and gamifying energy scenarios

Data visualisation tools: Business intelligence (BI) tools, such as Tableau and PowerBI, statistical software such as R and Stata, and other tools such as Excel and Python, have all been used to visualise quantitative data in colourful charts and graphs that can be easily read and navigated when hosted on online platforms such as dashboards, or in static media such as publications.

Energy calculators: Energy calculators can be used to allow users to manipulate different assumptions and triggers to form their own scenarios. It gives users the ability to see how adjusting different inputs can lead to different results and emissions, giving them a better understanding of plans and policies, as well as giving them an indication of how their own behaviour and role can affect the energy transition.

Simulations and games: Simulations and games have been developed to "gamify" scenario communication, allowing users to play games that navigate the energy transition by presenting different policies and behaviours in an interactive manner, leading to a better understanding of more technical concepts. These simulations and games can be developed for digital deployment to reach a broad audience and benefit from continuous updating, or can be developed for analogue play to build a general understanding about the trade-offs facing energy system planners.

[6] *Other examples are also showcased in Chapter 7.*



5. CASE STUDIES

This chapter presents case studies of participatory processes conducted by government and non-government institutions, as shared during exchanges within the LTES Network and beyond. This chapter makes clear reference to the tools and stakeholders in the participatory process mentioned in previous chapters. It aims to present real-life examples of participatory processes that involved a wide range of stakeholders and included innovative tools to ensure inclusivity and engagement. The main focus is on national scenario development processes; however, examples of non-government processes were included to provide novel and unique applicable methodologies and cross-cutting lessons learnt.

Understanding the case studies

Each case study is divided into four main components, outlining different aspects of stakeholder engagement:

1. At the top of the first page, icons are used to represent the different stakeholders that may be engaged (see Chapter 3), and their level of engagement is highlighted via a greyscale colour system.

2. The first page then consists of the executive summary, which contains the following elements:

   a. Short description of the participatory process and the challenge it aims to address.
   b. Governance – the institution that co-ordinated this process, and the other institutions that were involved.
   c. Scope – the geographical and sector scope of this process.
   d. Objectives – the purpose of holding this participatory process.
   e. Engagement activities – the tools and activities used throughout this process.
   f. Key outcomes – the main results of this process.
   g. Resources – the financial, human and technological resources used.

3. The second page of each case study visualises the participatory process in the example. The first column (in **blue**) indicates inputs into the process, the second column (in **green**) indicates the process itself and its related activities, and the third column (in **orange**) indicates the outcomes of the activities and the complete process. Arrows are used to indicate the stages of these processes and any iterative or bilateral interaction between different elements.

4. At the bottom of the second page, highlights and lessons learnt from these procedures are outlined as presented by the organising institutions.

Table 1 acts as a "cheat sheet" to allow the user to navigate to the case study most relevant to their own context.

Table 1 Summary of case studies

Country/ institution	Planning context	Primary objectives	Key stakeholders	Methods used	Resource requirements	Transferable elements
 Belgium	My2050 energy transition education	Build public literacy on energy transition Engage youth	Students, teachers, general public	Interactive calculator, classroom activities, climate coach programme	Medium–high (tool development, nationwide rollout)	Educational calculator methodology; youth engagement approach
 Brazil	Energy Transition Programme with focus on net zero by 2050	Build consensus by exploring scenarios and addressing divergences in technology policies	Government agencies, financial institutions, private sector, civil society, academia	Virtual debates, partner meetings, workshops, webinars for validation and dissemination	Medium (USD 284,736 total budget, project teams from 3 institutions)	Multi-institutional partnership model; virtual engagement approach; consensus-building through divergence mapping
 Canada	Net-zero transition	Co-ordinate energy modelling activities Foster dialogue between modellers and policy makers	Academia, government agencies, private sector, modellers	Energy Modelling Hub, annual forum, thematic committees, workshops	High (CAD 5 million funding, permanent staff of six)	Modelling hub structure; scientific community engagement framework
 Chile	National energy planning with focus on regional diversity	Build public trust and legitimacy Ensure inclusive representation	General public, industry, regional communities, policy makers	Workshops, public hearings, consultation registry, online surveys	Medium–high (multiple regional workshops, dedicated team)	Consultation registry approach; regional workshop methodology
 Colombia	Just energy transition with a territorial focus	Incorporate social dialogue and intersectional approach Shift from centralised to regional planning model	Government ministries, regional authorities, indigenous communities, civil society, academia	Multisectoral dialogue forums, workshops, focal points in key territories, collaborative research	Medium (dedicated staff for regional engagement and focal points)	Territorial focal point strategy; planning integration of social and environmental aspects

Country/ institution	Planning context	Primary objectives	Key stakeholders	Methods used	Resource requirements	Transferable elements
Cyprus	National Energy and Climate Plan	Communicate complex scenarios to policy makers Secure financing support	Ministries, national authorities, vulnerable households	Tailored policy briefs, visualisation tools, targeted sector reports	Low–medium (focused on efficient communication)	Policy brief development process; sector-specific communication approach
Finland	Carbon neutrality by 2035	Create shared vision with stakeholders Develop sector roadmaps	Industry federations, government ministries, citizens	Interactive workshops (World Cafés, Futures Wheel, Me-We-Us), surveys, sector roadmaps	Medium–high (established institutional process)	Interactive workshop methods; sector roadmap development process
Ghana	Strategic National Energy Plan with climate neutrality target	Develop sector-wide consensus Co-ordinate cross-sector inputs	Regulatory agencies, utilities, policy makers, CSOs, private sector, international partners	Energy Planning Committee, structured stakeholder meetings, feedback sessions	Medium (centralised committee structure, focused engagement)	Structured committee approach; stakeholder mapping methodology
Panama	Grid expansion and renewable energy development	Democratise energy planning Address energy access and poverty	Civil society, private sector, utilities, indigenous communities, local leaders	15 000 hours consultations, white paper development, nationwide discussions	High (extensive consultation, broad geographic coverage)	Energy democratisation framework; indigenous community engagement approach
United Arab Emirates	2050 National Energy Strategy	Align utility plans with national targets Balance short- and long-term goals	Utilities, ministries and local authorities, task forces	Bottom-up and top-down dual approach, task forces, working groups	Low–medium (focused engagement with utilities)	Dual approach methodology; utility alignment framework
KCERT 2050 (Kenya Carbon Emission Reduction Tool)	Energy transition and financial decision making	Enhance scenario communication Support financing decisions	Policy makers, finance ministry, local communities	Interactive calculator	Medium (tool development, multiple institutions)	Financial visualisation methodology; policy-finance communication approach
PAC Consortium	European grid planning	Enhance decarbonisation ambition Develop Paris-compatible scenario	NGOs, TSOs, technical institutions	Workshops for scenario-building, modeller exchanges, publications	Medium–high (consortium approach)	Civil society participation framework; multi-stakeholder consortium model
World Energy Council	Global energy scenarios	Identify regional priorities Create socio-political narratives	Academia, government, industry, start-ups	Regional deep dives, policy simulator, World Energy Trilemma	High (global network, multiple country committees)	Socio-political framework; simulation tools methodology

5.1 BELGIUM

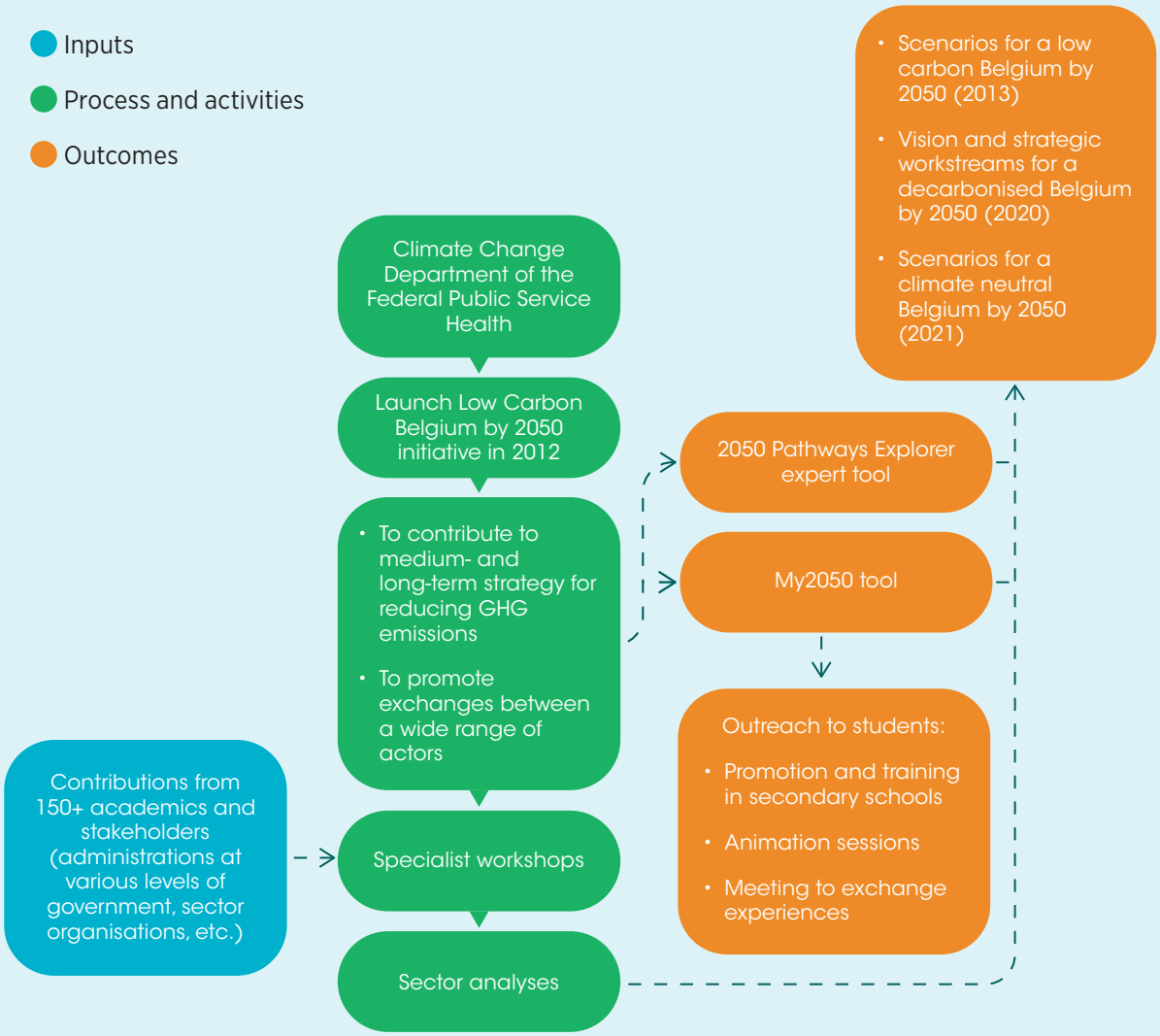
Scenarios as a communication tool: how Belgium utilises an interactive participatory process to communicate climate and energy transition topics to the country's youth

Youth constitute a vital driver for the energy transition. The Climate Change Department of the Federal Public Service Health, Food Chain Safety and Environment aimed to develop a strategy to engage citizens, especially youth, as a way to increase awareness and education through its energy and climate scenario work. Under the "Low Carbon Belgium by 2050" initiative, the Belgian government has developed their version of My2050, a "calculator" tool enabling citizens and students to envision their own transition scenarios towards a sustainable future.[7] In 2023, the My2050 tool was updated to allow students to explore net-zero scenarios for Belgium by 2050.

Governance	Spearheaded by the Climate Change Department of the Federal Public Service Health.
Scope	Geographical: National and local levels. Sector: Transport, buildings, industry, energy and agriculture.
Objectives	My2050 is dedicated to engaging citizens, particularly secondary school students, in a substantive dialogue focused on transitioning society towards a net-zero emissions future.
Engagement activities	• Nationwide, more than 1 400 sessions and interactive discussions have been conducted, and more than 28 000 pupils have benefited from the support of a climate coach since the project was launched in 2017. • Teachers were equipped with a comprehensive manual to effectively utilise the tool in classroom settings.
Key outcomes	The climate coach project aims to inspire and prepare students to make an active contribution to building a climate-neutral society by developing their understanding of the transitioning process toward a net-zero emission future and their ability to communicate and discuss it.
Resources	The Climate Change Department of the Federal Public Service Health, Food Chain Safety and Environment provides financial backing, and develops and oversees the project. GoodPlanet, a non-governmental organisation, manages the logistical aspects through a partnership agreement. This includes recruiting young professional coaches, promoting the initiative within the educational sector, and ensuring the nationwide allocation and effective execution of sessions. Additionally, these coaches receive their training at the start of the year from the aforementioned Climate Change Department.

[7] *Overview of tool's history: www.imperial.ac.uk/2050-calculator/history/.*

Process



Note: GHG = greenhouse gases

Highlight

Outreach to students through an interactive tool ensures planners reach a broad slice of society who will be active changemakers in the years to come.

Lessons learnt

1. Engaging school children ensures broader citizen participation and enhances knowledge and awareness of the energy transition and an understanding of complex energy scenarios.
2. Transfer of training and teaching knowledge from energy planners to teachers can ensure long-term sustainability of this activity and a broader reach and impact.
3. Discussing climate neutrality scenarios with pupils is an effective way to communicate important information to both parents and children, fostering a deeper understanding of energy and climate transition across generations.

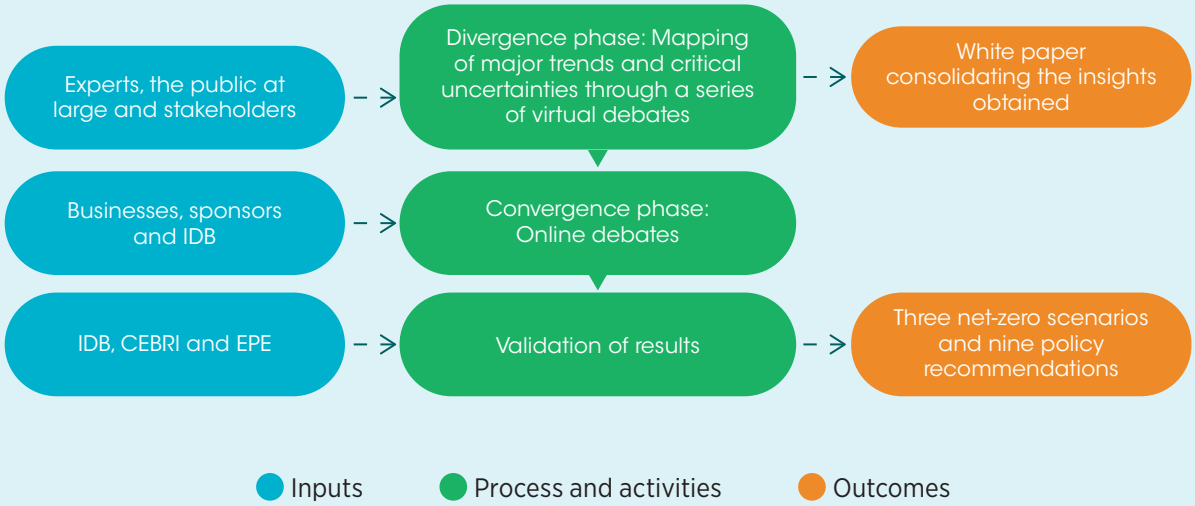
5.2 BRAZIL

Partnerships for stakeholder-led net-zero scenarios: how Brazil leveraged a diverse partnership between government, financial institutions and the scientific community to develop a consensus-based energy roadmap

The first phase of the Energy Transition Programme (PTE), run jointly by the Inter-American Development Bank (IDB), the Brazilian Centre for International Relations (CEBRI) and the Energy Research Office (EPE), was established to assess the constraints and the potential of Brazil's energy transition and to offer an independent and open contribution to the formulation of public policy geared towards Brazil's energy mix in 2050.

Governance	The programme was run jointly by EPE, IDB (multilateral financing institution) and CEBRI, with the stakeholder engagement organised by CEBRI. Modelling activities were conducted by CENERGIA (research lab).
Scope	Geographical: National. Sector: Energy and climate with a focus on land use.
Objectives	The programme aimed to help build consensus by supporting the analysis of critical uncertainties and by exploring scenarios and sensitivities, and addressing divergences in technology policies in the scenarios.
Engagement activities	• Virtual debates with a wide range of stakeholders to map major divergences. • Virtual debates to understand convergences and form logic for scenarios. • Partner meetings to validate results. • Workshops and webinars to disseminate results.
Key outcomes	Three different scenarios were prepared that converge on Brazil reaching zero-net greenhouse gas emissions in 2050: (a) Brazil transition; (b) Alternative transition, and (c) Global transition.
Resources	Financial: The total budget for PTE1 was USD 284 736 for IDB, CEBRI, private entities and EPE.

Process



Notes: CEBRI = Brazilian Centre for International Relations EPE = Energy Research Office; IDB = Inter-American Development Bank.

Highlight

A jointly developed scenario study between government, a multilateral finance institution and a think tank leveraged the strengths of each institution in a collaborative manner, bringing in various other stakeholders to shape the scenario's narrative, improve its quality and expand data availability.

Lessons learnt

1. Online tools for virtual conferencing and polling were highly effective for reaching stakeholders across the country.
2. Completing the necessary surveys within a workshop was more effective than outside workshop hours due to the limited time participants have available.
3. Workshop design should be compatible with specific objectives, for example informing and aligning on a certain topic or promoting deep exploration of topics and debate.

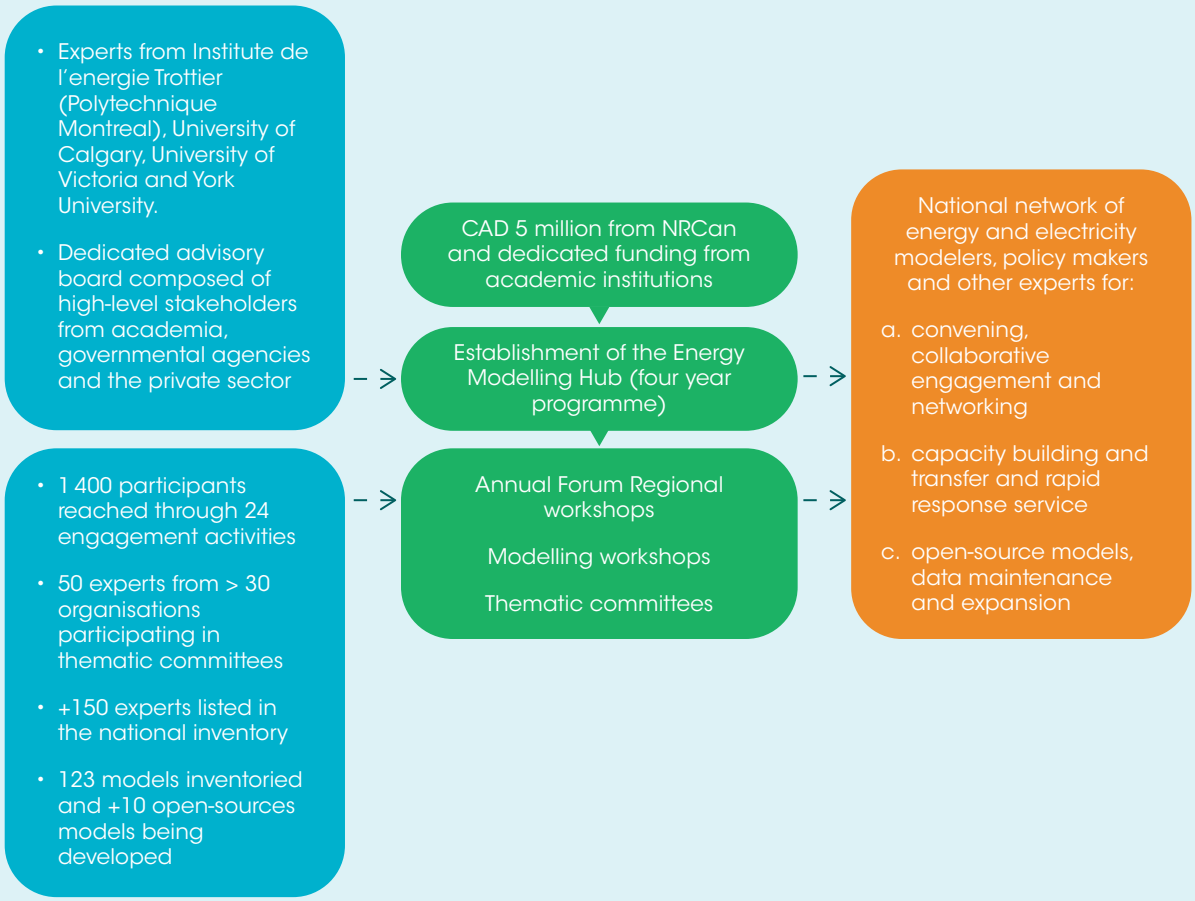
5.3 CANADA

Collaboration with the scientific community: how Canada leverages its diverse energy modelling capacities for co-operative scenario development

With the second-largest land mass in the world and a diverse range of energy resources, Canada faces unique challenges in transforming its energy system. Its federal structure, which grants significant political autonomy to its ten provinces, adds complexity to national energy planning and co-ordination. In response, Natural Resources Canada (NRCan) established the Energy Modelling Hub (EMH) in 2022 as a national forum to co-ordinate energy modelling efforts across the country. EMH serves as a network of energy and electricity modellers, policy makers and experts dedicated to guiding Canada's transition to a net-zero economy. Its mission is to bridge the gap between public policy and energy modelling communities by facilitating dialogue, enhancing access to modelling expertise, and promoting the use of open-source tools and data. By fostering collaboration and providing timely, evidence-based insights, EMH supports informed decision making to advance a decarbonised, affordable, reliable and equitable energy system for Canada.

Governance	EMH is a university-based structure overseen by an independent advisory board comprising academia, government agencies and the private sector. The board provides strategic direction and ensures the integration of diverse perspectives.
Scope	Geographical: Federal and provincial-level involvement. Sector: Power, energy and climate.
Objectives	To expand access to energy models, data and expertise across Canada, strengthen independent modelling capabilities, and promote collaborative efforts aimed at achieving net-zero targets.
Engagement activities	Among other activities, EMH organises an annual forum, a multi-model comparison forum, regional and modelling workshops, and technical advisory committees, all of which aim to foster dialogue and the exchange of best practices. EMH issues open calls to the modelling community for model development and applications. Additionally, EMH leverages its open-source models and tools, such as the IDEA visualisation tool and M3 Platform, for engagement sessions with diverse stakeholders such as students, modellers, NGOs and government representatives. These sessions focus on various topics, including the assessment of energy policies.
Key outcomes	• Influenced specific policy developments and energy strategies. • Enhanced decision-making processes through informed insights. • Promoted the concept of "co-operative federalism".
Resources	Financial: Funded with CAD 5 million from NRCan, EMH's financial support is further augmented by contributions from private foundations and other federal agencies. Human: EMH is overseen by an executive committee and supported by a permanent staff of six. Its operations are further assisted by volunteers from thematic committees and partners from different universities.

Process



Highlight

The EMH Forum and workshops successfully convened hundreds of energy modellers, government civil servants and policy makers, fostering a direct exchange of insights within the national modelling ecosystem to inform and respond to policy questions.

Lessons learnt

1. An institutional approach combined with "co-operative federalism" aligns effectively with Canada's constitutional requirements, facilitating co-ordinated energy planning across provinces.
2. The rapid pace of technical change and interdependencies demands input from a diverse range of experts, including those specialising in labour, supply chains and land use.
3. Open-source models and data play a critical role in enhancing transparency and credibility, enabling broader participation and scrutiny in the energy planning process.
4. Longer-term funding commitments are essential to sustain progress and ensure the continuity of collaborative efforts.

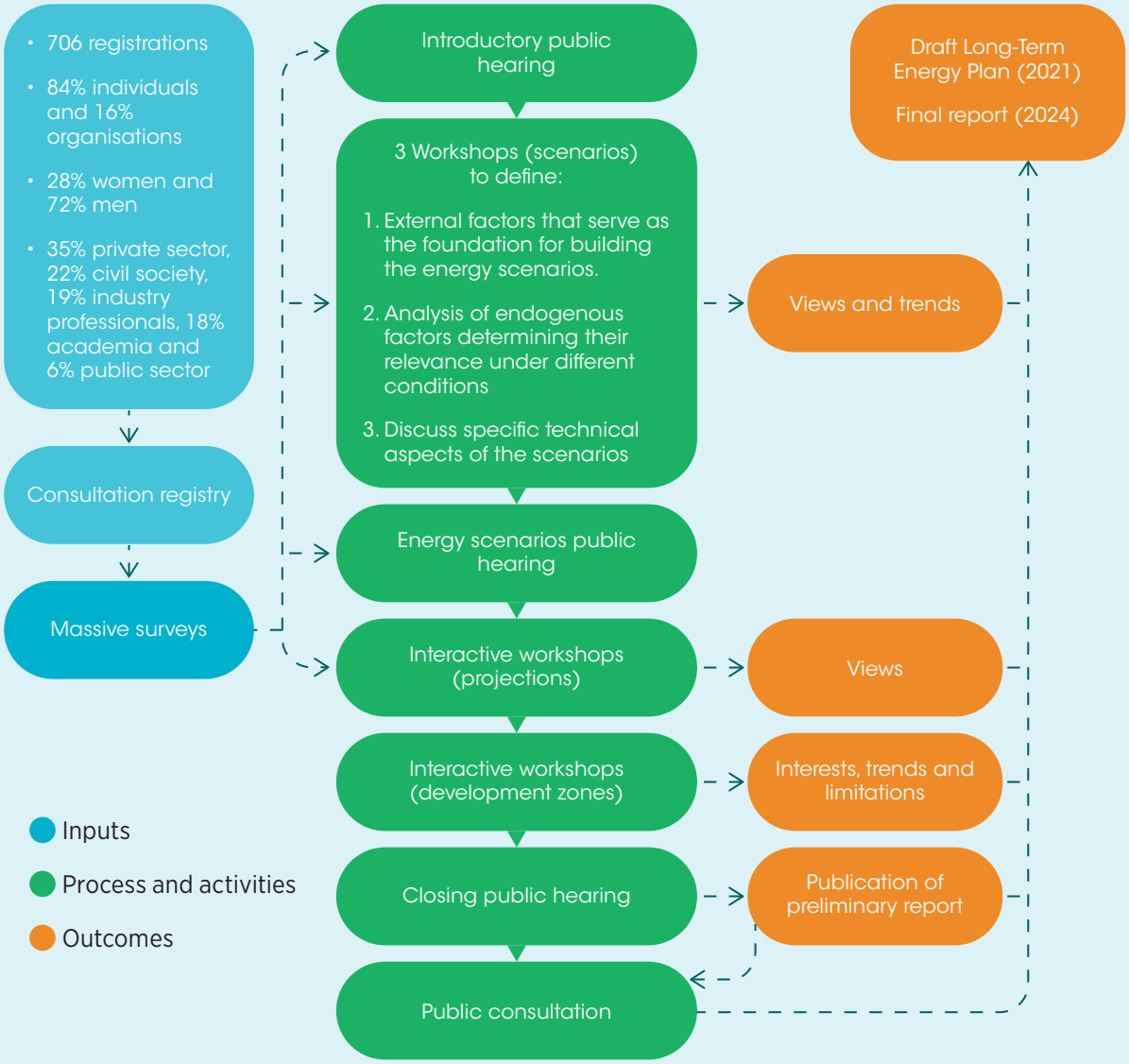
5.4 CHILE

Prioritising public engagement: how Chile's engagement strategy allows its people to actively contribute to planning a just and inclusive energy system

Chile's Ministry of Energy aims to enhance citizen and minority involvement in shaping public policy. This commitment to broadening participation was critical to the development of the Long-Term Energy Plan (Planificacion Energética de Largo Plazo, PELP). It includes developing LTES, pinpointing development zones for electricity generation, and forecasting energy demand and supply. This inclusive approach ensures diverse perspectives are considered, making energy policies more representative and comprehensive.

Governance	Led by the Ministry of Energy, the collaborative process engages several key ministries including mining, environment and agriculture. The ministry also spearheads a working group that encompasses citizens, public institutions and an academic support group.
Scope	Geographical: National and territorial. Sector: Energy and power.
Objectives	To achieve transparency and citizen legitimacy in decision making, obtain robust results by incorporating diverse perspectives, and enhance the acceptance of policy decisions.
Engagement activities	The process includes focused workshops on scenarios, projections and development zones. Additionally, it incorporates public hearings, consultations and online surveys to ensure wide-ranging participation.
Key outcomes	Citizen engagement has been a key feature in the national effort to legitimise the decision-making process and integrate community input. This inclusive approach fosters constructive dialogue, crucial for shaping the future of the country's energy policies.
Resources	The initiative is supported by the internal resources of the Ministry of Energy, along with a dedicated team within the ministry, ensuring focused and sustained effort towards these goals.

Process



Highlight

Chile's Citizen Consultation Registry is an online platform where individuals and organisations formally register to participate in the energy planning process. Registrants gain access to all PELP documents and can submit suggestions and comments throughout the process. The registry collects data on participants' region, gender and organisational affiliation, allowing the government to monitor representation and strategically improve participation from underrepresented segments of society.

Lessons learnt

1. Multidisciplinary teams in the planning process are essential for success. Chile's approach integrates experts from technical and social disciplines to design strategies that address both the technical aspects of energy planning and the specific needs of diverse stakeholder groups.

2. Participation's impact relies on the chosen methodology of engagement.

3. This approach has successfully advanced citizen involvement in strategic decisions by enabling the ministry to collect input from traditionally underrepresented groups.

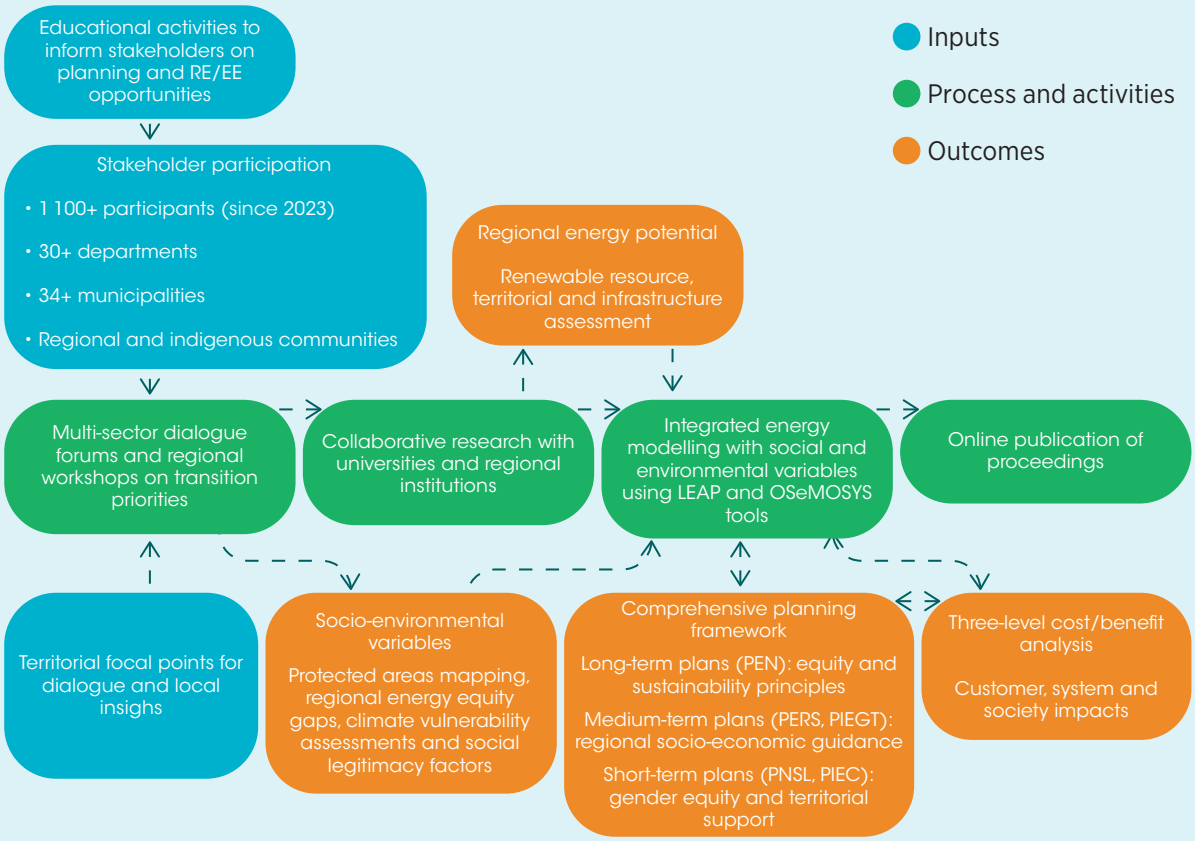
5.5 COLOMBIA

Shifting from national to territorial focus: how Colombia's energy planning incorporates social dialogue and intersectional approaches to drive a just energy transition

Colombia's energy sector is in transition, moving from a focus primarily on energy reliability and maximising revenue from coal and oil, to addressing climate goals while ensuring development across all regions of the country. The Unidad de Planeación Minero Energética (Mining Energy Planning Unit) (UPME) leads this transformation with a participatory approach to planning that emphasises territorial inclusion, particularly for previously marginalised regions and indigenous communities.

Governance	Planning workshops are led by UPME, with multi-sector involvement across government ministries, regional authorities and communities. Framed on the territorial strategy of the Ministry of Mining and Energy.
Scope	Geographical: National with regional and territorial disaggregation. Sector: Energy sector, with linkages to mining, climate action and social development.
Objectives	To shift from a centralised planning model to a territorial framework that incorporates social dialogue and local participation, ensuring that energy planning contributes to the socio-economic development of all regions while promoting climate action and a just energy transition.
Engagement activities	• Multi-sectoral dialogue forums and workshops engaging citizens across departments and municipalities. • Educational and training activities about energy planning processes. • Active community involvement in plan development and validation. • Collaborative research with universities and regional institutions. • Deployment of focal points in key territories for the energy transition.
Key outcomes	Since 2023, UPME has engaged over 1100 participants across 30 departments and 34 municipalities in its participatory processes. The process has integrated social and environmental variables into energy planning models and shifted from cost minimisation to a more holistic approach that considers regional socio-economic benefits.
Resources	UPME allocates dedicated staff for regional engagement, with focal points strategically positioned in key territories.

Process



Notes: EE = energy efficiency; LEAP = Low Emissions Analysis Platform; OSeMOSYS = open source energy modelling system; PEN = Plan Energético Nacional; PIEGT = Planeamiento Integrado de la Expansión en Generación y Transmisión; PNSL = Plan Nacional de Sustitución de Leña; PIEC = Plan Indicativo de Expansión de Cobertura Energética; RE = renewable energy.

Highlight

Colombia's innovative "focal points" strategy places UPME staff members directly within communities across the country, creating continuous channels of communication that build trust and strengthen engagement. These focal points belong to the communities they serve, which enables UPME to maintain ongoing dialogue with regions that were previously underrepresented in energy planning processes.

Lessons learnt

1. Shifting from a purely technical approach to an integrated territorial framework requires multi-sectoral dialogue and strategic deployment of focal points living within communities to facilitate ongoing engagement.

2. Incorporating socio-environmental variables into energy planning models is essential for a just and sustainable transition, particularly in a country with high renewable energy potential but significant developmental disparities.

3. A skilled moderator is vital to ensure that engagements with communities – which are usually limited in time – are efficient, gather useful insights and priorities, and do not veer off-topic.

4. Continuity of focal points is still challenging. The territorial framework must be constantly revised for improvement and to ensure continuity and stability.

5.6 CYPRUS

Reports and briefs for delivering information: how Cyprus utilises concise publications and other materials to communicate scenario results to policy makers

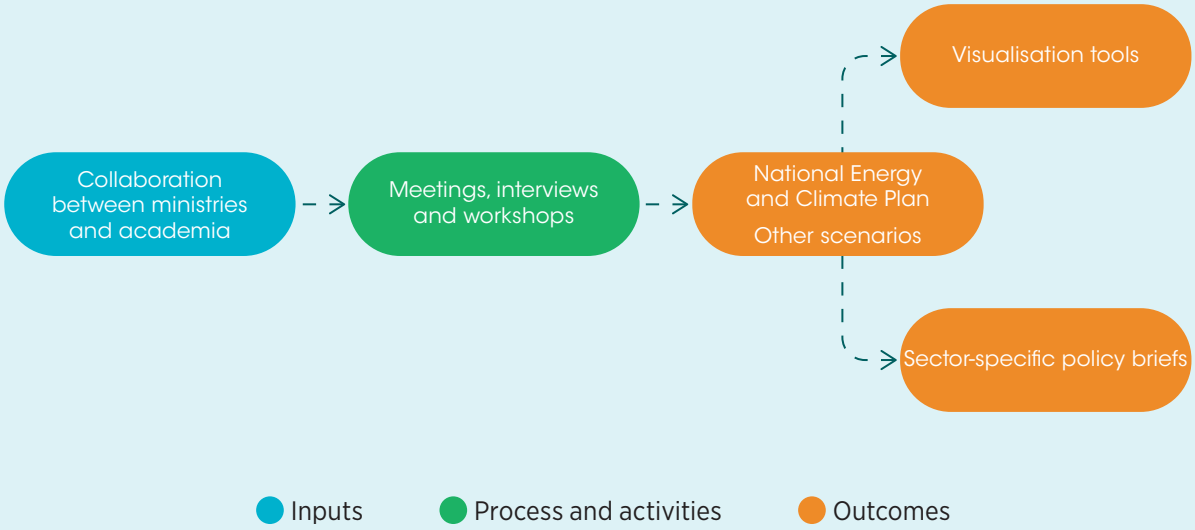
Policy makers and finance ministries sometimes have limited time to read and analyse energy and climate plans in order to inform their decision-making. The Cyprus National Energy and Climate Plan involves a comprehensive process of stakeholder engagement and information dissemination, primarily focused on the intricacies of energy transition and financing.

Governance	The Ministries of Finance and Environment co-ordinate the scenario development process, which is conducted by The Cyprus Institute (including outreach and communication), and substantially supported by other relevant authorities, such as the Ministry of Energy and Ministry of Transport.
Scope	Geographical: National, aligned with targets of the European Union. Sector: Energy and climate.
Objectives	• To effectively communicate the detailed aspects of energy scenarios, investment requirements and policy impacts. • To facilitate informed decision making by policy makers on energy transition strategies.
Engagement activities	• Development of short, concise policy briefs tailored to inform different stakeholders, including ministries and national authorities.[8] • Utilisation of clear, simple graphs and visualisation tools to illustrate complex scenarios and impacts, especially related to renewable energy and energy costs.[9] • Raising public awareness about cost-effective energy measures and addressing the financial needs of vulnerable households.
Key outcomes	• Enhanced understanding and decision-making capacity among policy makers and stakeholders through clear, concise and targeted communication. • Successful alignment of financial strategies with energy policies, ensuring both public and private investments are effectively utilised. • Strong stakeholder engagement that breaks down silos within state departments, leading to better data sharing, complementary planning and comprehensive policy implementation.
Resources	Teams from various technical committees across ministries and national authorities, co-ordinated by the Directorate-General for Growth in the Ministry of Finance and the Ministry of Environment.

[8] *Example: www.cyi.ac.cy/index.php/stedi-rc/research-information/stedi-rc-scientific-publications/climate-policy-is-good-economic-and-social-policy.*

[9] *Example: https://repository.cyi.ac.cy/bitstream/CyI/2496/1/Zachariadis_PlanBleu_Jan2025.pdf.*

Process



Highlight

The Cyprus Institute produces short and concise briefs that provide model-supported insights into proposed policies and measures, frequently targeting specific sectors present in its scenarios. For example, for advising on the suggested increase in the biofuel blend, the institute would produce a brief concerning the projected impact on automotive fuel prices.

Lessons learnt

1. The involvement of key government departments, such as the Ministry of Finance, in energy planning ensures streamlined communication and effective integration of financial considerations into energy policies.

2. Employing clear and concise communication tools, like policy briefs with key indicators and simple visual aids, is essential for effectively conveying complex energy scenarios and their implications to diverse stakeholders.

3. Enhancing stakeholder participation supports proactive planning – *e.g.* to reconcile green energy development with environmental concerns, to mainstream energy transition goals within public investment, and to plan for the construction of enabling infrastructure.

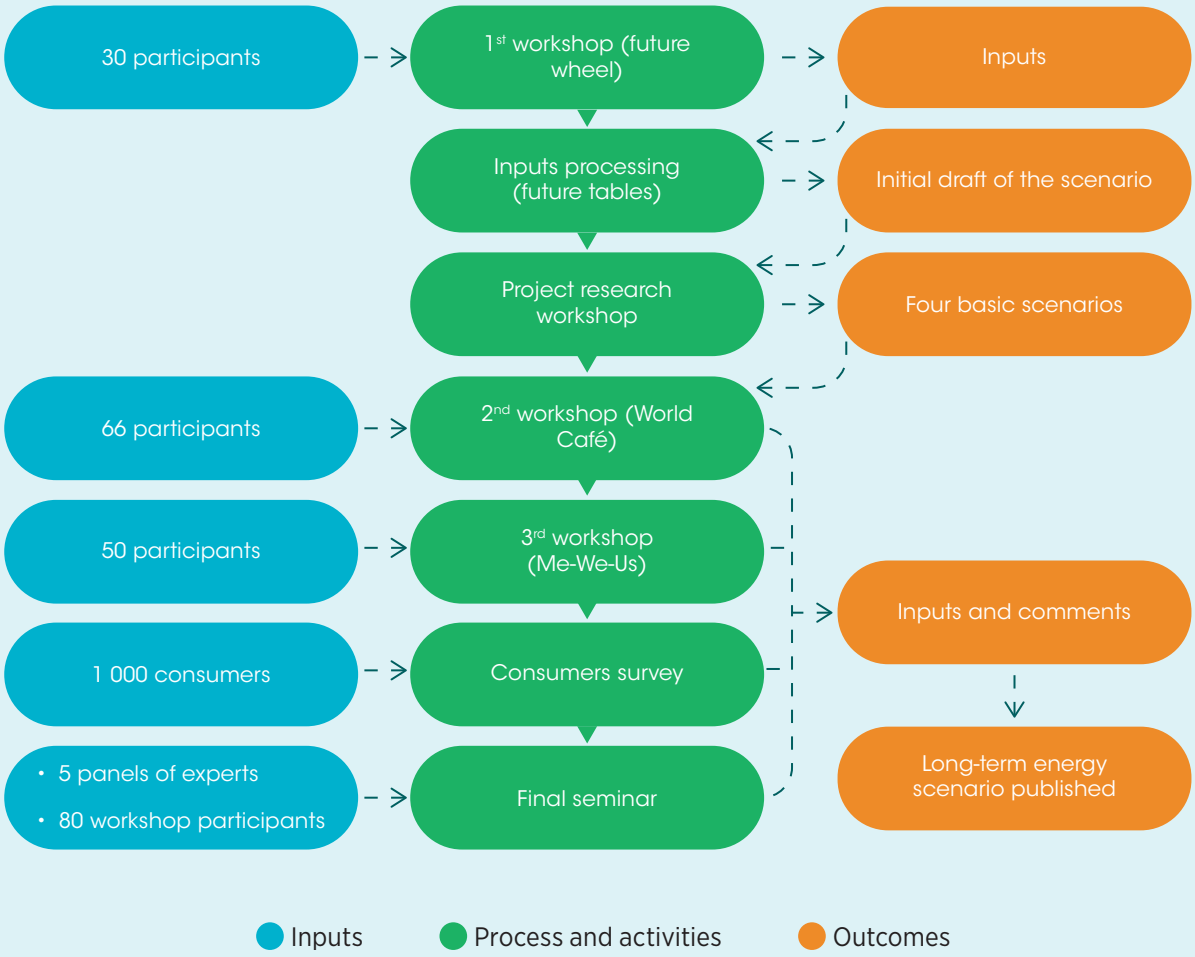
5.7 FINLAND

Research institutions as primary conveners: how Finland utilises the capacity of VTT Research Centre to develop energy and climate scenarios based on extensive stakeholder engagement with different sectors

Finland has an ambitious target to reach net-zero by 2035, and such a rapid transition requires a well-informed and robust approach that involves all stakeholders. VTT Technical Research Centre of Finland, a state-owned research company, supports the government of Finland by combining qualitative foresight methods with quantitative scenario modelling in interactive processes with stakeholders and decision makers to develop their strategies.

Governance	The National Energy and Climate Plan (NECP), LT-LEDS and LTES are led by the Ministry of Economic Affairs and Employment and conducted by VTT.
Scope	Geographical: National Sector: All the energy and greenhouse gas emission sectors, land-use sector, national economy.
Objectives	In the LTES process: formulating a shared vision with a large group of stakeholders to create alternative pathways, and develop an environment for learning from each other. Different stakeholders also provide different insights, such as target-setting, facilitation of the process, multi-disciplinarity and expert views. In the NECP, as well as in the medium-term energy and climate strategy-making, scenarios are formulated to fulfil the targets set by the government's programme and by the European Union. Stakeholders also formulate their own low-carbon roadmaps, which are also taken into account in the national scenarios.
Engagement activities	• Interactive workshops for vision and storyline formulation (such as World Cafés, Futures Wheel and Me-We-Us, PESTEL (Political, Economic, Social, Technological, Environmental and Legal) templates) for LTES. • Stakeholder and expert interviews and large surveys (consumer surveys). • Intermediate and final seminars for validation and feedback. • Publication of synthesis reports and sectoral and other reports. • National industrial federations were asked to create their own low-carbon roadmaps in 2020 as inputs to the climate and energy strategy preparation process, finalised in 2021. This process is now being updated in connection with new energy and climate strategy-making preparations.
Key outcomes	Development of various LTES and Carbon Neutrality for 2035 Roadmaps. Encouraging different stakeholder groups to join the process by developing their own low-carbon roadmaps, as well as by interacting with them in LTES preparations. Finland has a long tradition of active dialogue between policy makers, stakeholders and research organisations, with a perspective of mutual understanding and collaboration that has increased transparency and acceptance of plans.
Resources	Not available.

Process



Highlight

A long-standing history of facilitating active dialogue to achieve stakeholder involvement in scenario development has encouraged stakeholders from different industries and areas to consistently engage in planning activities. This approach showcases how local industries and other stakeholders can effectively contribute to energy planning, with key learnings on how system specifics can be included with greater accuracy.

Lessons learnt

1. A well-structured process is key, covering scenario formulation, data gathering, analysis and feedback loops.
2. The development of LTES, being a complex and multidisciplinary problem, demands multidisciplinary skills to effectively engage with different stakeholders.
3. Involving stakeholders, including citizens, is vital. Given limited resources, effective prioritisation of engagement at different stages is essential (see Chapter 4 to explore use of tools at different stages of energy planning).

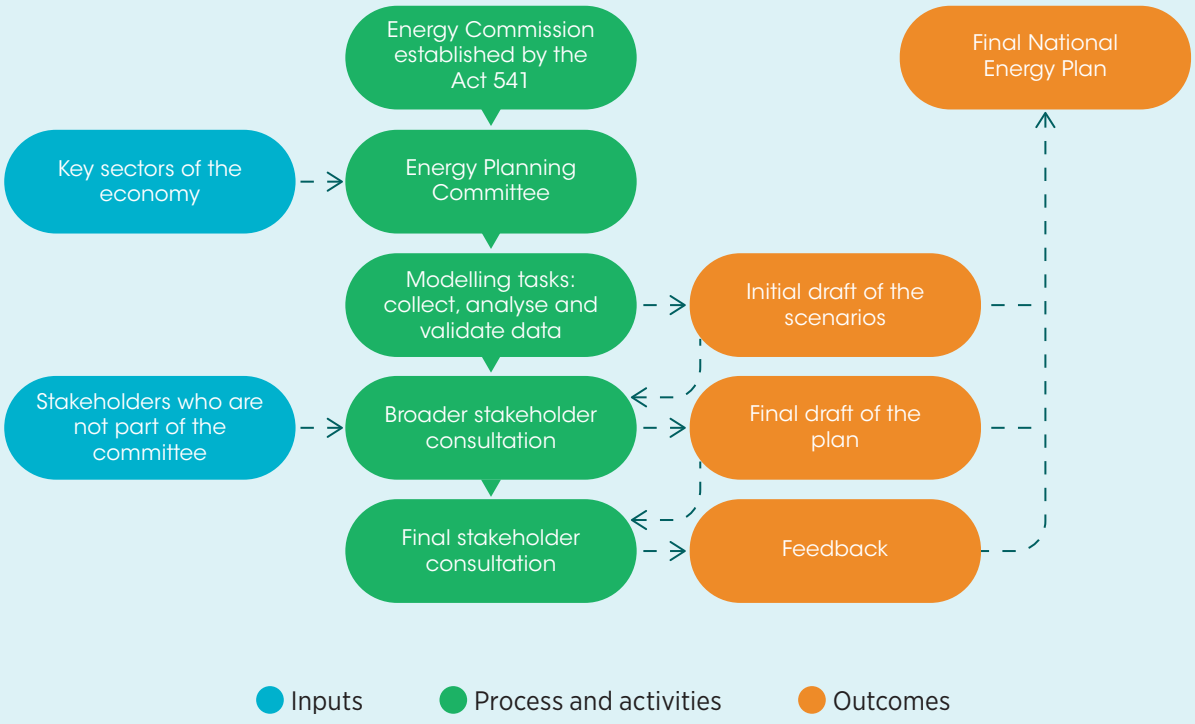
5.8 GHANA

Consultation as a strategic approach: how Ghana leverages structured stakeholder participation in energy transition planning

Ghana has a Strategic National Energy Plan initiative, led by the country's Ministry of Energy, which demonstrates a commitment to achieving climate neutrality by 2070. The Energy Commission, established under the Energy Commission Act 541 and the Ministry of Energy, provides the technical support for modelling, scenario development and analysis. The whole planning process is characterised by intensive stakeholder engagement, co-ordinated by the Energy Commission. The process ensures the involvement of a diverse group of stakeholders, including regulatory agencies, legislators, the judiciary, utilities, policy makers, civil society organisations, the private sector and international partners, with the goal of achieving a sector-wide consensus.

Governance	The Energy Planning Committee, formed under the Energy Commission and comprising representatives from key economic sectors, guides the process to reach net-zero emissions by 2070. This includes a high-level Steering Committee (including Ministries of Energy and Finance, and international partners) to provide strategic direction; and a Technical Committee of sectoral experts to review analytics and recommendations.
Scope	Geographical: National. Sector: Energy.
Objectives	To develop consensus across the energy sector.
Engagement activities	Setting up the Energy Planning Committee, comprising the technical and steering committees, engaging stakeholders in scenario development through workshops, gathering feedback, refining plans, and consensus-building for finalisation.
Key outcomes	This approach ensures a collaborative and consensus-driven path towards the realisation of Ghana's energy transition goals, facilitating effective planning and implementation of the strategic energy plans for 2070.
Resources	Not available.

Process



Highlight

Clear stakeholder mapping and identification allowed a targeted and catered approach to engaging stakeholders, fostering trust in and the legitimacy of the process. The Energy Commission identified and invited specific organisations from different categories, including government ministries, regulatory bodies, state enterprises, private sector companies, NGOs, academic institutions and media organisations. Participants are then strategically assigned to relevant committees and groups based on technical expertise and sectoral knowledge.

Lessons learnt

Physical meetings with stakeholders are the most effective way to facilitate participatory processes in Ghana, conducted through consultative workshops and committee sessions, fostering transparency and acceptability of energy plans.

1. Engaging in participatory processes allows for the analysis of various risks and uncertainties related to energy planning.

2. Building relationships and trust with stakeholders is a time-consuming but crucial aspect of successful participatory energy policy development.

5.9 PANAMA

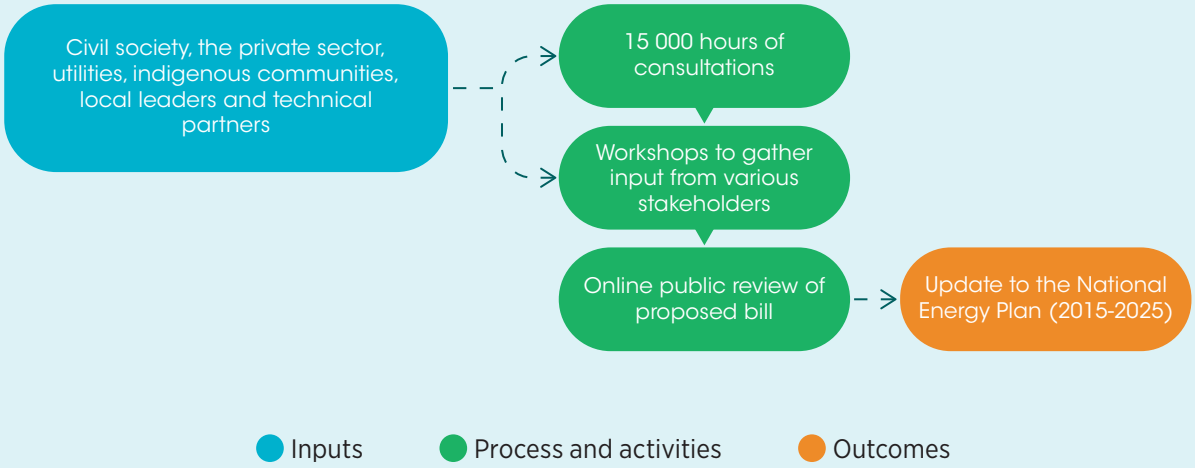
Stakeholder consultation to democratise energy planning: how Panama embraced an inclusive and dynamic stakeholder outreach plan to enhance market and community acceptance

Under the context of its National Energy Plan (PEN) and Energy Transition Agenda (ATE), Panama aimed to achieve societal buy-in for grid expansion and renewable energy to address energy access and energy poverty. In response, the Secretariat of Energy initiated a robust engagement process, investing 15 000 hours in consultations and developing a strategic plan with stakeholders for grid innovation to ensure the success of the new energy plan across diverse communities.

Governance	The process was led by Panama's Secretariat of Energy.
Scope	Geographical: National level with insights from local communities.
Objectives	The process aims to democratise Panama's energy transition and secure societal acceptance for a robust, sustainable energy policy and grid expansion.
Engagement activities	The process included 15 000 hours[10] of consultations, the creation of a white paper for grid innovation, and nationwide discussions to gather input from civil society, the private sector, utilities, indigenous communities, local leaders and technical partners. These activities culminated in an online public review of the proposed energy bill.
Key outcomes	The key outcomes of the process were the development of a transformative law to democratise Panama's energy transition, the identification of necessary regulatory adjustments, the creation of a strategic innovation plan for the grid system, and a societal inclusion effort that led to an adapted bill ready for presidential approval and congressional presentation. Panama's consultative approach directly resulted in concrete policy outcomes, including regulatory adjustments affecting 30% of the 242 action lines identified across their energy transition strategies.
Resources	Not available.

[10] *This figure represents the total consultation time invested by Panama's Secretariat of Energy, conducted over three years, involving workshops and evaluation sessions with diverse stakeholders including civil society, academia, private sector, indigenous communities and government entities. The consultations specifically focused on developing five strategies for the power sector and two for the hydrocarbon sector. A key component was analysing opportunities and challenges in grid modernisation and energy access.*

Process



Highlight

Extensive consultations across the country with often-neglected groups, within a clear framing of democratising the energy transition in Panama.

Lessons learnt

1. Investing significant time and resources in consultations ensures that issues like energy access and poverty are addressed comprehensively by incorporating diverse perspectives.
2. Explicitly including marginalised groups in the process promotes a democratic transition and ensures representation from all sectors of society. This was done by including indigenous and rural populations through direct engagement and on-the-ground focus groups.
3. Prioritising public acceptance and support is critical for the success of initiatives like grid expansion and renewable energy projects.

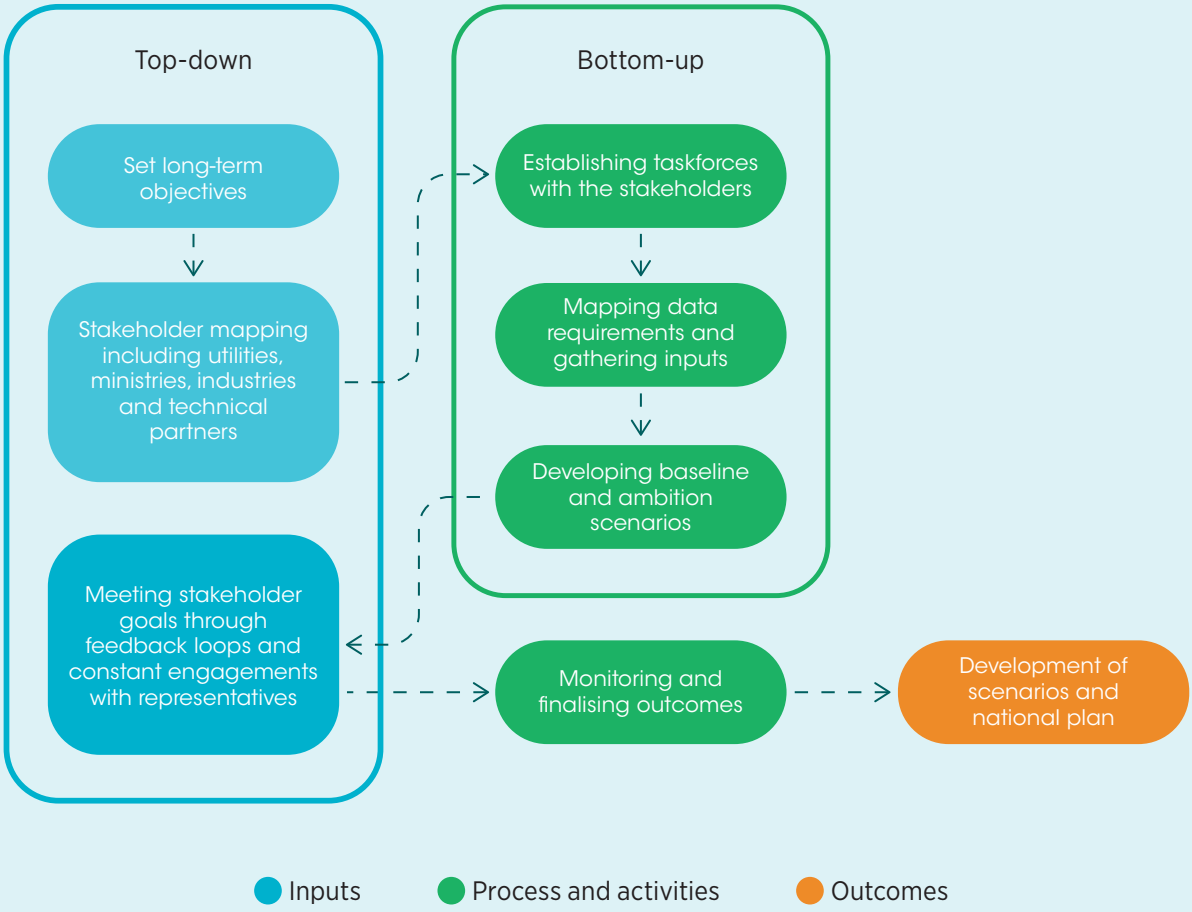
5.10 UNITED ARAB EMIRATES

Leveraging a bottom-up and top-down stakeholder engagement strategy: the United Arab Emirates' innovative approach to integrating utilities into its energy vision

For its UAE Energy Strategy 2050, the United Arab Emirates needed to include existing grid expansion plans and limitations within their long-term energy scenarios to develop more realistic pathways. The Ministry of Energy and Infrastructure implemented a sophisticated stakeholder engagement process, utilising a bottom-up approach for achieving short- to medium-term goals and a top-down approach for long-term objectives.

Governance	The Ministry of Energy and Infrastructure led the formation of task forces and working groups that included key utility stakeholders and local authorities.
Scope	Geographical: National level with insights from the local level in the emirates.
Objectives	The primary aim was to balance the immediate operational realities of utilities with the country's long-term vision to triple renewable energy capacity by 2030 and achieve net-zero emissions by 2050.
Engagement activities	The United Arab Emirates' planning approach was structured in three phases: identification, assessment/communication, and engagement, with an emphasis on feedback loops. The identification phase mapped key stakeholders and defined engagement scope. During assessment, task forces mapped data requirements, evaluated scenarios against future conditions, and identified opportunities to enhance resilience and optimise decision making. The engagement phase involved structured dialogues with public and private stakeholders, aligning with national priorities such as UAE Centennial 2071, Net Zero by 2050 and Energy Strategy 2050. Through continuous feedback and scenario analysis, the United Arab Emirates developed a responsive framework balancing immediate needs with long-term objectives, reinforcing commitments to sustainable development and innovation-driven policies.
Key outcomes	The United Arab Emirates successfully integrated the key stakeholders' perspectives into its UAE Energy Strategy 2050, ensuring that the set targets were not only ambitious but also grounded in the current planning and operational context of the local authorities, utilities and key stakeholders.
Resources	Not available.

Process



Highlight

Early and proactive engagement with utilities enables the United Arab Emirates to integrate existing plans while establishing clear, strategic targets for utilities and stakeholders. This approach ensures alignment with long-term emission reduction and energy transition goals.

Lessons learnt

1. A dual approach, combining bottom-up methodologies for short- to medium-term goals and a top-down vision for long-term objectives, ensures adaptability and sustainability.
2. Stakeholder collaboration – early and thorough engagement with key stakeholders, including utilities and industry players, is essential for aligning ambitious energy and emission targets with operational realities.
3. Continuous stakeholder feedback enables dynamic adjustments, ensuring policies and initiatives remain responsive to emerging challenges and opportunities.

5.11 KCERT 2050 (KENYA CARBON EMISSION REDUCTION TOOL)

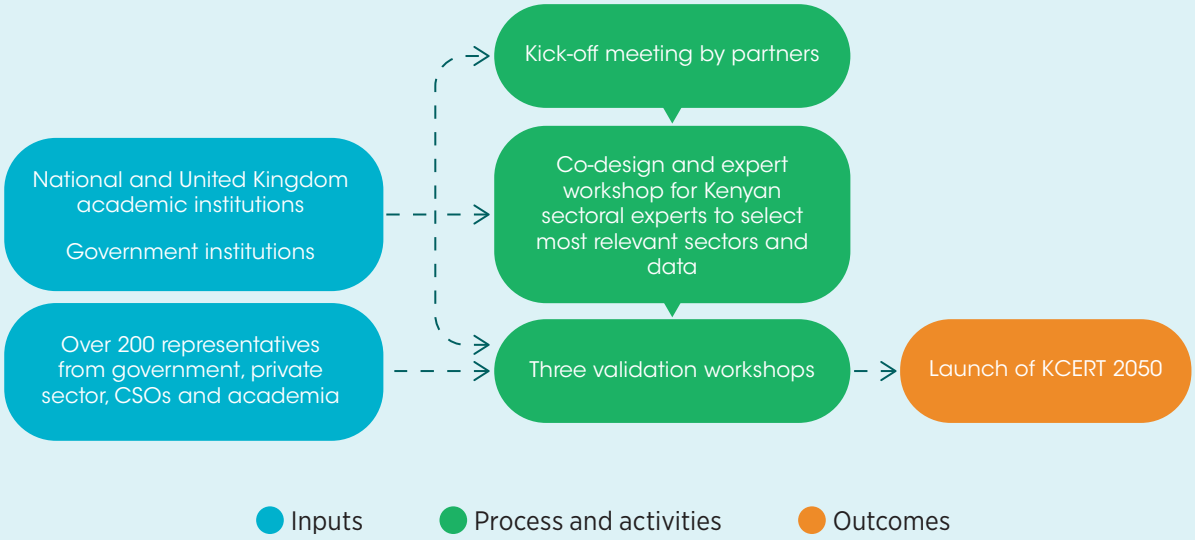
Scientific expertise in scenario communication: how the KCERT 2050 project leverages academic experts to enhance their scenario communication for energy policy making and understanding

The collaboration between academia and government in Kenya showcases innovative approaches to support the country's energy transition. Such initiatives highlight the role of academic research and tools in informing national policy and finance strategies.

The KCERT 2050 project represents the first interactive energy model of its kind in East Africa, designed to help identify energy-secure pathways between 2015 and 2050. This collaborative effort demonstrates how engaging research institutions can bridge data gaps and foster integrated policy development environments, while creating user-friendly visualisation tools that enhance scenario communication for diverse stakeholder groups.

Governance	Joint efforts between academia and government departments, led by the Ministry of Energy, to integrate these communication methods into national energy planning.
Scope	Geographical: National. Sector: Energy.
Objectives	• To provide decision makers and the public with accessible, comprehensive tools for understanding the complexities of energy transition, sectoral emission reduction and financing. • To aid the development of realistic and sustainable energy policies and financial strategies.
Engagement activities	• The International 2050 Calculator programme involves creating user-friendly versions of energy transition tools for various audiences.
Key outcomes	• Different versions of KCERT 2050, comprising a visual web tool, and gamified and detailed spreadsheet-based models to cater to different stakeholders. • Improved capacity among Kenyan government technocrats, policy makers and other stakeholders to comprehend and plan for the energy transition, incorporating both technical and financial aspects. • Enhanced ability to simulate different scenarios and visualise their energy needs, emission reduction and net-zero ambition, leading to more informed decision making. • Fostering a culture of data-driven evidence-based decision making and transparent policy development, breaking down silos within government departments for better collaboration and data sharing.
Resources	Not available

Process



Note CSO = civil society organisation; KCERT = KENYA CARBON EMISSION REDUCTION TOOL.

Highlight

Using a multitude of visualisation tools catered for different audiences to communicate national scenarios effectively for decarbonisation strategies, educational purposes, and investment objectives.

Lessons learnt

1. Developing audience-specific tools, ranging from spreadsheet-based to visualisation-based tools, to engage stakeholders effectively improves communication and data transparency, and breaks down departmental silos, enhancing collaboration.
2. Ongoing refinement of tools like the 2050 calculator, driven by data, ensures policies stay relevant and adapt to changing scenarios and information.
3. Collaborative efforts between academia and government are vital for national capacity building, bridging data gaps and fostering integrated, co-operative policy development environments.
4. These dynamic tools transform citizen engagement and participation in matters related to individual and societal decarbonisation measures.

5.12 PARIS AGREEMENT COMPATIBLE (PAC) SCENARIO CONSORTIUM

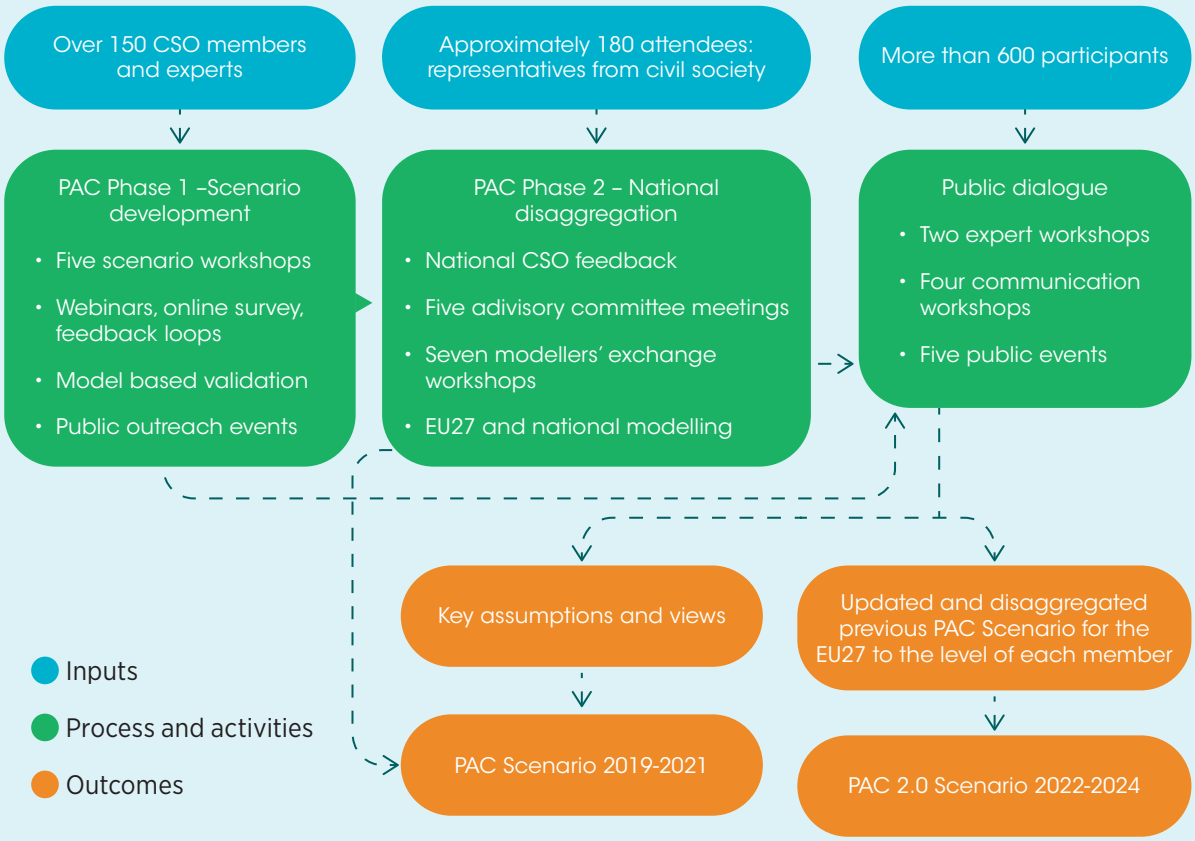
Leveraging civil society participation for ambitious scenarios: how the PAC Scenario and PAC approach contributed to the European grid planning process through deep engagement of CSOs

A coalition of NGOs, supported by TSOs and technical and research institutions, aimed to enhance European decarbonisation ambitions in relation to infrastructure planning by developing a scenario that would be in line with the Paris Agreement goals. The PAC Scenario process leveraged thorough engagement with a diverse set of organisations across the continent to present an alternative and ambitious pathway for meeting climate neutrality in Europe by 2040.

Governance	The PAC Consortium includes Climate Action Network Europe with over 200 NGO members, European Environmental Bureau with over 170 members, Renewables Grid Initiative with 31 members including NGOs and TSOs, and REN21 with 107 international members from various sectors.
Scope	Geographical: Europe-wide and European national level.
Objectives	The first phase of PAC aimed to review the European process of scenario-building, used for grid planning and created/managed by the European Network of Transmission System Operators (the Ten-Year National Development Plan, or TYNDP), develop a Paris-compatible energy scenario, facilitate knowledge exchange among modellers and system planning experts, and promote global grid collaboration awareness. The following phase focused on discussions related to implementation of the PAC Scenario, delivering disaggregated results for each of the EU member states, enhancing modellers' exchanges, empowering NGOs in policy discussions, broadening international collaborations, and disseminating the insights with open data and open-source tools.
Engagement activities	• Thirteen workshops,[11] including scenario-building workshops and modellers' exchanges, exploring decarbonisation strategies, and the implications for different sectors of energy planning engagement, validation and communication. • Face-to-face, hybrid sessions, online workshops and webinars for national and European-level actors to exchange their views. • The PAC process yielded publications on hydrogen, the energy crisis, power grids, nature-positive renewables, socio-economic benefits and avoided losses, and citizen engagement, guiding the transition to a Paris Agreement-aligned, decarbonised energy future. The project has also provided input into the European grid planning process.
Key outcomes	Implemented by CSOs, the PAC project outlines a Paris-aligned European energy scenario targeting a 65% emissions cut by 2030, climate neutrality and 100% renewables by 2040.
Resources	Financial: Financed by the German Federal Ministry for Economic Affairs and Climate Action. Human: Team of around ten people representing all organisations from the consortium.

[11] *At the time of writing this report.*

Process



Notes: CSO = civil society organisation; EU27 = European Union, which consists of 27 countries; PAC = Paris Agreement Compatible.

Highlight

Active contributions, centred on modelling, from civil society in political and system planning discussions provided added value by presenting alternatives for the future energy system design. This enriched the discussions, improved the quality of the following modelling and (European) system planning iterations, empowered civil society actors, and made the perceived image of the decision makers more open and transparent.

Lessons learnt

1. The PAC project demonstrates the importance and added value of bringing the civil society perspective into the policy making, scenario-building and grid planning processes, which increases the legitimacy and accountability of the planning outcome and these processes.

2. The experiences from the PAC project underline the need to dedicate adequate resources to establish meaningful relationships with diverse stakeholders (NGOs, researchers, industry and others) for strategic energy planning, which should be maintained throughout the entire process, not only after delivering the initial input from these actors.

3. Publishing the datasets used for modelling in open source increases transparency and allows external entities to check, replicate and improve the overall approach and modelling/planning methodologies.

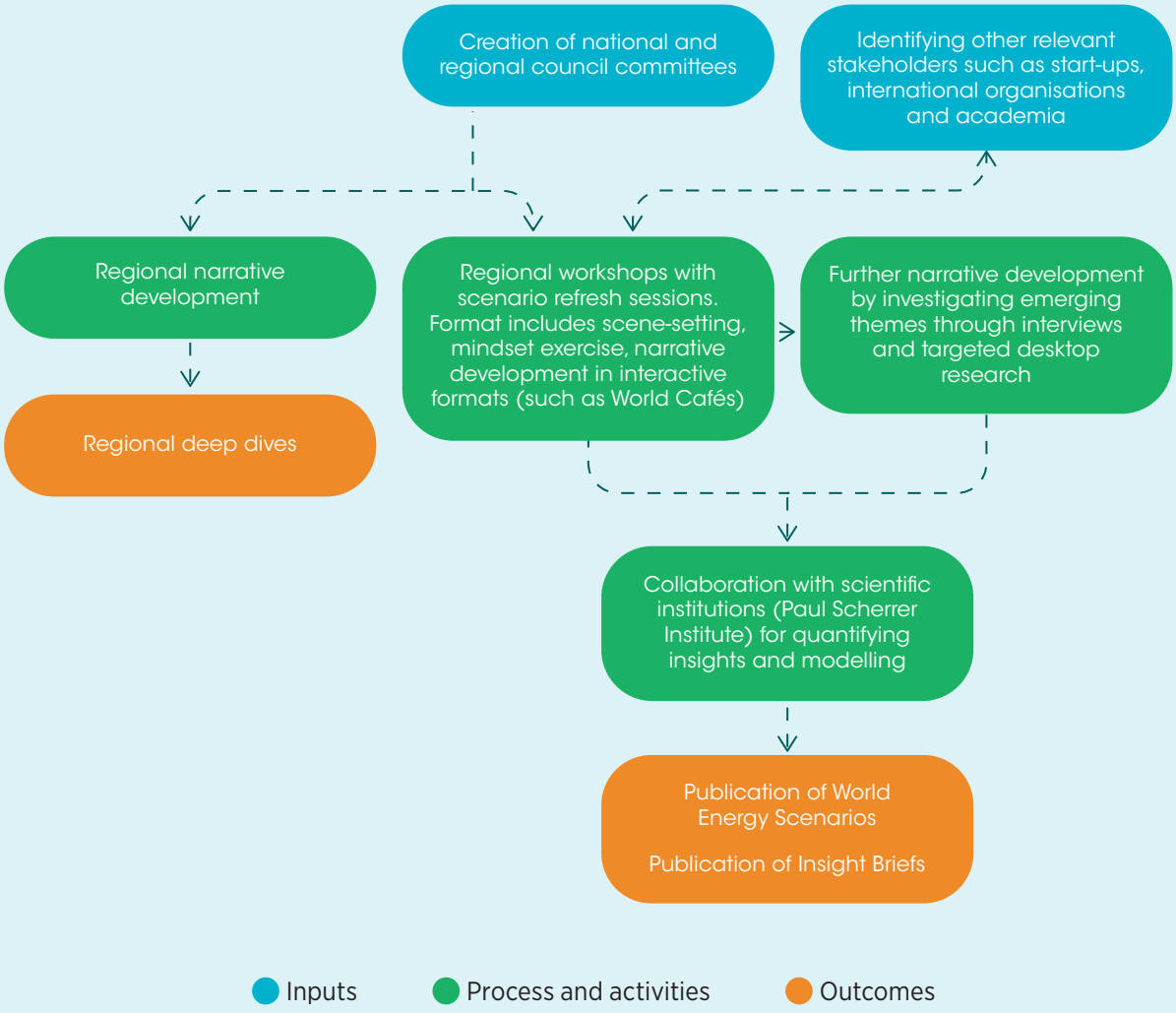
5.13 WORLD ENERGY COUNCIL

Global engagement to define regional priorities: how the World Energy Council (WEC) uses socio-political frameworks and simulations to derive insights to shape its global scenarios

The WEC conducts a rigorous stakeholder engagement process leading up to its World Energy Scenarios publication. The process involves hundreds of stakeholders, including academia, government, industry and start-ups, through regional deep dives and other activities, which aim to identify regional priorities and challenges.

Governance	The WEC secretariat manages this process, and organises regional activities through its national member committees.
Scope	Geographical: Global, with regional activities. Sectoral: Energy.
Objectives	To reflect global priorities and challenges and develop plausible scenarios that reflect socio-political realities and challenges.
Engagement activities	Engaging stakeholders in scenario narrative foresight development through tools such as the World Energy Trilemma, the Trilemma Framework and horizon-scanning tools such as World Energy Pulse, Issues Monitor, the policy simulator and other activities in order to identify key challenges and stakeholder perspectives on the different scenarios.
Key outcomes	This approach ensures a participatory process to develop plausible narratives to support business and government in their own planning, deriving insights from a diverse set of stakeholders.
Resources	Human and financial resources from regional and country member committees, as well as the secretariat.

Process



Highlight

WEC's thorough and diverse workshops leverage strong facilitation to co-create socio-political narratives for global scenarios, combined with interactive exercises that allow stakeholders to examine their own roles within the changes exemplified in these scenarios.

Lessons learnt

1. Ensuring diverse participation from across sectors (*e.g.* academia, government, industry, start-ups) and regions is critical for capturing global energy priorities and challenges.

2. Employing diverse tools, such as policy simulators, frameworks and interactive workshops, helps cater to varying stakeholder needs and fosters dynamic collaboration.

3. Narrative-based scenarios that consider socio-political realities alongside technical and economic factors provide actionable and relatable insights for stakeholders. This can provide a useful accompaniment to more common techno-economic scenarios.

6. CONCLUSION

Participatory methods continue to be utilised more widely in government planning activities, especially with the essential and timely focus on a clean and just energy transition. Engaging in stakeholder consultation can help achieve these goals by building inclusive and empowering processes, increasing public acceptance and buy-in for the ongoing transition. This toolkit, designed for scenario planners in government planning institutions, but relevant also for other actors involved in scenario building and energy system modelling, provides a versatile resource for planners to enhance their energy scenario development processes. It offers a range of tools, case studies, and insights that can be applied in several practical ways.

One key use of the toolkit is identifying relevant case studies. Planners can examine the detailed examples provided, selecting those that align with their specific objectives and contexts. For instance, a country aiming to improve public engagement might draw inspiration from Brazil's use of virtual debates and online workshops. Similarly, another focusing on concise policy communication could benefit from Cyprus's approach to creating clear and effective policy briefs.

By reviewing the activities and tools showcased in the case studies, planners can evaluate the feasibility of the different participatory methods within the constraints of their resources and institutional capabilities. For example, a country with limited financial resources might prioritise online consultations over more resource-intensive in-person workshops, ensuring practical and efficient implementation.

By analysing successful examples, planners can also identify best practices for working with specific stakeholder groups and select tools that align with their desired outcomes. The toolkit also highlights lessons from other countries, enabling planners to anticipate and avoid potential challenges.

By leveraging the toolkit as a guide and reference, national energy planners can integrate effective participatory processes into their energy planning. Drawing on real-world examples and tailoring these insights to their unique circumstances, planners can foster a more inclusive, transparent and successful energy planning process.

Challenges and future work

This toolkit also highlights the importance of participatory processes in national energy planning, and some existing and novel cases and tools that have been used by governmental and non-governmental institutions to engage these stakeholders. However, overarching challenges and gaps remain that warrant further research and implementation. For example, during our activities, experts highlighted the dearth of existing mechanisms to inform stakeholders about how their participation influenced planning results and project outcomes. A more reciprocal communication style could be key to ensuring stakeholders maintain their interest in participating in such activities. Other experts also highlighted that in some instances, stakeholder engagement could be considered a "box-ticking" exercise, nullifying its alleged purposes and decreasing confidence among stakeholders. Some experts also shared concerns regarding the project team's inherent biases affecting inputs and the way they are represented within modelling exercises.

Challenges also remain in translating some innovative methodologies of public participation within a comprehensive national-level planning process, where constraints such as resources and/or political will may exist, limiting the potential of stakeholder engagement in national scenarios. Others highlighted

the challenge of evaluating the participatory process outcomes, measuring key performance indicators (KPIs), and evaluating the benefits of implementing a participatory process versus not conducting one.

New opportunities and challenges may also arise, including the use of artificial intelligence (AI), machine learning and natural language processing (NLP) techniques to improve and analyse stakeholder priorities and inputs into designing the participatory activities, as well as addressing their comments in the scenario development process and results.

Such challenges can be worth examining at the project design level, in relation to the project's purported objectives. Can the challenges be overcome simply by improving the participatory strategy and using the correct tools? Or are novel methods and frameworks needed? As further importance and funding are placed on using participatory methods in scenario design and policy making, we may continue to see these questions being addressed, with innovative solutions and case studies that will continue to be explored within the work of the LTES Network.

7. ADDITIONAL MATERIAL

This chapter presents a non-conclusive list of various publications, tools, software and other material to support planners in designing and implementing their participatory strategies for long-term energy scenario development. These are not necessarily endorsed by IRENA, but are the result of discussions with experts throughout the project's activities, alongside desktop research.

7.1 PUBLICATIONS

PARTICIPATORY METHODS TOOLKIT: A practitioner's manual

Dr Nikki Slocum – UN University – CRIS

Designed for both new and experienced practitioners, this toolkit includes detailed fiches on 10 methods, an overview of 40 others, and general guidelines. The manual's format is adaptable for easy use and customisation, serving as a dynamic resource for sharing practical knowledge in the field of participatory approaches.

https://archive.unu.edu/hq/library/Collection/PDF_files/CRIS/PMT.pdf

DELIBERATIVE FUTURES TOOLKIT: TOWARD 'FUTURE-ORIENTED' COMMUNITIES AND DECISION MAKING

MaREI Centre

This toolkit offers future-thinking strategies to tackle climate change, focusing on inclusive and sustainable decision making. It includes scenario analysis, modelling tools and practical guides for various stakeholders like educators, activists and community practitioners. It aims to facilitate collaborative and forward-thinking approaches for building low-carbon, climate-resilient societies.

www.ucc.ie/en/media/projectsandcentres/imagining2050/Imagining2050Toolkit.pdf

COMMUNITY ENERGY PLANNING: BEST PRACTICES AND LESSONS LEARNT IN NREL'S WORK WITH COMMUNITIES

NREL

This document is a best practice guide focused on community energy planning. It is informed by expert interviews and literature reviews, emphasising the importance of local engagement in clean energy initiatives. The guide outlines five key practices: thorough preparation, authenticity in community interactions, respecting community agency, meeting specific community needs, and promoting inclusive participation. It is designed to enhance the effectiveness of community-based energy planning and deployment.

www.nrel.gov/docs/fy22osti/82937.pdf

PARTICIPATORY METHODS IN ENERGY SYSTEM MODELLING AND PLANNING – A REVIEW

Connor McGookin, Brian Ó Gallachóir and Edmond Byrne

This paper reviews participatory methods in energy system modelling and planning, analysing 59 studies. It focuses on stakeholder engagement and its integration with quantitative analysis, highlighting differences in approaches at national and subnational levels. The review reveals limited collaboration with non-academic stakeholders and a need for more democratised processes in energy research.
www.sciencedirect.com/science/article/pii/S1364032121007838

ADVANCING PARTICIPATORY ENERGY SYSTEMS MODELLING

Connor McGookin, Diana Süsser, Georgios Xexakis, Evelina Trutnevyte, Will McDowall, Alexandros Nikas, Sheridan Few, Per Anderson, Brian Ó Gallachóir and Fionn Rogan

This paper emphasises the need for integrating diverse perspectives into energy system models, crucial for guiding emissions reduction strategies and informing energy policies. It addresses the lack of structured participatory processes in energy modelling by offering good practice guidance for involving stakeholders and the public. The proposed framework provides various entry points for participatory elements, acknowledging the complexities of energy modelling and participatory research. The paper highlights key challenges and future research areas, advocating for practitioners to support a fair and just transition to a climate-neutral future.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4509315

USING ROBUST DECISION-MAKING TO DEVELOP LONG-TERM STRATEGIES – A PRACTICAL GUIDE

Jairo Quirós-Tortós, Luis Víctor-Gallardo, Mariana Rodríguez-Arce and Alejandra Soto-Rodríguez

Robust decision-making (RDM) offers an adaptive approach, engaging stakeholders to create flexible, resilient strategies. Developed by The Climate Lead Group and 2050 Pathways Platform, this RDM Guide provides a ten-step framework, informed by Latin American and Caribbean experiences, to design effective LTS under varying future scenarios.
https://2050pathways.org/wp-content/uploads/2024/09/2050PP_RDMReport_FINAL092624Pages.pdf

SCENARIOS FOR THE ENERGY TRANSITION (LTES NETWORK PUBLICATION SERIES)

IRENA

These publications contain numerous case studies on good practices and experiences shared by experts throughout engagements and activities within the LTES Network. These case studies contain examples of stakeholder engagement, scenario communication and institutional governance that can support practitioners in designing their own practices.
www.irena.org/publications/2020/Sep/Scenarios-for-the-Energy-Transition-Global-experience-and-best-practices
www.irena.org/Publications/2023/Jan/Scenarios-for-the-energy-transition-Experience-and-good-practices-in-Africa
www.irena.org/publications/2022/Jul/Scenarios-for-the-Energy-Transition-LAC

7.2 TOOLS AND PLATFORMS

REPOSITORIES

Facilitator School: Alongside online courses on facilitating workshops and meetings, this website contains a repository of different templates that could be used to facilitate and plan workshops, different guidelines and tips, and links to helpful applications and tools.
www.facilitator.school

URBACT Toolbox: The URBACT Toolbox, designed for local-level urban planning, offers a range of resources including tools, templates and guidance for participatory, integrated action. While tailored for community-focused initiatives, its comprehensive framework and emphasis on stakeholder engagement and knowledge sharing make it adaptable for national planning contexts as well.
https://urbact.eu/toolbox-home

ILO International Training Centre: This is a repository of different methodologies to facilitate in-person participatory meetings including icebreakers and creative co-creation methods.
www.itcilo.org/methods

USYS Transdisciplinarity Lab: A toolbox for the co-production of knowledge and co-production between different scientific disciplines and between science and society. The various tools offered have all been successfully used and tested in different teaching and research environments by the TdLab or the td-net. They are simple and straightforward and thus can be applied in any research or teaching project. The TdLab offers conceptual guidance for the application of these tools.
https://tdlab.usys.ethz.ch/toolbox.html

Guidelines for public engagement in energy infrastructure (IEECP and RGI): These guidelines, aimed at citizens, developers and policy makers, provide tailored recommendations for engaging in energy projects using an interactive tool that structures advice around four principles: early engagement, transparency, inclusiveness and trust.
https://renewables-grid.eu/activities/engage4energy.html

Electricity Transition Playbook: A tool to help policy makers build and deliver plans to transition to a clean electricity system. Through good practices and case studies, one section explores public participation and support, and considers the consumers and the communities that are impacted by the transition and the importance of engaging with them.
www.greengridsinitiative.net/general-8

IIASA's Scenario ensembles and database resources: This resource contains a large number of scenario explorers, visualisations and databases from the integrated assessment modelling community.
https://iiasa.ac.at/scenario-ensembles-and-database-resources

Callio.pe: A scenario visualisation tool that allows you to navigate hundreds of alternative energy system configurations (SPORES) to reach carbon neutrality across the entire European energy system in 2050.
https://explore.callio.pe/

Decision Theatre: The Decision Theatre method is an participatory approach designed to facilitate collaborative decision making for complex societal challenges. It combines interactive visualisation, empirical data, mathematical modelling and structured dialogue among stakeholders – including researchers, policy makers, experts and citizens – to build shared understanding and explore possible futures.
https://dt.asu.edu/publications

SURVEY PLATFORMS

Online surveys: To conduct surveys that might need time to complete.

Microsoft Forms, Google Forms, SurveyMonkey, Qualtrics

Real-time polling: For use during events and webinars for real-time interaction and insight-gathering.

Mentimeter, Slido, Kahoot, Prezi, Ahaslides

CO-CREATION PLATFORMS

Brainstorming: To facilitate group co-creating and deliberation in online settings.

Miro, Mural, Microsoft Whiteboard

Virtual workshops: Video conferencing platforms with facilities for conducting webinars, meetings and break-out groups.

Zoom, Microsoft Teams, Webex

DATA VISUALISATION

Dashboards: For the creation of interactive data visualisation platforms to be presented in reports or digital platforms.

PowerBI, Tableau, Looker Studio

Charts:

Microsoft Excel, Google Sheets, Python/ Stata, R, Canva

FRAMEWORKS

World Energy Trilemma Index: This tool, created by the World Energy Council, can serve as a valuable assessment tool in participatory processes, analysing national energy systems across three key dimensions: security, equity and sustainability. It can be utilised to jointly evaluate various indicators and understand their policy implications, assisting stakeholders in shaping and refining energy strategies, informing policy decisions, and guiding effective energy transitions through detailed data analysis and expert insights.
www.worldenergy.org/transition-toolkit/world-energy-trilemma-index

Social acceptance of renewable energy: This paper introduces a framework for the understanding of social acceptance of renewable energy, from the socio-political, community and market perspectives. This might be helpful in guiding discussions with citizens and CSOs on their perspectives on energy developments in their area.
www.researchgate.net/publication/227997801_Social_Acceptance_of_Renewable_Energy_Innovation_An_Introduction_to_the_Concept

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APPENDIX A – METHODOLOGY AND DATA COLLECTION

1. Engagement through workshops and events:

A blend of thematic workshops, webinars, bilateral calls and participation in relevant activities provided platforms for diverse stakeholder participation. These formats facilitated the exchange of ideas and experiences, crucial for understanding the dynamics of participatory processes in LTES. Dozens of speakers and hundreds of participants were involved in these discussions:

- 2nd International LTES Forum – Session 2 on stakeholder engagement in LTES development (2020)
- International Energy Workshop – Side event on energy scenario communication for strengthened inputs and trustworthy outputs (2022)
- 4th International LTES Forum – Interactive workshop on participatory processes for LTES development (2022)
- Country workshop on participatory processes for LTES development (2023)
- Joint workshop (REN21, GGI, RGI and IRENA) on public engagement for energy and grid planning (2023)
- Joint workshop (IRENA and IEECP) on stakeholder-driven scenarios for a just energy transition (2023)
- 7th International Conference on Renewable Energy Sources and Energy Efficiency, Energy Security 2023 Cyprus – Session on effective stakeholder engagement for energy scenario communication (2023)
- IRENA 14th Assembly – Participatory strategies for just and renewable-based scenarios (2024)
- 5th International LTES Forum – Communication strategies (2024)
- Joint Workshop (IRENA, REN21 and RGI) – Stakeholder engagement in energy planning: Across all voltage levels (2024)
- LTES Peer-to-Peer series, Colombia – UPME (2025)

2. Scientific guidance:

The structuring and content of this report and the associated workshops were influenced by a scientific advisory committee outlined in the acknowledgement section of this report.

3. Data collection:

Information was gathered through a combination of interactive sessions, literature review and expert interviews with government officials responsible for energy planning and national consultation processes, as well as scientists and experts from civil society. This approach ensured a comprehensive understanding of good practices in participatory processes within the development of LTES in both government and non-governmental settings.

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