IMPROVING DECISION-MAKING
FOR THE ENERGY TRANSITION

Guidance for using Strategic Environmental Assessment

CHAPTER 4

NATIONAL/REGIONAL ENERGY POLICIES, PLANS AND PROGRAMMES

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Links to the complete guidance document and to individual chapters are also available.

CHAPTER 4

NATIONAL/REGIONAL ENERGY POLICIES, PLANS AND PROGRAMMES[1]

4.1 THE CHALLENGES FACED BY ENERGY PLANNING

All countries face the challenges of climate change, and most have already taken steps to promote the transition away from fossil fuel consumption to enable and promote investment in renewable energy. It is reported that solar and wind are now being installed at a rate that is three times faster than all other new electricity sources combined.[2]

Traditionally, energy plans have played a strong role in setting the framework for regulations in the energy sector (e.g., concerning the type of power plants that can be built or prices that can be charged for fuels). They focus on estimating demand and determining the types of energy sources to be used to meet it. However, over the past three decades, energy systems have been deregulated in many countries resulting in reduced long-term energy planning. Decisions have increasingly been left to the market. In the last few years, this trend has reversed following increasing concerns over the threat of climate change.

As a result, many countries have already, or are now in the process of, reviewing, revising or developing new national energy policies, strategies and plans to respond to the climate change threat so as to reflect the need for developing renewable energy and how they will achieve this.[3] In developing such PPPs, countries need to balance their energy interests against the interests of other sectors,[4] the people and the future of planet, and this adds a further layer of complexity to the tasks that governments face. There are considerable benefits to cross-sectoral integration in developing these energy PPPs (Box 4.1).

Box 4.1: Benefits of cross-sectoral integration in developing energy PPPs

Cross-sectoral integration can offer substantial benefits for the energy sector, including: enhanced efficiency; opportunities to promote sustainability; economic savings; resilience, technological advancement and more coherent policy frameworks. By breaking down silos between different sectors, integrated energy systems can better meet the demands of a growing population while addressing the urgent challenges of climate change, biodiversity decline and resource depletion. For example:

- Excess heat from industrial processes can be used for district heating;
- Electric vehicles can act as energy storage devices for load balancing in the electricity grid;
- Agricultural waste can be a resource for bioenergy production;

[1] Prepared with substantial contributions from Roel Slootweg (SevS, Netherlands); and Arend Kolhoff (Netherlands Commission for Environmental Assessment)

[2] Blakers and Ruther (2023)

[3] In addition to other renewable energy options, national energy policies increasingly recognise the growing importance of hydropower - new, reconstructed, and especially pumped hydropower. The latter can "shift" surplus energy from solar and wind power by pumping water to a reservoir and subsequently generate electricity when wind is low or at nights when it is needed by consumers. See: https://www.eurelectric.org/publications/energy-storage-enabling-higher-integration-and-utilisation-of-variable-renewables.

[4] Through their demand for space and their potential biophysical and social impacts, energy PPPs have direct linkages with other sectors. For example, in marine environments increased competition is being observed between fisheries, shipping, wind power and biodiversity conservation objectives. Similarly, hydropower schemes in river basins may result in downstream erosion problems, create obstacles for river navigation, lead to reduced fisheries, and degrade valuable riverine and wetland ecosystems. Access roads for wind turbines and power lines may open up pristine areas for uncontrolled exploitation.

- Cross-sectoral collaboration can spur innovation and new business opportunities, such as integrated energy services and smart grid technologies, and
- Integrated approaches can align different sectors towards common goals such as carbon neutrality and energy security, making plan implementation more effective.

SEA is a process that seeks such alignment of PPPs and can play a facilitating role in bringing different sectoral interests together.

An energy policy or plan usually sets out a government's strategy regarding the production, distribution and consumption of energy. It may include sections addressing legislation and standards, international treaties, guidelines for energy conservation, taxation and energy subsidies and other matters.[5] Frequently a dominant issue is the risk of mismatch between energy supply and demand (the energy crisis). Increasingly energy PPPs are now addressing the costs of energy and environmental issues - notably greenhouse gas emission reduction. Such PPPs aim to guide the future of local, national and regional energy systems, reflecting the needs resulting from population growth and consumption patterns.

Despite these new challenges, energy planning remains a largely technical and economic exercise. Yet, wider environmental and socio-economic (including cultural) factors are highly relevant to developing models for meeting future energy demands. But these have largely been neglected. This is especially true in addressing issues affecting under-represented and marginalized and vulnerable populations, e.g., indigenous peoples, urban poor, future generations and stewards of cultural heritage and natural systems.

The energy transition is fuelling a rapid increase in the demand for land for large energy generation facilities (e.g. solar farms, wind farms, hydropower) and the associated infrastructure (e.g. for transmission lines, access roads, energy storage facilities) as well as for mines to access the minerals required for the technologies involved (e.g. lithium). This links the domain of energy PPPs directly to spatial planning frameworks such as land use planning, regional development planning, river basin management planning, coastal zone management planning, and marine spatial planning.

For most countries, the energy transition will be gradual (over many decades). As new renewable energy options are explored, committed to and developed, many countries are still likely to continue to rely on coal, oil and other fossil fuels for some time to come (despite clear evidence that planetary boundaries have already been breached).[6] So, there will be a continued reliance on a mix of energy sources (both fossil fuel-based and renewables-based) and energy policies, plans and strategies will be likely to continue to reflect this. In addition, where countries are committed to transitioning to renewable energy sources, few are likely to focus on a single form of renewable energy. Most will include a mix of renewable energy types in the mix being considered and developed.

Green hydrogen and ammonia are receiving considerable attention in the development of energy plans. The 'green' element of this is dependent on deriving the high amounts of energy required to drive the chemical process from renewable sources, particularly solar and wind power (see Chapter 11).

4.2 HOW SEA CAN BENEFIT THE PROCESS OF DEVELOPING AN ENERGY PPP?

The benefits of using SEA are discussed in detail in the Preface to this guidance and amplified in Chapters 1 and 2. Table 4.1 lists some added benefits that are specific to developing energy PPPs.

[5] Energy Policy Wikipedia.
[6] Nine planetary boundaries have been identified, and six of these already crossed - Stockholm Resilience Centre

Table 4.1: Added benefits of SEA for energy PPPs

Current practice in developing energy PPPs	Possible contribution of SEA
Demand driven: goal is to provide the energy needed.	• Supply focus: identify what renewable energy supply can be generated sustainably[7], considering interests and demands from other sectors.
Economy and technology dominate the final outcome.	• Environmental and socio-economic consequences of alternative development pathways are also assessed and may lead to a different outcome.
Focus on energy sector.	• Alignment / consistency with other (multi-) sector and spatial PPPs. • Analysis of opportunities (or win-wins) for cross-sectoral collaboration. • Addressing cumulative and synergistic effects with other PPPs.
Involvement of public and private energy stakeholders.	• Broad stakeholder engagement including potentially affected actors; structured involvement process.
Planning for ambitious targets.	• Assesses institutional roles and capacities and where clarification and or harmonisation may be necessary (may lead to reduced level of ambition).
No formalised process.	• SEA process regulated by law (in an increasing number of countries) with in-built guarantees for stakeholder participation and public review

4.3 INCREASING APPLICATION OF SEA IN THE ENERGY SECTOR

Table 4.2 lists examples of SEAs conducted for a wide range of PPPs for the energy sector in many countries. The table shows that:

- SEA in support of national energy planning is increasing worldwide but is not yet common practice;
- SEA supporting hydropower is widely applied in South and SE Asia, increasingly as part of river basin planning;
- SEA is also applied in support of oil and gas development, both on land and off-shore;
- SEA supporting wind is widely applied in Europe often as part of spatial planning, and
- The names and scope of planning documents differ widely and include, for example, energy policy, plan, strategy; energy and climate plan, or renewable energy plan; etc.

Section 4.5 provides further information on the status of SEA application to energy PPPs.

[7] Hydropower is renewable as long as rainfall feeds a river system; sustainability is sometimes questionable as particularly dams with reservoirs are associated with significant biodiversity impacts and deep reservoirs in a wet tropical climate can emit greenhouse gases comparable or greater than coal fired power plants.

Table 4.2: SEAs supporting PPPs in the energy sector and multi-sector PPPs with an important (renewable) energy component
Source: NCEA, Netherlands

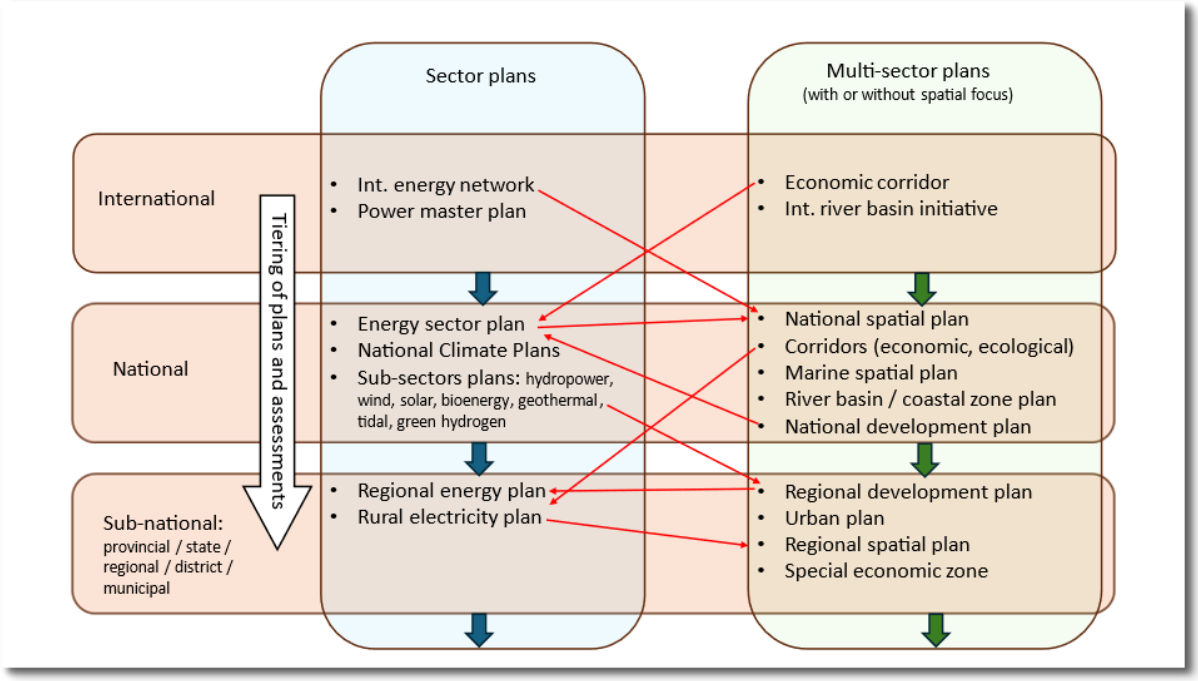
ENERGY SECTOR PPPS SUBJECT TO SEA		MULTI-SECTOR PPPS SUBJECT TO SEA	
International level			
Energy policy	Nile equatorial lakes region 2007	River basin plan	• Kenya / Tanzania 2012
Mekong hydropower plan	• Mekong river 2010		
Power development plan	• Greater Mekong Sub-region 2015		
Energy strategy	• European Union, 2022		
National level			
Energy policy	• Slovak Republic 1997, 2000 • Canada 2002 • Czech Republic 2002 • Ghana 2009 • Myanmar 2014 • Rwanda 2015 • Zambia 2019 • Nigeria 2022	National spatial plan	• Netherlands 2011, 2013 • Montenegro 2015
Energy plan	• Belgium 2008 • Vietnam 2011, 2014, 2019 • Estonia 2014 • Australia 2015 • Taiwan 2015 • Samoa 2017 • Cape Verde 2017 • Angola 2018 • Nigeria 2019 • Bhutan 2019 • Philippines 2021 • Ghana 2022 • Nigeria 2022	River basin plans	• Croatia 2015 • Rwanda 2015 • Vietnam 2008 • Georgia 2010 • Bolivia 2012
		Marine spatial plan	• Germany 2009 • Estonia 2015 • Netherlands 2016 • Sweden 2018 • Ireland 2023 • Scotland 2023
Energy and climate plan	• EU member states 2018-2023 • Serbia 2023	Corridor plan	
Energy strategy	• Montenegro 2013 • Serbia 2015 • Jordan 2020 • Scotland 2023 • Zambia 2023		
Renewable energy plan	• South Africa 2015, 2019 • Azerbaijan 2016 • Zambia 2022		
Off shore energy plan (mainly wind)	• UK 2003, 2004, 2005, 2006, 2008, 2009, 2011, 2014, 2016, 2017, 2018, 2019, 2022 • Ireland 2010 • Netherlands 2014, 2021		
Hydropower sector plan	• Nepal 1997, 2014, • Lao PDR 2004 • South Korea 2007 • Vietnam 2009 • Albania 2018 • Myanmar 2018		
Oil and gas sector (on land and off shore)	• Ghana • Cyprus • Tanzania • Uganda • Mozambique • Kenya		
Sub-national level			
Electricity supply plan	• Canada 2012	Regional development plan	• Tanzania 2015, 2016
Hydropower development plan	• Vietnam 2008 • Bhutan 2011 • India 2012, 2014 • Pakistan 2014	Regional energy strategies	• Netherlands 2022
		Spatial plan	• Montenegro 2010 • Serbia 2010

Note: The search was based on archive material and a web search conducted in English. SEAs reported in local languages (other than English) are not included. The names of PPPs may have changed.

4.4 HOW SEA FOR THE ENERGY SECTOR RELATES TO THE PLANNING CONTEXT

The optimal use of SEA to support planning in the energy sector will be determined by the wider context of the particular planning framework in a country (or state, region/province, municipality) – i.e. beyond the context of the energy sector itself. Figure 4.1 presents a generalised and simple tiered typology of such frameworks. It differentiates between plans at international, national and sub-national level (the horizontal boxes representing the so-called planning tiers). Depending on the administrative organisation of a country, the sub-national level can be further detailed at lower levels, for example with a municipal level. A federal country will also have a distinction between federal and state planning responsibilities.

Figure 4.1: Hypothetical typology of planning frameworks of relevance to the energy sector and their tiering to levels of government



Notes: The names of plans in the figure are examples from amongst the range currently prepared. Red arrows illustrate a few possible cross-linkages between plans; in reality there are many more possibilities.

The left-hand vertical box represents, in a simplified manner, the hierarchy of ***energy sector planning*** (plans prepared by energy ministries/departments as the lead authority, although this can involve government agencies, regulatory bodies, and private sector companies with delegated responsibilities), The instruments developed may include strategies, policies, plans, programmes PPPs), and ultimately the implementation of energy projects/developments. Programme and project levels are not included in the figure.

The right-hand vertical box represents ***multi-sector planning*** frameworks in which the energy sector and other sectors have an interest, act as stakeholders and where collaboration is essential.[8] In its

[8] In a regional development plan for example, the energy sector is an essential driver of development. Development planning provides indications of the future energy demand for which an energy authority will need to define infrastructure investment needs, to guarantee the supply and distribution of various types of energy and energy carriers. In spatial planning frameworks (including river basin and coastal zone management plans, and marine spatial plans), the zonation of sector interests is regulated. Energy sector interests relate to locations for energy generation types (e.g., wind, solar, hydropower, etc.), power facilities and corridors for pipelines and powerlines. The allocation of ecosystem services (water for hydropower; biomass for bioenergy) can also be regulated.

most simple representation this encompasses (i) all types of spatial planning, including land use and river basin planning, coastal zone and marine spatial planning (Annex 21 discusses the role of spatial planning for energy planning), and (ii) all types of development planning ranging from international economic corridors to regional development plans (Annex 22 discusses linkages between the energy sector and other sectors).

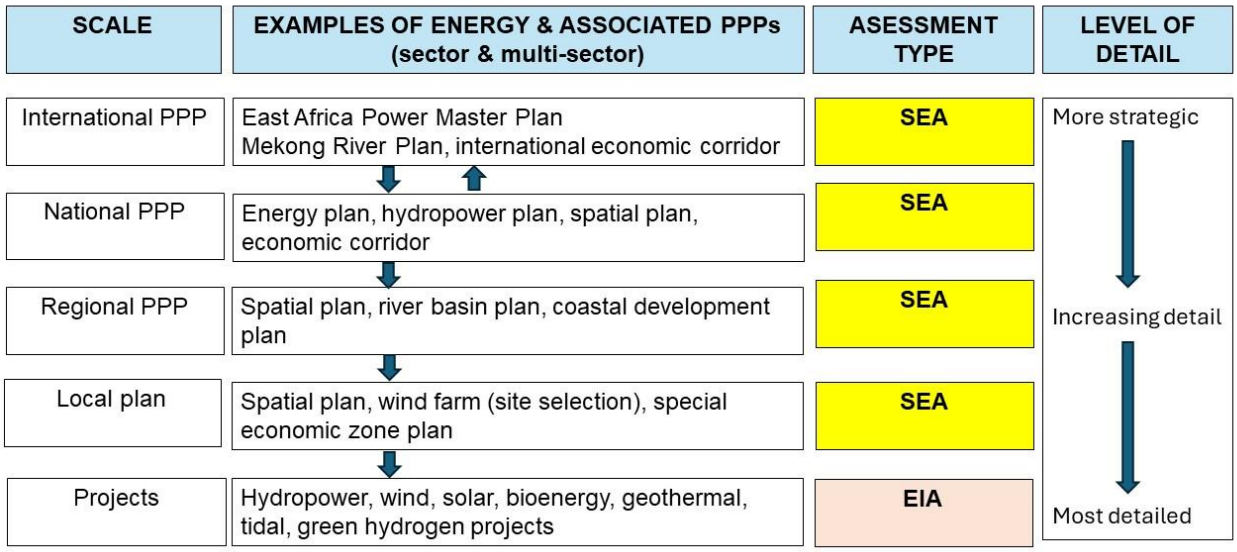
Each country will have a different set-up and terminology for its planning framework. All countries are likely to have energy sector plans, but not necessarily at all levels of government. Similarly, many countries will have an overarching development strategy or vision, sometimes supported by regional development plans without spatial focus. Spatial planning frameworks are far less common. Member-states of the Commonwealth of Nations may have followed the example of British town and country planning. But in low- and middle-income countries, spatial planning still is particularly uncommon. Yet, there is a noticeable increase in countries starting to develop regional spatial development plans.

SEA can and has been applied at all the levels of planning shown in Figure 4.1 and for both single sector plans (including for energy) as well as for multi-sector development and spatial plans. Planning situations differ widely in terms of scope. They can be broad and strategic with little detail at higher levels, or narrowly focussed and with high level of detail at lower levels. As discussed in Chapter 1, sections 1.2 and 1.7, there is no one-size-fits-all approach to SEA and each one must be tailored and designed according to the context and needs of energy planning in the country (or more locally) whilst following basic principles (see Chapter 1, section 1.4) and stages/steps (see Chapter 2). In these circumstances, in designing an SEA, it will be critically important to understand the complex, inter-connected, dynamic elements of a country's energy system (generation, distribution, consumption/use) and how efficient, reliable, affordable and sustainable they are. These elements shape energy plans, investments and outcomes at national, regional and global levels. Energy systems now need to be responsive to a number of issues linked to the energy transition which will require concerted efforts from governments, businesses, civil society and international organizations to transform energy systems in a manner that is environmentally sustainable, socially inclusive and economically viable (see also Annex 23).

The level of detail involved (for both plans and SEAs – and project EIAs) will increase through the hierarchical tiers[9] of policy-making and planning and projects (see Figure 4.2).

[9] Tiering is the organised transfer of information and issues from one planning level and assessment level to another (e.g. SEA to EIA). Effective tiering has the potential to streamline and strengthen not only the impact assessment processes, but also the associated plans and projects.

Figure 4.2: Tiering of plans, projects and environmental assessments



Adjusted from Thérivel and González Del Campo (2021)

In theory, SEA can be applied at all levels (or tiers) in the planning hierarchy. Higher level SEA can inform lower-level assessments and plans, thus effectively funnelling assessment questions to higher level of detail on more narrow planning decisions (see Annex 23). In practice, however, the planning hierarchy is not always perfectly tiered and SEA is definitely not applied at all planning levels. More often than not, SEA gets a one-time opportunity to contribute relevant information to a tier of planning steps. When defining the process design and scope of an SEA, it is therefore vital to understand the position of the plan to be assessed in the overall planning hierarchy of the country, keeping in mind that the SEA will, in any case, provide important information to define the scope of the ultimate project ESIAs at the lowest tier.

Box 4.2 provides some hypothetical examples regarding planning frameworks to illustrate the issues which may need to be addressed when deciding on the role of SEA.

Box 4.2: How SEA can support energy planning: some hypothetical examples

Example 1: Country with national energy plan but no spatial planning

This is a common situation in many low- and middle-income countries. The national energy policy has to set the national energy mix and define energy infrastructure interventions to meet future energy demands. This is done without having concrete spatial policy directions and not addressing other sectors' interests in geographically defined areas.

Very often this is partly solved by developing sub-sector plans, such as a hydropower master plan which identifies suitable locations for power facilities in all river basins. Yet, the focus remains on energy production, usually not fully taking into account the interests of other sectors including nature conservation interests, let alone having a view on potential contributions to sustainable development goals that go beyond the energy sector boundaries.

SEA can fill the void in spatial information. Apart from assessing the consequences of planned energy sector interventions, it can also assess the suitability of locations based on an assessment of the expected cumulative effects of all sector plans on a particular region, river basin or marine area. SEA can identify relevant actors and stakeholders and engage these in the process. The SEA can thus contribute significantly to the energy planning process, for example, by providing better information on a realistic contribution of particular energy types to the energy mix, or indicating the need to avoid locations where other interests will give rise to social unrest and/or legal procedures (including areas of high biodiversity interest).

Example 2: Country with national energy plan and regional spatial plans (sub-national level)

In this situation the national energy plan informs the regional spatial plans regarding energy infrastructure needs for which suitable locations need to be identified. Conversely, the spatial plans can inform the energy planning process on future regional developments, providing possible estimates for energy demand.

SEA ideally has two possible entry points:

- the energy policy level and the regional spatial plan. The focus of an energy policy SEA will be on coordination and coherence with other national sector policies, identifying drivers of environmental change (affecting water, air, land, biodiversity) and setting boundaries of sustainability.
- The focus of the second option will be the geographical delineation of areas sensitive to drivers of environmental change (e.g. high biodiversity areas), identification of areas providing critical ecosystem services (e.g., essential water storage or supply areas), areas where cumulative effects may occur, and areas where people are vulnerable to impacts.

Climate vulnerability also has a geographical focus. If only one of the two planning processes is subject to SEA, the scoping for the SEA process has to cover both entry points as much as possible.

Example 3: Country with a national energy plan and an international power pool partner

The intermittency of renewable energy sources has given rise to international planning and development of energy infrastructure networks to secure a stable electricity supply. SEA can inform coordinated decision-making amongst the participating countries, e.g.:

- on developing alternative trajectories of international energy corridors with a comparison of impacts (spatial focus); and
- on governance arrangements and international coordination for environmental monitoring and management, including possible gaps (regulatory focus).

Annex 24 provides details of the EU Energy Union's requirements for National Energy and Climate Plans, which are subject to SEA under the EU SEA Directive.

SEA can play a vital role in providing relevant and timely information on important environmental socio-economic issues (opportunities to maximise benefits and how to minimise, mitigate or manage risks and negative impacts). In this way, SEA can support decision makers to make well-informed decisions. The key environmental and socio-economic issues likely to be associated with different types of renewable energy development, retiring coal-fired power station and coal mines, and with associated infrastructure (e.g. transmission lines, access roads, etc.) are discussed in section 4.8 below and in detail in Chapters 5-13.

Annexes 25 and 26, respectively, list key planning decisions and associated issues that will need to be addressed by SEAs for an energy sector plans (left-hand vertical box in Figure 4.1) and multi-sector plans (right-hand vertical box in Figure 4.1). These annexes provide insight into the wide variety of sectoral, cross-sectoral and spatial issues that may need to be addressed before a well-informed decision on energy planning can be taken. Real-life case examples from various countries around the world are referenced. The cases do not necessarily exactly follow the logic of the tables in these two annexes (for example the Wind and Solar Spatial Plan from South Africa is both an energy plan and a spatial plan), illustrating the fact that real life is diverse and does not fit with schematic tables).

Through its emphasis on stakeholder engagement, SEA provides a process to facilitate communication and dialogue that is critical in developing the tiered range of energy and associated PPPs shown in Figure 4.2, Such communication should be fostered between PPPs in the tiers (vertical communication) – ideally in both directions, and between the PPPs for different renewable energy types (horizontal communication) (Figure 4.3).

Figure 4.3: Communication between the tiers and types of energy plans

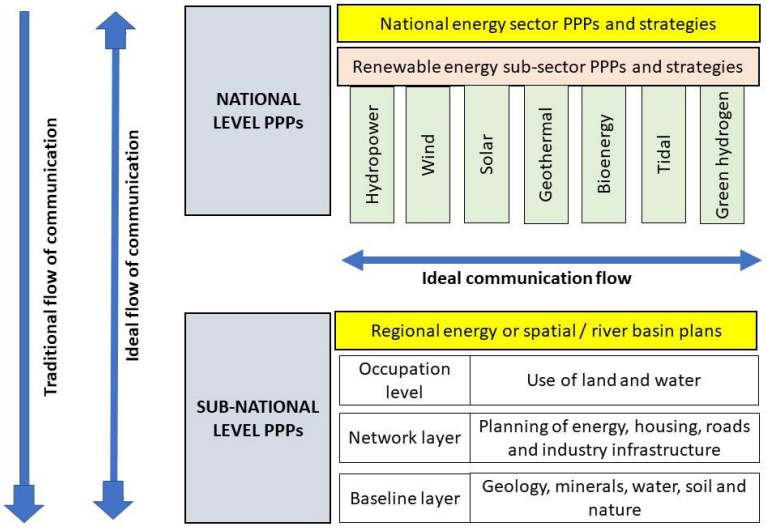


Table 4.3 compares the functions of SEAs undertaking at national and regional levels

Table 4.3: SEA for national and regional planning compared
Source: adapted from NCEA (2019)

SEA for national planning	SEA for regional planning
SEA assists national energy ministries/departments and agencies in: • Linking energy sector development to ***infrastructure development needs*** governed by other ministries/departments (e.g., road, rail, transmission lines, transport, water management). • ***Aligning energy sector PPPs*** with other national policies, e.g., by avoiding conflicts with labour rights policies. • Identifying where ***institutional roles and responsibilities*** may require clarification or harmonization. • Assessing the adequacy of existing ***institutional capacity,*** and identifying capacity required for ***compliance and enforcemen***t mechanisms. • Identifying where the energy sector and other sector ***laws and regulations*** require revision, updating or strengthening, e.g., in relation to environment, health and safety, cultural heritage and biodiversity conservation/management, etc. • Addressing ***cumulative effects*** of renewable energy developments, e.g., multiple hydropower dams in a single catchment. • Identifying ***skills required for new employment opportunities***, needs for technical and vocational training, and spin-offs (e.g. potential for creating small- and medium-sized enterprises or value-adding industries). • Identifying needs for investment in ***research and development*** in renewable energy technologies. • Ensuring consideration of environmental and social aspects of ***coal mine and/or coal-fired power plant early retirement/closure or repurposing*** and adoption of appropriate measures for rehabilitating affected areas. • Ensuring consideration of environmental and social aspects of ***safe disposal of toxic materials*** at end-of-life of renewable energy projects (e.g., safe disposal of used solar panel and wind turbine components).	SEA supports regional authorities by: • Assessing potential positive and negative ***interactions*** with other productive sectors, such as livestock, farming and fisheries. • Establishing ***priorities for conservation and development*** and characterization of stakeholders. • ***Improved governance*** between regional and national levels in relation to energy planning. • Encouraging ***regional inter-sectoral coordination*** to increase the efficiency of the transport network, rural and urban planning, and biodiversity conservation efforts. • Addressing human ***rights***, land use rights, and community participation. • ***Planning for public services*** (education, health care, public water supply) where new renewable energy schemes are expected.

Energy policy-making and planning has traditionally focused on estimating demand and determining the types of energy sources to be used to meet it. More recently, other goals such as minimising the cost of energy while addressing environmental concerns, particularly reducing greenhouse gas emissions, have been incorporated. Such policies and plans aim to guide the future of local, national, regional systems, reflecting the needs resulting from population growth and consumption patterns.

Despite these new challenges, energy policy-making and planning remains a largely technical and economic exercise. Wider environmental and social (including cultural) factors are highly relevant to developing models for meeting future energy demands, but have largely been neglected.

Energy planning is often conducted within governmental organisations but may also be carried out by large energy companies such as electric utilities or oil and gas producers. It may involve input from

different stakeholders drawn from government agencies, local utilities, academia and other interest groups. Energy planning is frequently undertaken using integrated approaches that consider both the provision of energy supplies and the role of energy efficiency in reducing demands.

Energy plans have traditionally played a strong role in setting the framework for regulations in the energy sector (e.g., concerning the type of power plants that can be built or prices that can be charged for fuels). But, as noted above, over the past three decades, in many countries, energy systems have been deregulated resulting in reduced long-term energy planning and decisions have increasingly been left to the market. In the last few years, this trend has reversed following increasing concerns over the environmental impacts of energy consumption and production, particularly considering the threat of global climate change. Sustainable energy planning is particularly appropriate for communities who want to develop their own energy security, while employing best available practice in their planning processes.

As for any other SEA, its application to energy PPPs should seek to merge with and support the process of development of the PPP to achieve maximum influence on its design and content. The experience of Vietnam in applying SEA to support preparation of successive Power Development Plans (PDPs) illustrates an evolution in SEA integration (Box 4.3)

Box 4.3: Evolution in SEA integration in Vietnam's Power Development Plans

The case of Viet Nam's Power Development Plans (PDPs) illustrates how incorporating SEA into the planning process for successive PDPs ensured that they were based on a more thorough understanding of their implications for the economy, society and environment of the country.

The first integration of SEA into the PDP was done in the preparation of the Hydropower Master Plan in the context of PDP VI. This pilot SEA considered the potential impacts of 21 large-scale hydropower schemes included in PDP VI. Five scenarios were considered: one with a base case consisting of the existing schemes included in PDP VI, and four that progressively reduced the number of hydropower schemes and replaced them with least-cost alternatives (generally thermal power) identified through the PDP process. The impacts of alternative generating sources were considered in each scenario, providing a meaningful analysis of the different options to meet the needs for generation capacity defined in PDP VI.

The lessons learned from the pilot SEA showed that changes were needed in the PDP planning process to ensure that social and environmental impacts were fully integrated into the plans for the sector. The SEA proposed a detailed model of how this was to be achieved and to inform the development of the SEA in PDP VII, which was based on the experiences and capacities developed in the execution of the pilot hydropower SEA linked to PDP VI.

The original PDP VII was prepared in 2011–2012 to guide the development of the power sector for the period 2011–2030. It analysed future electricity demand scenarios by sector, considering potential economic and social development trends. It also assessed the most effective, least-cost power generation options for meeting likely future demand patterns. The SEA was done simultaneously with the preparation of the PDP. While there was close coordination at the different stages of analysis during the PDP and the SEA preparation, there were also limitations in the extent to which the SEA was fully integrated into the PDP process.

Awareness of these impacts and concerns that the demand projections were too high led to a revision of PDP VII. The preparation of the revised PDP was based on the SEA from the original plan, with the scenarios in the analysis defined in relation to impacts identified in the SEA and related to the achievement of policies on renewable energy and energy efficiency.

The latest version of Viet Nam's PDP— the revised PDP VII (RPDP VII)—is a model of good practice in integrating an SEA in the preparation of a strategic plan that is important not just for Viet Nam but for the power sector of other countries, particularly in the Greater Mekong Subregion. The SEA provided an understanding of the implications of the different development options in the PDP, leading to significant changes in the final contents of the plan, ensuring better alignment to national

development policies of Viet Nam and that it more effectively reflected specific national targets in areas such as renewable energy and greenhouse gas (GHG) mitigation.

Source: ADB (2018).

See also Annex 28.

Regional cooperation will be of increasing importance in developing such PPPs as there will be collective opportunities for diversifying electricity generation mixes and reducing reliance on fossil fuel resources.

4.5 STATUS OF SEA PRACTICE IN THE ENERGY SECTOR

Despite repeated calls to include more strategic forms of impact assessment in energy planning, decisions about renewable energy development are still predominantly approached on a project-by-project basis.[10] Nevertheless, energy plans and programmes, and sometimes policies, are subject to SEA in many parts of the world (as illustrated in Table 4.2). In Europe, for example, energy plans are explicitly listed in the SEA Directive (2001/42/EC) while in low and middle-income countries energy is, next to transport, the most important sector in which SEAs are required to be undertaken.

An overview of the current state of research on and practice of SEA in the energy sector[11] concludes that SEAs for energy PPPs have similar shortcomings to SEAs in other sectors. In particular, the assessment of cumulative effects and the consideration of alternatives are currently done poorly. The study observes that, almost without exception, plan alternatives instead of strategic alternatives are developed and assessed in practice. Based on detailed case reviews, the study identifies meaningful energy alternatives from policy to programme levels (Table 4.4)

Table 4.4: PPP levels and energy alternatives
Source Gessler *et al.* (2021)

Level	Characteristic	Alternatives	Energy alternatives	Methodology
Policy	Federal course and guidance.	• System alternatives . • Strategic options.	• Alternative energy concepts. • Variations in energy mix. • Renewable sources. • Distribution options.	Broad-brush, qualitative (e.g., scenario analysis)
Plan	Strategy for a spatial or sectoral planning section.	• Development strategies within the sector, plan variations.	• Energy supply strategies. • Broad spatial alternatives. • Degree of exploitation • Infrastructure options.	Quantitative and qualitative methods (e.g., impact matrices).
Programme	Schedule of activities in a specific area.	• Alternatives to proposed actions (site, scope, mode).	• Site alternatives (bundle of projects) • Degree of exploitation. • Restriction options.	Quantitative (e.g. MCA, CBA).

Early examples of SEAs for energy policies are from the Czech and Slovak Republics (Box 4.4) and the UK where the Department for Business, Energy & Industrial Strategy (BEIS) (formerly DTI, BERR

[10] Nwanakezi *et al*. (2022)
[11] Geissler *et al*. (2021)

and DECC) has undertaken a sequence of Offshore Energy SEAs (OSEA) focused on oil and gas since 2001 (Box 4.5).

A recent case study used renewable energy transitions in Saskatchewan, Canada, to demonstrate how a transitions-based SEA framework can be applied to explore the capacity needs, opportunities, risks and obstacles in existing institutions and governance arrangements for low-carbon transitions (Box 4.6).

Box 4.4: SEA of energy policy in Czech and Slovak Republics

SEA of Czech Energy Policy (1997): This identified objectives and measures for the development of the entire sector (electricity, coal and gas) including future privatisation and use of economic instruments. It also addressed the future use of nuclear power, including specific project issues:

- Whether to stop or proceed with a second nuclear power plant already approved and partly built; and
- Whether to change the limits for open-cast coal mining, which would result in the destruction of additional villages in North Bohemian and North Moravia.

The SEA process focused mainly on the elaboration of the report. Extensive scoping included a national public hearing to comment on the draft policy and the proposed assessment methodology. The scoping process initiated the development of three distinct scenarios of energy mixes. These could be achieved by the use of available administrative, and legal and economic instruments to regulate behaviour of companies and individuals. The scenarios were extensively modelled and assessed against a set of 16 categories of environmental, social and economic impacts. A public review of the draft SEA report was held in the main chamber of the Czech Senate.

SEA of the Slovak Updated Energy Policy (EP 1997): This comprised a number of steps:

- Provision of information to the public about preparation of the EP;
- Expert review, including presentation of opinions for public discussion;
- Public forum on the EP with participation from state and professional bodies, industry, universities and research institutions, NGOs and the media;
- Statement by the Ministry of Environment (MoE) on the basis of expert opinion, other comments and public discussion;
- Conclusion of the public discussion, with the Statement of MoE and the Statement of the Ministry of Economics sent to all participants, and
- Submission of a new version of the proposed EP to the Slovak government – subsequently approved.

The SEA process had a number of positive features, notably with regard to public consultation and input. But NGO representatives strongly criticised the shortcomings of EP-1997 and weaknesses in the policy development process itself which lacked adequate environmental, health and socioeconomic assessments.

Source: Dusik (2003 a, b)

Box 4.5: Offshore energy SEAs in the UK

Since 2001, the UK has undertaken a series of Offshore Energy SEAs (OSEA) considering various areas of the UK continental shelf (SEA areas 1-8), in addition to an SEA for Round 2 wind leasing. The more recent Offshore Energy SEAs (OSEA, OSEA2, OSEA3 AND OSEA4) incorporated the entire UK continental shelf (with the exception of Northern Ireland and Scottish territorial waters for renewable energy, and Scottish territorial waters for carbon dioxide transport and storage), for technologies including oil and gas exploration and production, gas storage and offloading including carbon dioxide transport and storage, renewable energy (including wind, wave and tidal power), and offshore hydrogen production and transport.

As these SEAs have been carried out, the process has evolved and continues to improve. It includes consultation with the public, environmental authorities, and other bodies, together with such neighbouring states as may be potentially affected. The process is guided by a Steering Group comprising departmental representatives, conservation and other agencies, NGOs, industry representatives and independent experts. The diverse members' role is to act as technical peers, guiding the selection of SEA methods and identifying the right information sources.

Source: https://www.gov.uk/government/collections/offshore-energy-strategic-environmental-assessments

Box 4.6: SEA for energy transitions

A study showed how applying SEA to renewable energy transitions in Saskatchewan, Canada, identified significant benefits, opportunities and risks in renewable energy transitions. Opportunities existed to address energy security concerns and promote distributed generation, but perceived risks included the immediate economic impacts of transitioning away from a fossil-based economy, reliability risks owing to the intermittent nature of renewables, and political uncertainty about the future electricity landscape. The results showed the need for clear transition goals and implementation strategies, including full commitment to the transition agenda. For transitions-based SEA, results highlighted the need for transparency and accountability to ensure effective implementation and the difficulty in establishing new assessment regimes. The lessons of this study appear broadly relevant for addressing low-carbon transition challenges and opportunities in other jurisdictions.

Source: *Nwanakezie et al. (2022)*

EU requirements for member states to produce National Renewable Energy Action Plan (NREAP) and National Energy and Climate Plans (NECP) and how SEAs apply to these are discussed in Annexes 24 and 36.

4.6 GUIDANCE AND TRAINING FOR DEVELOPING ENERGY PPPS

It is often difficult to know whether individual governments have issued internal guidance for developing energy PPPs as this information may not be made public.

The EU has issued guidance for preparing progress reports on the implementation of National Energy and Climate Plans (NECPs) (EU 2022) (see Annex 36 for discussion of NECPs). It sets out principles and good practice and describes how the reports should address a range of issues. But there is no specific requirement to subject the NECPs to an SEA process (EU 2022).[12]

In the USA, guidance is available for community energy strategic planning (USDE 2013) (Box 4.7) whilst, in the UK, Energy Systems Catapult has published ***guidance on how to create a Local Area Energy Plan*** (LAEP) (Box 4.8). Both suggest a series of steps for the process.

Training

The International Renewable Energy Agency (IRENA) provides capacity building support to countries for developing or updating national energy masterplans through its Masterplan Development Support Programme.[13] The programme typically spans one to two years and includes several weeks of in-country training to calibrate a system planning test model, explore energy planning scenarios, and develop a national energy masterplan document. In-country sessions are complemented by online training and other meetings.

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A52022XC1229%2802%29%from=EN

[13] see: www.irena.org

Box 4.7: Guide to Community Energy Strategic Planning (CESP), USA

In 2013, the US Department of Energy prepared a Guide to Community Energy Strategic Planning (CESP) (USDE 2013). It offers the following 10-step process for creating a robust strategic energy plan for a local government and community that can help save money, create local jobs, and improve national security:

1: Establish and charge a leadership team;
2: Identify and engage stakeholders;
3: Develop an energy vision;
4: Assess the current energy profile;
5: Develop energy goals and strategies;
6: Identify and prioritize actions;
7: Put together a financing strategy;
8: Develop a blueprint for implementation;
9: Plan to evaluate, and
10: Develop, adopt, and publicize the CESP.

The guide offers tools and tips to complete each step and highlights examples from successful planning efforts around the country. It aims to help local governments and community stakeholders to use the CESP framework to build on initial energy successes by moving from single projects and programmes to a comprehensive, long-term energy strategy that delivers benefits for years to come.

A CESP is seen not as a static document but rather as a long-term blueprint to focus and guide efforts and actions toward a defined energy vision. The plan articulates goals, develops strategies and actions to meet the goals, and identifies and allocates resources to assure effective completion of these strategies.

Source: USDE 2013.

Box 4.8: Guidance on how to create a Local Area Energy Plan (LAEP), UK

In the UK, Energy Systems Catapult has published ***guidance on how to create a Local Area Energy Plan*** (LAEP). It is aimed at local government organisations who are looking to create a plan to help them meet their net zero goals and climate emergency declarations.[14] A LAEP sets out the change required to transition an area's energy system to Net Zero in a given timeframe. This is achieved by exploring potential pathways that consider a range of technologies and scenarios, and when combined with stakeholder engagement leads to the identification of the most cost-effective preferred pathway and a sequenced plan of proposed actions to achieving an area's Net Zero goal.

The Guidance provides a detailed description of a 7-stage end-to-end process:

1. Preparation;
2. Stakeholder Identification and Engagement;
3. Understanding and Representing the Current Local Energy System;
4. Modelling Options for the Future;
5. Scenario Refinement and Selection;
6. Actions, Priorities, and Decisions, and
7. Create the Plan

Source: https://es.catapult.org.uk/guide/guidance-on-creating-a-local-area-energy-plan/

[14] See: https://es.catapult.org.uk/guide/guidance-on-creating-a-local-area-energy-plan/

4.7 STEPS IN UNDERTAKING AN SEA FOR AN ENERGY SECTOR PPP

As for any SEA, one carried alongside or as an integrated component of developing or reviewing an energy sector policy, plan, programme of equivalent (e.g., a strategy), should follow the basic stages and steps set out in Chapter 2.

In most countries having legislative or regulatory requirements for SEA, energy sector PPPs are specifically identified as requiring an SEA. Similarly, multilateral development banks usually require an SEA/SESA to be completed when they are providing funding for energy sector development such as initiatives to support the energy transition. Examples regarding the latter include an SEA initiated in 2022 by the Asian Development Bank in Indonesia and scoping for a possible SEA in the Philippines (2023-2024) - both linked to implementing the Energy Transition Mechanism in countries in Southeast Asia.

4.8 ENVIRONMENTAL AND SOCIO-ECONOMIC ISSUES THAT AN ENERGY PPP WILL NEED TO ADDRESS

At the level of energy planning, several key environmental and social issues need to be addressed to ensure sustainability, equity and resilience (Box 4.9). Addressing these issues requires an approach that considers the interconnections between energy, environment and society. SEA can contribute by incorporating sustainability principles, equity considerations and stakeholder engagement mechanisms into energy planning, for governments to promote a transition to a more resilient, equitable and sustainable energy future.

Box 4.9: Key environmental and socio-economic issues for energy planning

- ***Climate change mitigation***: Energy policies must prioritize reducing greenhouse gas emissions to mitigate climate change. This involves promoting the transition to low-carbon energy sources, and implementing measures to improve energy efficiency and reduce energy waste in accordance to the Nationally Determined Contributions under the Paris Agreement (see Box 1 in the 'Background to this guidance and the energy transition' in the preliminary sections).

- ***Air quality and public health***: Fossil fuel combustion for energy generation contributes to air pollution, which has significant public health impacts. Energy policies should include measures to reduce air pollutants such as particulate matter, nitrogen oxides, sulphur dioxide and volatile organic compounds to protect human health and improve air quality.

- ***Water resources management***: Energy production and consumption can have significant impacts on, but also depend on water resources through activities such as cooling of power plants (water temperature), hydraulic fracturing (fracking) for natural gas extraction (pollution), hydropower generation (hydrological changes) and hydrogen production (freshwater withdrawals).

- ***Biodiversity conservation***: Energy infrastructure development such as dams, transmission lines, access roads and renewable energy installations can disrupt ecosystems and threaten biodiversity. Energy policies should incorporate measures to minimize habitat destruction, preserve biodiversity hotspots, restore degraded ecosystems providing important ecosystem services and mitigate impacts on sensitive species and ecosystems.

- ***Land use and land rights***: Energy infrastructure development requires land (or sea). This can lead to conflicts over land rights, displacement of communities and loss of agricultural land or natural habitats. Energy policies should promote sustainable use of land and marine areas, respect indigenous and local land rights and prioritize land conservation and restoration efforts.

- ***Energy access and equity***: Access to affordable, reliable and clean energy services is essential for poverty alleviation, economic development and social equity. Energy policies should prioritize universal energy access, particularly for marginalized and underserved populations, through initiatives such as rural electrification programmes, off-grid solutions and subsidies for low-income households. Benefit-sharing can be a mechanism to compensate communities affected by, for example, solar and wind parks or transmission lines, in terms of low-cost energy or sharing in financial benefits via private-public mechanisms.

- ***Just Transition [15] for workers and communities***: The transition to a low-carbon economy may have adverse social and economic impacts on workers and communities dependent on fossil fuel industries. Energy policies should include measures to support affected workers through retraining programmes, job creation initiatives, income support and community development projects to ensure a just transition to sustainable energy.

- ***Community engagement and participation***: Engaging and consulting with local communities and stakeholders is essential for building trust, addressing concerns and ensuring the social acceptability of energy projects (see Chapter 1, section 1.10). Energy policies should promote meaningful community engagement processes, including stakeholder consultations, public hearings and participatory decision-making mechanisms.

- ***Environmental justice***: Energy policies should address environmental justice concerns by ensuring that the benefits and burdens of energy development are equitably distributed among all segments of society, particularly vulnerable and marginalized communities. This requires considering social demographics, socio-economic status and historical inequities in energy policy design and implementation.

- ***Resilience to climate change and natural disasters***: Energy infrastructure is vulnerable to climate change impacts and extreme weather events such as hurricanes, floods and wildfires. Energy policies should promote climate resilience by enhancing the robustness and reliability of energy systems, diversifying energy sources and integrating climate risk assessments into infrastructure planning and design.

The main sources of non-renewable energy of critical concern as regards climate change are carbon-based fossil fuels such as coal, oil, and natural gas. These are burned to generate energy in power stations and internal combustion (vehicle) engines.

As far as reducing reliance on fossil fuel-based energy production is concerned, this guidance focuses on the need for retirement of coal-fired power plants and the closure of associated coal mines (Chapter 11). The renewable energy sources addressed by the guidance are: hydropower (Chapter 5), wind (Chapter 6), solar (Chapter 7), bioenergy (Chapter 8), geothermal (Chapter 9), tidal (Chapter 10) and green hydrogen/ammonia (Chapter 11). For all renewable resources discussed in these chapters, it is essential to also consider the impacts of associated infrastructure (see Chapter 13).

For all these sources, there is a relatively common set of issues for which there is potential for environmental and socio-economic impacts to arise for which management and mitigation measures need to be addressed (see Tables 4.5 and 4.6, respectively). The specifics of these issues for different energy developments are addressed in subsequent chapters.

Many of the environmental and socio-economic issues discussed in Chapters 5 – 12 will appear to be at a project level. This is because most our knowledge of these issues is derived from experience of implementing energy generation activities around the world - both for fossil fuel and renewable energy developments and projects. These are the very issues likely to be identified during scoping for an SEA (see Chapter 2, section 2.5), either because stakeholders are familiar with them or, often, because they have been directly affected by them. It is important to understand these issues because they may give rise to cumulative impacts from multiple projects when a PPP is implemented, and a critical role of SEA is to identify the potential and risk of cumulative impacts arising. Furthermore, these are the issues that

[15] See section 5 in Preface

may require to be addressed by changes to existing laws, regulations or PPPs, and this is a matter on which an SEA should make recommendations.

Given the challenges of climate change and international commitments concerning GHG emissions, new or revised energy PPPs need to focus on how to change the balance in energy sources to reduce GHG emissions, promote and invest in renewable energy options, reduce long-term cumulative impacts and ensure that energy development does not add to pressures on the planetary boundaries. Many countries have already made considerable progress in this transition. An SEA for a national or more local energy PPP seeking to promote this transition will need to address all these issues (as applicable).

Table 4.5: Environmental issues associated with closing coal-fired power plants/coal mines and developing renewable energy facilities

Theme	CFPP	Coal Mines	Geothermal	Hydropower	Solar	Tidal	Wind	Bio-energy	Green H & NH_3
	Early Retirement	Closure	Development						
Integrity of habitats and preservation of biodiversity									
Integrity of protected & sensitive areas									
Delivery of ecosystem services									
Maintenance of air quality									
Fresh water use/demand									
Maintenance of water quality									
Waste (solid, gas, liquid, toxic, hazardous, spoil) & pollution)									
Land/water contamination									
Noise and vibration									
Greenhouse gas emissions									
Land degradation (erosion/sedimentation/deforestation)									
Land/marine use change									
Flooding									
Hydrological change (rivers, estuaries)									
Demand for mineral extraction									
Risk of earthquake damage									
Land drainage									
Visual impacts									

Note: Issues may be directly related to the retirement/closure of CFPPs/mines or development of RE facilities; or indirectly to the need for associated infrastructure (e.g. access roads, transmission lines) and material sourcing (e.g. minerals).

Table 4.6: Socio-economic issues associated with closing coal-fired power plants/coal mines and developing renewable energy facilities

Theme	CFPP	Coal Mines	Geothermal	Hydropower	Solar	Tidal	Wind	Bio-energy	H & NH_3
	Early Retirement	Closure		Development					
Economic growth									
Legacy socioeconomic issues									
Employment and labour conditions									
Local economy and livelihoods									
Gender and vulnerabilty									
Indigenous communities									
Food security and price									
Skilled workers									
Health and safety									
Physical and economic displacement									
Conflicts									
Migration									
Community engagement and cohesion									
Public services and infrastructure									
Cultural heritage									
Human rights									

Note: Issues may be directly related to the retirement/closure of CFPPs/mines or development of RE facilities; or indirectly to the need for associated infrastructure (e.g. access roads, transmission lines) and material sourcing (e.g. minerals).

4.9 DESIGNING THE SEA PROCESS AND CHALLENGES IN IMPLEMENTING ITS RECOMMENDATIONS FOR ENERGY SECTOR PLANNING

When designing the process of an SEA applied to an energy plan, it will be important to ensure that it has the best chance of supporting and influencing the plan, i.e., to ensure that the SEA is as effective as possible (see Chapter 1, section 1.12). In this regard, it is critical that the government agency commissioning the SEA considers how the SEA can be integrated with the planning process to the greatest extent possible. Section 1.5 (Chapter 1) provides a discussion of how SEA relates to the plan development process and how *ex ante* SEA provides the best opportunity for influencing plan preparation.

In seeking to best design the SEA process, the expert team will need to work with the relevant government agencies to clarify the process and steps involved in developing a new, or revising an existing, energy plan. This is necessary to determine when critical steps and decisions in plan development will be made and when products and recommendations of the SEA can best support and inform the planning process.

At the same time, when designing the SEA process, the key actors involved in developing/revising the plan should be identified and a strategy developed to make sure that they are informed of the SEA, understand how it can help their work, and are involved in (e.g., kept informed) of SEA progress, and receive essential information at appropriate and critical times.

A key product of an SEA will be a Strategic Environmental and Social Management Plan (SESMP) (see section 2.7.2 and Annex 16 which sets out the recommended content of a SESMP). The SESMP should be developed in close consultation with those government and non-government agencies and organisations that are likely to have a role in its implementation so that they are involved in agreeing its contents and recommendations, verifying that they are achievable and proportionate to identified key issues, and to ensure that roles and responsibilities are fully understood and 'bought into'. A key challenge to implementing SESMP recommendations (e.g., for environmental or social management or for monitoring key indicators) is that there is often a lack of adequate technical skills, capacity and equipment, and budget allocations may be insufficient. This means that the SESMP should address where capacity strengthening and/or training may be required, and it should be fully costed where possible.

Furthermore, there is sometimes a lack of clarity over institutional mandates and jurisdictions, and thus rivalries and 'defence of turf'. This may be the result of unclear or overlapping legislation/regulations. It can lead to institutional conflicts regarding roles and responsibilities to implement SEA/SESMP recommendations. These potentials should be address and solutions found when consulting on the content of the SESMP.

Once the implementation process has been agreed to by all parties involved, it will be critical to monitor the progress of implementation and make and make any additional changes required that are needed to ensure success.