Selecting energy sector plans for SEA

The case of the Quan Nam provincial hydropower plan in Vietnam (Annex 30) gives a good approach to start with the introduction of SEA by first doing a "safe" ex-post assessment of a plan already agreed upon. This experience was used, after SEA became a legal obligation, to further develop the instrument on several successive National Power Plans.

In answering the question of what type of plan can benefit most from SEA, there are two approaches:

1. **The most influential plan**: A national energy plan makes fundamental choices for the future of the entire energy sector, which translates into detailed follow-up planning. It seems to be the obvious and most relevant plan to be assessed. However, it is an ambitious endeavor, and the plan may simply not be open for update for a prolonged period.

2. An alternative approach is to simply focus on the **first available energy-related plan** scheduled for revision that would benefit from an SEA.

To determine which plan can benefit most from an SEA, a number of questions can be asked:

- **Country energy system:** What elements of a country's energy system have the most relations with other sectors, have the most contested spatial claims, or lead to public debate? For this one has to have a good understanding/description of the energy system. The elements in Box A27.1 provide entry points. Note that some of the elements are directly linked to other than energy planning frameworks. For example, energy consumption is defined by other sectors; location of energy infrastructure is linked to spatial planning; energy markets may be governed by finance departments.

- **Country planning system:** Understand and describe the country specific system of energy planning and multi-sector planning linked to energy sector interests as described in Chapter 4, Section 4.4. Indicate relevant cross-linkages from an energy perspective. Use Annex 21 on the role of spatial planning frameworks for renewable energy planning and Annex 22 on relations between sector plans and national energy plans for inspiration.

- **Open policy choices:** Which policy choices are definite, and what choices need to be elaborated? Think of tasks for the energy transition defined in the Nationally Determined Contributions under the Paris Agreement or use the key issues for the energy transition in the second part of Box A27.1 for inspiration.

- **Describe the key decisions** in terms of What, Where, How, and When as described in Table A27.1.

- **Timing of plan updates:** Make a time schedule indicating when a relevant planning exercise and moment of decision-making are foreseen.

Box A27.1: Elements of a country's energy system and issues linked to the energy transition

Energy resources: Energy systems rely on primary energy sources, including fossil fuels (such as coal, oil, and natural gas), renewable energy sources (such as solar, wind, hydro, biomass, and geothermal), and nuclear energy. The availability and diversity of energy resources influence the resilience and sustainability of the energy system.

Energy production infrastructure: Energy production infrastructure encompasses facilities and technologies for extracting, refining, processing, and generating energy from primary sources. This includes power plants, refineries, drilling rigs, mines, and renewable energy installations.

Energy transmission and distribution networks: Transmission and distribution networks transport energy from production facilities to end-users, including households, businesses, and industries. These networks consist of power lines, pipelines, substations, transformers, and distribution grids.

Energy storage systems: Energy storage systems play a crucial role in balancing supply and demand, stabilizing the grid, and integrating variable renewable energy sources. Storage technologies include batteries, pumped hydroelectric storage, compressed air energy storage, and thermal storage systems.

Energy consumption sectors: Energy consumption sectors represent the end-users of energy, including residential, commercial, industrial, transportation, and agricultural sectors. Each sector has unique energy demands, consumption patterns, and efficiency opportunities.

Energy policies and regulations: Energy policies and regulations govern the development, operation, and management of the energy system. This includes policies related to energy security, environmental protection, renewable energy deployment, energy efficiency, pricing, subsidies, and market competition.

Energy markets and economics: Energy markets facilitate the buying and selling of energy resources, products, and services. These markets operate under various economic models, including regulated monopolies, competitive markets, and hybrid systems. Factors such as supply and demand, market dynamics, pricing mechanisms, and government interventions influence energy market outcomes.

Energy technologies and innovation: Advances in energy technologies and innovation drive the transformation of energy systems, improving efficiency, reducing costs, and expanding the use of renewable energy sources. Key technologies may include solar panels, wind turbines, electric vehicles, smart grids, energy-efficient appliances, etc.

Environmental and social considerations: Environmental and social considerations are integral to the sustainability and resilience of energy systems. This includes minimizing environmental impacts (notably air pollution), addressing climate change (notably greenhouse gas emissions), protecting biodiversity, ensuring energy access for all, and promoting social equity and justice.

International energy relations: Energy systems are increasingly interconnected at the global level through trade, investment, and cooperation. International energy relations involve negotiations, agreements, and partnerships related to energy security, supply chains, geopolitics, and sustainable development goals.

Several key issues are likely to shape the future of country energy systems (no order of priority):

Energy demand projections taking into account economic growth, technological advancements, policy changes, demographic trends, and historical consumption patterns. Drivers of energy demand include economic factors (GDP growth, industrial output), demographic factors (population growth, urbanization rates), technological factors (changes in energy efficiency, new technologies, or energy intensity), policy and regulatory factors (subsidies, tax incentives, environmental regulations), and behavioral factors (consumer behavior, preferences for energy sources).

Energy transition challenges, including the intermittency of renewable energy sources, how to address peaking power (which refers to power plants that generally run only during periods of high electricity demand, known as peak demand), balancing power (a critical component of modern power systems that ensures the electricity supply meets demand in real-time and maintains overall grid stability), grid integration issues, investment barriers, and the social and economic impacts on communities dependent on fossil fuel industries. The inclusion of intermittent renewable energy sources like wind and solar adds complexity to balancing the grid. Effective market structures are needed to incentivize balancing services, and investments in advanced technologies like smart grids, battery storage, and responsive load management systems are essential.

Transition fuels bridge the gap between traditional fossil fuels and renewable energy sources. Transition fuels, such as natural gas, have lower carbon emissions compared to coal and oil. By replacing more carbon-intensive fuels, transition fuels help to reduce overall greenhouse gas emissions in the short to medium term. They provide a reliable and flexible source of energy that can complement intermittent renewable energy sources to stabilize energy grids. It is essential to recognize that they are not a long-term solution to climate change.

Energy security and resilience are a critical concern in the face of geopolitical uncertainties, natural disasters, and cyber threats. Countries will need to diversify their energy sources, enhance grid reliability,

invest in energy storage and smart grid technologies, and strengthen international energy cooperation to mitigate risks and disruptions.

Decentralization and digitalization of energy systems are reshaping how energy is produced, distributed, and consumed. Distributed energy resources such as rooftop solar, energy storage, and electric vehicles, coupled with digital technologies, are enabling more flexible, efficient, and resilient energy systems.

Electrification of end-use sectors such as transportation, heating, and industry requires expanding electric vehicle infrastructure, promoting heat pumps and electric heating, and incentivizing electrification in industrial processes.

High energy consumption sectors have difficulty reducing their carbon emissions. These include industrial processes (chemicals, refining, steel, etc.) and heavy-duty transport (freight trucks, bus fleets, shipping, aviation). Fossil fuels can be replaced by green hydrogen. Green hydrogen allows for storage and transportation of energy. The uneven worldwide distribution of renewable energy requires international transportation of hydrogen.

Energy access and equity: Ensuring universal access to affordable, reliable, and clean energy services remains a priority, particularly in developing countries. Closing the energy access gap requires investments in off-grid and mini-grid solutions, rural electrification initiatives, and policies that prioritize the needs of marginalized communities.

Circular economy and resource efficiency: Moving towards a circular economy model in the energy sector can help reduce resource depletion, waste generation, and environmental impacts. This involves promoting energy efficiency, recycling and reuse of materials, and designing products and processes with lifecycle considerations in mind.

Climate change adaptation: Countries need to increase resilience to climate-related hazards, and integrate climate considerations into energy planning, infrastructure development, and policy-making processes.

Just Transition and social impacts: Managing the social impacts of the energy transition, such as job displacement, community disruption, and economic disparities, is essential for ensuring a just and equitable transition. Governments, industry, and civil society must collaborate to support affected workers and communities through retraining programs, job creation initiatives, and social safety nets. Both the phasing out of carbon and the mining for lithium, cobalt, nickel, copper, and other critical minerals required for the transition have serious consequences. This has led to calls for a just transition, which the IPCC defines as *"a set of principles, processes and practices that aim to ensure that no people, workers, places, sectors, countries, or regions are left behind in the transition from a high-carbon to a low-carbon economy."*

Global Energy Governance and cooperation mechanisms are crucial for addressing transboundary energy challenges, promoting sustainable energy development, and achieving international climate goals. Multilateral agreements, partnerships, and initiatives are needed to facilitate knowledge sharing, technology transfer, and capacity building across borders.

Table A27.1: Schematic presentation of key energy decisions, type of plans in which these decisions are elaborated, and focus of SEA for such plans

	Key decisions	Type of plan	SEA focus
What	• Fuel mix • Private versus public responsibility • Energy import / export • International network of electricity • Energy access • Centralised or decentralised energy systems	National energy plan	• Drivers of environmental change: emissions, exploitation of natural resources • Climate scenarios for demand projections • Alignment with other sector plans • Alignment to NDCs

Where	• Site location for energy facilities, on land and marine area. • Corridor trajectories for power- and pipelines	National and sub-national spatial plans, or combined spatial/energy plans	• Land use change • Biodiversity and ecosystem services • Human occupation / uses • Vulnerable groups (winners and losers) • Climate vulnerability and risks
How	• Technology choices	From energy sub-sector plans to project design	• Drivers of environmental change: emissions, exploitation of natural resources • Climate vulnerability and risks
When	• Timeline of implementation	All plans	• Consistency with timelines of other plans and regulations

- **Making a choice:** With the understanding of the energy system, the issues on which planning decisions are needed, and the inventory of relevant planning frameworks, a choice for what plan process an SEA can be most appropriate can be made. The time schedule may play a role in deciding what plan to choose to get the most benefits from the SEA process. And last, but not least, the level of commitment and ambition of the lead authority and the available capacity and funding to implement the process can be defining factors in the selection.