CENTRE FOR INDUSTRIAL POLICY

REGIONAL ENERGY-ECONOMY PLANNING:

A Framework to Accelerate Decarbonization and Support Economic Development

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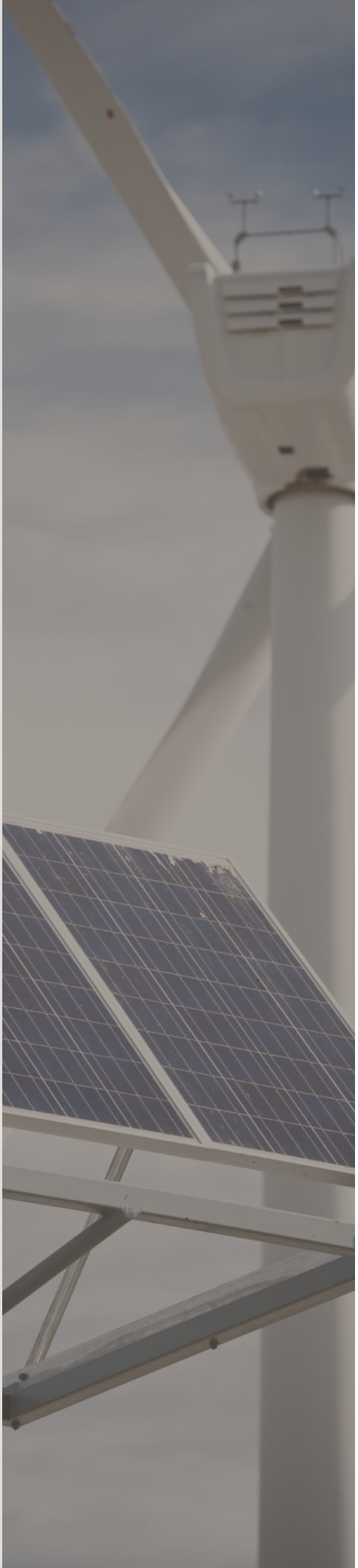

EXECUTIVE SUMMARY

Regional energy economy planning is an emerging but actionable framework for aligning Canada's energy transition with regional economic development, land use, and community well-being, rather than treating these as separate or competing agendas. It offers Canadian governments a way to turn investment in clean energy, grids, and demand-side measures into a deliberate regional development strategy that supports jobs, diversification, and climate commitments.

Concept and framework

Regional energy economy planning is an integrated approach that links energy system transformation with regional economic development, territorial cohesion, and community well-being at sub-national and sub-provincial scales. It expands beyond techno-economic modeling by embedding energy decisions in spatial planning, governance reform, and industrial strategy, coordinating generation, transmission, storage, and demand-side measures as levers for regional prosperity and climate action. Internationally, this approach appears as a "family" of planning practices rather than a single model, combining spatially explicit energy planning, economic development tools, multi-level governance, and mechanisms for local value creation. Common design principles include: clear national targets that can be translated into spatial and capacity obligations; multi-tier governance connecting system planning with regional and local plans; mapped priority areas for energy and industry; financing and procurement tools that turn plans into projects; and robust mechanisms for community and Indigenous engagement and just transition.

Lessons from international frameworks

This report shares comparative lessons from five established and two emerging frameworks—Germany, France, Spain's Basque Country, New South Wales (Australia), South Africa, Québec, and the United Kingdom—to show how regional energy economy planning can be institutionalized. The five established frameworks have years or decades of implementation experience; the two emerging frameworks — Québec and the United Kingdom — have robust legislative and planning architectures in place but have not yet been operationalized or tested at scale. These cases demonstrate how energy transition investments can be explicitly tied to regional economic strategies, industrial clustering, and local benefit-sharing, rather than treated as purely technical grid assets. Key lessons relevant for Canadian practitioners include:

- Coordinated multi-level governance with clear hierarchies or compatibility requirements so that provincial or national climate and electrification targets drive regional and local plans, while allowing contextual adaptation;
- Employing spatially explicit priority areas—such as renewable acceleration areas, renewable energy zones, or economic land zones—to coordinate generation, networks, and industrial development in specific regions;
- Integrating industrial and regional policy into energy planning, including localization requirements, cluster development, and support for SMEs and local ownership models; and
- Designing social inclusion, just transition, and Indigenous partnership mechanisms into planning processes, ownership structures, and financial arrangements, rather than assuming decentralization alone will democratize energy.

Emerging Canadian practice: Québec's PGIRE

Within Canada, Québec's Integrated Energy Resources Management Plan (*Plan de gestion intégrée des ressources énergétiques*, PGIRE) is an emerging example of how regional energy economy planning can be legislated and operationalized. Created through Bill 69, the PGIRE establishes a legally mandated, regularly updated 25-year multi-fuel, multi-sector plan that coordinates electricity, renewable natural gas, hydrogen, biomass, and thermal energy across sectors. The framework is explicitly designed to align Hydro-Québec's Action Plan 2035 and the province's 2050 carbon-neutral target with regional economic development, including new commercial arrangements between renewable producers and adjacent industrial consumers. The plan operates at the provincial scale, establishing a binding strategic framework within which regional and local energy and land-use decisions will need to align, with mechanisms for downward coordination to be developed through subsequent implementation, and is intended to be closely aligned with *Plan pour une économie verte 2030* and the province's legislated GHG reduction targets. For other Canadian jurisdictions, the Québec experience underlines the value of:

- Legislating an integrated provincial energy–economy plan with a clear time horizon and update cycle;
- Planning all major energy carriers and end-uses together and;
- Using provincial planning to authorize new commercial and tariff structures to accelerate regional projects and anchor industrial activity and jobs.

Why it matters for Canada

This report argues that Canada faces converging pressures—rapid electrification, constrained transmission capacity, net-zero commitments, regional inequality, and Indigenous rights—which heighten the need for integrated regional planning. Current community energy initiatives and provincial climate policies provide important foundations but remain fragmented at the regional scale and only partially linked to economic development strategies, particularly in rural, remote, and northern regions. Regional energy economy planning frameworks could encourage Canadian provinces and territories to:

- Target new generation and transmission into regions where they can anchor industrial diversification, such as hydrogen production, critical minerals processing, and low-carbon port logistics;
- Embed energy siting and grid expansion into regional land-use planning to reduce conflicts, shorten permitting timelines, and provide greater certainty for investors and communities and;
- Link energy infrastructure explicitly to local fiscal benefits, employment, and supply-chain development, rather than relying on trickle-down effects—in other words, community wealth creation.

In a context of geopolitical uncertainty and trade tensions with the United States, regional energy economy planning can help strengthen domestic resilience and bargaining power by building robust regional clean energy systems and supply chains. It also offers a tool to address regional disparities and contested resource politics, improving the political durability of Canada's energy transition. The different frameworks and approaches we share here offer opportunities for comparative learning, but any initiatives developed from them must of course be firmly grounded in local and regional contexts.

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PART I

REGIONAL ENERGY ECONOMY PLANNING: COMPARATIVE APPROACHES

Introduction

Regional energy economy planning is an emerging planning paradigm that explicitly links energy system transformation with regional economic development, territorial cohesion, and community well-being at sub-national and sub-regional scales. This is a rarely used term in academic and policy literature, where “regional energy economy modeling” remains dominant. The latter has largely focused on techno-economic optimization, system modeling, and multi-criteria decision methods to balance supply, demand, technology choice, and environmental constraints, while paying comparatively limited attention to spatial governance, industrial strategy, and community development. Yet a growing body of work on integrated and spatial energy planning demonstrates that planning practices have begun to adopt institutionalized frameworks that coordinate energy infrastructure siting, land use, and economic development, particularly in Europe.

The comparative case studies assembled here demonstrate that, even if not consistently labeled as such, regional energy economy planning is already being practiced in a variety of institutional forms. For Canada, these international experiences offer timely lessons as

provinces confront rapid electrification, constrained transmission capacity, and the need to reconcile climate commitments with regional inequality and Indigenous rights. Existing community energy planning and provincial climate policy provide important foundations but remain fragmented at the regional scale and only partially linked to economic development strategies, especially in rural, remote, and port-dependent regions. By articulating regional energy economy planning as a coherent planning concept and examining established and emerging frameworks in Germany, France, Spain, South Africa, Australia, Québec, and the United Kingdom, this report aims to equip Canadian policymakers, planners, Indigenous governments, and regional development actors with approaches that harness the energy transition as a lever for inclusive, place-based economic transformation.

This report presents regional energy economy planning as both a concept and a practical policy framework for Canadian regions. It begins by outlining the relevance and implications of this approach for Canadian jurisdictions and actors. A subsequent section then traces the evolution of energy, spatial, and regional development planning, identifying key gaps in how energy transitions have been linked to place-based economic development and community well-being. This is followed by a comparative overview of the five established and two emerging international frameworks (where there is a strong legislative foundation but limited implementation experience to date), detailing their governance structures, spatial tools, industrial strategies, and approaches to social inclusion and just transition (with detailed case studies of each jurisdiction available in **Part II**). Cross-cutting lessons and design principles are then explored, translating these into an analytical framework that can guide future regional energy economy planning initiatives.

Relevance and implications for Canada

A regional energy-economy planning approach offers a means to align energy system transformation with regional economic development, land-use planning, and community well-being, rather than treating these as parallel or competing agendas. Such a framework would allow provinces and territories to use energy generation, transmission, storage, and demand-side investments as deliberate levers for jobs, industrial diversification, and climate action at the regional scale. The comparative evidence that we have assembled across seven international cases, including the Integrated Energy Resources Management (PGIRE) framework in Québec, demonstrates that institutionalizing this linkage is both feasible and politically salient in the current context of economic uncertainty, contested trade relationships, and accelerating decarbonization pressures.

Benefits for Canada's regions

The international cases in Germany, France, the Basque Country, New South Wales, South Africa, Québec, and the United Kingdom show that regional energy economy planning can turn energy transition into a core regional development strategy. In these jurisdictions, spatial planning tools, multi-level governance reforms, and targeted

industrial strategies are used to coordinate renewable deployment, grid upgrades, and value chains with regional strengths, such as port infrastructure, manufacturing bases, or natural resource endowments.

For Canada, similar benefits could be realized by:

- Using regional energy planning to target new generation and transmission into areas where it can anchor industrial diversification, such as hydrogen production, critical minerals processing, or low-carbon port logistics.
- Embedding energy siting and grid expansion into regional land-use planning to reduce conflicts, shorten permitting timelines, and provide certainty to investors and communities.
- Linking energy infrastructure explicitly to local fiscal benefits, employment and supply-chain development, as seen in frameworks where regional plans steer industrial clustering and municipal revenue generation.

Given that many Canadian regions, including rural, remote and northern areas currently experience fragmented energy planning and partial linkages to economic strategies, a regional energy economy approach could help coordinate existing community energy initiatives, provincial climate policy and regional development efforts into a coherent strategy.

Ranges of approaches and key learnings

This report identifies a spectrum of regional energy economy frameworks, from evolving planning approaches to highly codified masterplans, each offering distinct lessons for Canadian provinces and territories. For example, Germany's spatial energy planning system uses area-based land designations and multi-level spatial plans to align renewable build-out with industrial clusters, ports, and municipal revenues, while France links a national energy roadmap to binding regional spatial and economic strategies. In Spain's Basque Country, the regional territorial plan for renewable energy uses suitability mapping and territorial rules to steer projects toward zones where resource potential, grid capacity and socio-economic priorities coincide, and in South Africa, national renewable energy and industrial plans connect designated renewable energy zones and special economic zones to a just transition industrial strategy in coal regions. In New South Wales and the United Kingdom, renewable energy zones and strategic spatial energy plans embed energy pathways within existing regional economic geographies and network planning.

Across these cases, several features stand out as particularly valuable for Canada:

- Multi-level governance with clear hierarchies. Successful frameworks create a structured relationship between national or provincial targets and regional and local plans, often through legal compatibility requirements or iterative two-way planning (where national targets inform local plans, and local realities in turn shape national goals) while still allowing contextual adaptation.

- Spatially explicit designation of priority areas. Zonal tools—renewable acceleration areas, renewable energy zones, or economic land zones—provide clarity about where energy infrastructure and associated industries should cluster.

- Explicit integration of industrial and regional policy. Exemplary frameworks treat energy expansion as a vehicle for industrial policy and regional development, with measures such as localization requirements, cluster development, innovation zones, and support for small and medium sized enterprises.

- Deliberate social inclusion and just transition mechanisms. Particularly in South Africa and in elements of New South Wales, energy planning is tied to community benefit-sharing, worker transition, and targeted investment in historically marginalized regions.

For Canadian provinces and territories, the key learning is not to replicate a single model, but to combine these elements into provincial frameworks that legally link decarbonization and electrification targets to regional spatial and economic plans, define regional zones where energy, infrastructure, and industrial strategies converge, and create mechanisms for Indigenous governments, municipalities, and regional development actors to shape scenarios and project pipelines in ways that secure social license and local benefit.

Political salience and the Canada–US trade context

The political importance of regional energy economy planning for Canada is heightened by current challenges, including strained trade relations with the United States. In a context where cross-border trade conditions are uncertain and industrial policy is increasingly shaped by geo-economic competition, Canada's ability to leverage its energy transition for domestic value creation becomes strategically significant.

A regional energy economy framework can support this in several ways:

- Strengthening domestic resilience and bargaining power. By building robust regional clean energy systems and associated supply chains, provinces can reduce exposure to cross-border disruptions while positioning themselves as reliable partners or competitors in North American clean energy and critical minerals markets.

- Aligning climate and competitiveness agendas. International examples show how energy plans can be used to steer investment into export-oriented manufacturing, green fuels and equipment sectors, thereby responding simultaneously to climate commitments and industrial competition.

- Addressing regional inequality and social license. Canada faces pronounced regional disparities and contested resource politics; frameworks that direct energy and industrial investment into lagging or carbon-intensive regions can underpin a more politically durable transition.

In this sense, regional energy economy planning offers a tool of economic and territorial strategy that can help Canada navigate an unstable trade environment, meet net-zero objectives, and maintain political cohesion across provinces and territories.

Québec's Integrated Energy Resources Management Planning as an emerging Canadian practice

Within the Canadian federation, Québec's emerging Integrated Energy Resources Management Planning framework (*Plan de gestion intégrée des ressources énergétiques*, PGIRE) stands out as a potential leading practice. Established through Bill 69 — the *Act to Ensure the Responsible Governance of Energy Resources* (2025) — the legislation creates a legally mandated 25-year, multi-fuel, multi-sector plan, updated every six years with a three-year progress review, that integrates electricity, renewable natural gas, hydrogen, biomass and thermal energy across sectors and end-uses. The plan establishes a binding strategic trajectory within which energy distributor supply plans and regulatory decisions by the *Régie de l'énergie* must align. This framework is explicitly designed to align Hydro-Québec's Action Plan 2035 and the province's 2050 carbon-neutrality aspiration with economic development objectives, including new commercial arrangements between renewable producers and energy-intensive industrial users, supported by strengthened ministerial authorization conditions on electricity access. Québec has a long history of energy planning, but the PGIRE represents a significant evolution to an integrated and government-led system with statutory force and systematic update mechanism.[i]

PGIRE links energy infrastructure directly to local employment and industrial development, positioning Québec to capitalize on its hydroelectric resources and electrified manufacturing base, using low-cost, low-carbon electricity as a primary competitive input, including aluminum, steel, critical minerals, data centres, and advanced manufacturing. Québec already exchanges 34–36 TWh annually with Ontario, the Maritimes, and the northeastern United States; the more significant infrastructure challenge is the investment required to connect remote generation sites to industrial and population centres via expanded transmission networks. The PGIRE establishes the province-wide strategic framework within which regional and local energy and land-use decisions will need to align, with the mechanisms for that downward coordination to be developed through subsequent implementation. The framework promotes collaboration among the provincial government (led by MEIE with six contributing ministries), energy distributors (Hydro-Québec, Énergir,

and Enbridge Gaz Québec), the *Régie de l'énergie* as independent regulatory advisor, Indigenous communities engaged through a dedicated Québec–First Nations table and bilateral territorial consultations, and civil society through a structured participatory process including a 14-region public tour, thematic expert workshops, and a formal public consultation period. The energy transition is positioned as a driver of economic competitiveness and regional industrial development.

For other provinces and territories, the Québec case illustrates:

- The value of legislating an integrated, province-wide energy–economy plan with a clear time horizon and update cycle.
- The importance of planning all major energy carriers and end-uses together, rather than in siloed electricity, fuels, transport or building strategies.
- The potential to use provincial planning to strengthen ministerial conditions on energy authorizations and support new kinds of commercial arrangements between clean energy producers and industrial consumers that anchor local industrial activity.
- The importance of grounding energy planning in an explicit economic strategy, treating clean energy as a locomotive for job quality and regional industrial development.

Québec's approach offers a domestically grounded reference point for strategically coordinated, long-horizon energy transition governance.

The evolution of energy planning and regional development approaches

Goals for decarbonization, electrification, and energy resilience have intensified interest in community and regional energy investments, yet most scholarship still treats energy planning as a technical exercise rather than a lever for regional development. Energy economy modelling dominates work on regional energy planning, focusing on techno-economic optimization, multi-criteria decision-making, and integrated resource planning, with limited attention to spatial governance, industrial strategy, or community development (Salak et al., 2024). Parallel literatures on spatial and energy planning have grown since the 1970s oil crisis and the emergence of integrated energy plans, but reviews conclude that this evolution has not yet translated into systematic support for local and regional development, nor into routine integration of community participation in planning (De Pascali & Bagaini, 2019; Mirakyan & De Guio, 2013; Nijkamp & Volwahsen, 1990). Early work linked energy to the physical functioning of cities and later to sustainability debates after the Rio conference, yet empirical applications remained focused on buildings, population density, and environmental impacts, rather than multi-sector regional strategies or long-term institutional change (De Pascali & Bagaini, 2019; Mirakyan & De Guio, 2013).

Case studies of regional energy strategies, such as Italy's Regional Energy Master Plan for the Marche Region, show the potential of coordinated planning but also highlight persistent gaps. Italy's approach has advanced local and regional policies and energy-saving measures, supported by coordinated audits and information campaigns, yet it was constrained by short-termism and weak integration of industrial and economic sectors into strategic planning (Brandoni & Polonara, 2012; Cormio et al., 2003; De Pascali & Bagaini, 2019; Li et al., 2011). Even where regional economic development is considered, the focus tends to be on labour markets, firm attraction, and local demand, rather than on deliberately restructuring regional energy–economy relations or building new value chains (Aksoy, 2019; Nijkamp & Volwahsen, 1990; Prasad et al., 2014). Multi-criteria and bottom-up modelling frameworks, including integrated resource planning and various integrated energy plans, incorporate more dimensions—such as environmental and social factors—and attempt to address uncertainty and human-made imprecision, but they largely stop at informing project or technology choices rather than embedding energy decisions in broader territorial development strategies (Beccali et al., 2003; Kanudia & Loulou, 1999).

More recent research recognises that energy systems are deeply intertwined with land use, sectoral structures, and local governance, making long-term planning complex but also rich in opportunity (Codemo et al., 2025). Studies of land use and energy highlight spatial factors—such as soils, hydrology, climate, and past land-use—in shaping technology choices and site suitability, yet they rarely move beyond siting optimisation to consider how spatial decisions could be used to steer regional economic restructuring (Stoeglehner & Abart-Heriszt, 2022). At the same time, local and municipal inclusion is emphasised as vital for institutionalising energy policies and improving quality of life, underscoring the importance of multi-level governance in regional energy transitions (van Dijk et al., 2022). Community energy (CE) literatures expand the focus from infrastructure to social innovation, defining CE as citizen-driven projects—often renewable-based—that can be organised through cooperatives, trusts, non-profits, or grassroots movements, with "community" understood in both place-based and practice-based terms (Hewitt et al., 2019; Hoffman et al., 2022). These contributions stress that meaningful participation is critical to avoid resistance and to build new social architectures for energy, but they also document substantial challenges: predictive tools for community demand remain limited, organisational forms are highly diverse, and outcomes often fall short of genuine democratisation of energy despite supportive rhetoric (Hsueh & Yan, 2011; Huang et al., 2015).

The decentralisation and democratisation agendas that gained prominence in the post–recession era frame distributed energy systems as opportunities for local economic development and citizen empowerment, yet practice tends to lag behind this promise. Distributed and decentralised systems can spread energy market income across local utilities, SMEs, and residents, and allow planners to match existing large loads with distributed generation, but these economic opportunities have received less attention than environmental and technical issues (Brandoni & Polonara, 2012; De Pascali & Bagaini, 2019; Mirakyan & De Guio, 2013). Empirical research shows that large

multinational firms still dominate energy transitions, public-private partnerships and incentive regimes often prioritise developer returns over community benefit, and community energy frequently remains voluntary, ad hoc, or subordinated to grid-centred planning logics (Karunathilake et al., 2018). Local control and regional support structures are therefore crucial if decentralised systems are to shift power relations, maximise local revenues, and avoid reproducing existing inequities in new technological forms (Kerr et al., 2017) Across these literatures, the central gap is the absence of *explicit, strategic frameworks for regional energy economy planning that systematically links multi-level governance, spatial planning, industrial and community development, and just transition objectives into a coherent practice.*

Comparative Overview of Regional Energy-Economy Planning

Regional energy economy planning emerges clearly across the seven frameworks examined as **an integrated, multi-level practice that aligns** decarbonization, spatial planning, and economic development, even where it is not explicitly named as such. Each framework uses energy transition objectives to steer regional land-use, infrastructure investment, and industrial strategy, but they differ in their balance between central steering and regional autonomy, the extent to which industrial policy is embedded, and in their approaches to social inclusion and just transition (Table 1). Taken together, these cases show that regional energy economy planning is less a single model than a family of planning approaches that combine spatially explicit energy planning with economic development tools, institutionalized multi-level governance, and mechanisms to link infrastructure with local value creation.

Table 1 *Legislation and plans analysed by jurisdiction*

JURISDICTION	LEGISLATION AND PLANS ANALYZED
Germany	Spatial Energy Planning (SEP) (embedded in federal spatial planning and building law); Windenergieflächenbedarfsgesetz (Wind Area Requirements Act, WindBG); Erneuerbare-Energien-Gesetz (Renewable Energies Act, EEG); Bundesbedarfsplan / national grid and network development plans; Landesentwicklungspläne (LEP – State Spatial Development Plans); Regionalpläne (Regional Plans); Municipal land-use and zoning plans (Bauleitplanung, including Flächennutzungs- and Bebauungspläne).
France	Programmation pluriannuelle de l'énergie (PPE – Multiannual Energy Programming); Stratégie Nationale Bas-Carbone (SNBC – National Low-Carbon Strategy); Schéma régional d'aménagement, de développement durable et d'égalité des territoires (SRADDET); Schémas régionaux climat-air-énergie (SRCAE – Regional Climate, Air and Energy Plans); Plans climat-air-énergie territoriaux (PCAET – Territorial Climate-Air-Energy Plans); Schémas de cohérence territoriale (SCoT – Territorial Coherence Schemes).

JURISDICTION	LEGISLATION AND PLANS ANALYZED
New South Wales (Australia)	Electricity Infrastructure Roadmap; Renewable Energy Zones (REZs) designated under the Electricity Infrastructure Investment Act 2020; Electricity Infrastructure Investment Act 2020 (as enabling framework for Roadmap and REZs).
Basque Country (Spain)	Plan Territorial Sectorial de Energías Renovables (TSP-ER / TSPRE – Territorial Sectoral Plan for Renewable Energies); Estrategia Energética de Euskadi 2030 (3E2030 – Basque 2030 Energy Strategy); Long-term climate and energy law (LTECC – Ley de Transición Energética y Cambio Climático).
South Africa	South African Renewable Energy Masterplan (SAREM); Renewable Energy Development Zones (REDZ); Special Economic Zones (SEZs – as paired with REDZ in the analysis); Renewable Energy Independent Power Producer Procurement Programme (REIPPPP – linked to SAREM as an implementation/procurement tool).
Québec (Canada)	Integrated Energy Resources Management Plan (PGIRE – Plan intégré des ressources en énergie); Hydro-Québec Action Plan 2035; Québec Plan for a Green Economy (PEV - Plan pour une économie verte (PEV) 2030; Bill 69 – Act to ensure the responsible governance of energy resources (enabling framework for PGIRE).
Great Britain (United Kingdom)	Strategic Spatial Energy Plan (SSEP); Regional Energy Strategic Plans (RESPs); Local Area Energy Plans (LAEPs); Centralised Strategic Network Plan (CSNP); Economic land zones (17 zones used within the SSEP methodology).

At one end of the spectrum are frameworks that treat **energy as a core component of statutory spatial planning and territorial cohesion**. Germany's spatial energy planning approach and France's combination of a national multi-year energy programme with binding regional spatial and economic plans exemplify this model. In Germany, spatial energy planning is embedded in federal spatial planning and building law, with national legislation requiring states to designate at least two per cent of their land area as acceleration zones for wind and other renewable energy projects. Regional plans and municipal land-use plans then make these requirements concrete, steering renewable siting, industrial clustering, and grid upgrades in ways that link national decarbonization targets with regional economic development and municipal revenues. France similarly uses a ten-year national energy plan, legally tied to a long-term low-carbon strategy, as the policy backbone that regional strategic spatial plans must interpret and implement. These regional plans integrate energy and climate objectives with transport, housing, land use, and biodiversity, and they impose compatibility requirements on local climate–air–energy plans and urban plans, thereby creating a vertically coherent planning chain in which regional energy infrastructure choices are systematically linked to territorial development.

A second group of frameworks uses zonal, **project-oriented instruments to concentrate renewable development and associated infrastructure in specific regions**, explicitly treating these zones as engines of regional growth. New South Wales's electricity infrastructure roadmap and designated renewable energy zones, Spain's Basque territorial sectoral plan for renewable energy, and South Africa's combination of a

national renewable energy master plan, renewable energy development zones, and special economic zones represent this more targeted approach. In New South Wales, the roadmap identifies and enables renewable energy zones in law, concentrating large amounts of new renewable generation and long-duration storage in a set of regional zones with strong wind and solar resources, land availability, and planned transmission upgrades. These zones are planned as integrated packages of generation, storage, and network infrastructure, under the coordination of a dedicated state entity and a broader governance architecture, with specific guidelines for Aboriginal engagement and benefit-sharing to ensure that they function as regional development nodes rather than solely as grid assets. In the Basque Country, the territorial plan for renewable energy builds on a hierarchy of strategic documents — including a 2030 energy strategy and a long-term climate and energy law — to define suitability maps and spatial rules that steer renewable projects into areas where resource potential, grid capacity, and socio-economic development objectives align. The Basque framework explicitly hard-wires local economic development into energy siting by targeting zones that can support industrial diversification, job creation, and local value-added, while managing land-use conflicts. South Africa's package of renewable energy and industrial policies goes further in explicitly aligning the energy transition with industrialisation and just transition agendas. The national renewable energy master plan sets targets for additional renewable capacity and for local manufacturing in solar, wind, and storage value chains, while the designation of renewable energy development zones and special economic zones is used to co-locate generation areas with industrial hubs, streamline environmental approvals, concentrate infrastructure investment, and direct new jobs and industrial activity toward "transition hotspots" affected by coal decline.

The emerging frameworks in Québec and the United Kingdom illustrate a third pattern, where **regional energy economy planning is being consciously designed as a nested, multi-tier system linking national net-zero pathways with regional and local plans**. Québec's integrated energy resources management planning process and the United Kingdom's national strategic spatial energy plan, regional energy strategies, and local area energy plans share an emphasis on whole-system planning and explicit feedback loops across scales. In the United Kingdom, the national strategic spatial energy plan is conceived as a spatial strategy for generation, storage, networks, and hydrogen infrastructure, operating at a zonal scale that respects devolved planning powers but sets a clear map of priority areas aligned with net-zero, security, and cost-efficiency objectives. Regional strategies then tailor this national pathway to regional resource conditions, economic geographies, and demand profiles, while local area plans further localise planning by integrating building retrofit, local heat networks, and distributed generation, explicitly tying energy system design to neighbourhood-level socio-economic priorities. This national–regional–local architecture is designed to ensure that local and regional plans both inform, and are constrained by, national network planning instruments, thereby closing the loop between regional land-use decisions, industrial clusters, and regulated network investment. Although Québec's integrated energy resources management planning is at an early stage, it similarly aims to bring together electricity system planning, decarbonization targets, and regional development objectives in a

unified planning process, with particular attention to grid constraints, partnerships with Indigenous Nations, and the spatial distribution of large industrial loads. In Québec's case, how this translates directly to regional and local plans remains to be seen.

Across all frameworks, **governance design is central to how regional energy economy planning operates in practice.** The German and French models rely on long-standing spatial planning systems and legal obligations to ensure coordination across federal, state, regional, and municipal levels. Planning instruments such as state development plans, regional plans, and regional spatial and development strategies translate national laws and climate targets into context-appropriate regional strategies, while mandatory public participation provisions in planning law structure stakeholder involvement. In New South Wales, the electricity infrastructure legislation creates new entities and roles — including a state-owned infrastructure coordinator, a consumer trustee, and oversight by independent regulators — to manage the planning, procurement, and consumer protection aspects of the roadmap and the renewable energy zones. South Africa's renewable energy master plan is overseen by an executive committee chaired by the national energy minister and situated within a broader industrial master plan process under the trade and industry department, employing a "social compact" governance model that brings together government, business, and labour in implementation forums and working groups. The United Kingdom's national strategic spatial energy planning architecture likewise introduces formal governance tiers and boards, with the national electricity system operator responsible for methodology and public engagement, and regional planning bodies expected to co-produce regional energy strategies with local authorities and stakeholders. These governance arrangements illustrate different ways of institutionalising multi-level coordination but share a view that energy planning cannot be left solely to utilities or system operators and must be embedded in broader territorial governance.

The frameworks also reveal **a common insistence that energy transition investments must be translated into concrete regional economic development strategies rather than assumed to generate trickle-down benefits**. In Germany, regional spatial plans are used not only to allocate sites for onshore and offshore wind and solar, but also to steer the clustering of manufacturing, port upgrades, and service hubs in ways that support new industrial value chains such as green hydrogen, with municipal ownership models and revenue-sharing mechanisms explicitly encouraged. France's national energy plan uses quantitative targets for renewables, biomethane, and demand management to shape public procurement, calls for projects, and industrial policy signals, while regional spatial and development strategies and associated regional plans are expected to align energy projects with economic diversification, innovation ecosystems, and regional equity goals. The Basque territorial plan for renewable energy makes local value-added and job creation one of its explicit criteria for designating suitable renewable zones, drawing a direct line between spatial energy planning and industrial policy. In New South Wales, renewable energy zones are positioned as regional growth engines, with policy documents framing them as sources of construction and operations jobs, supply-chain opportunities, and long-term benefit-sharing arrangements for host communities, including First Nations. South Africa is perhaps the most explicit in this regard, setting detailed localisation goals

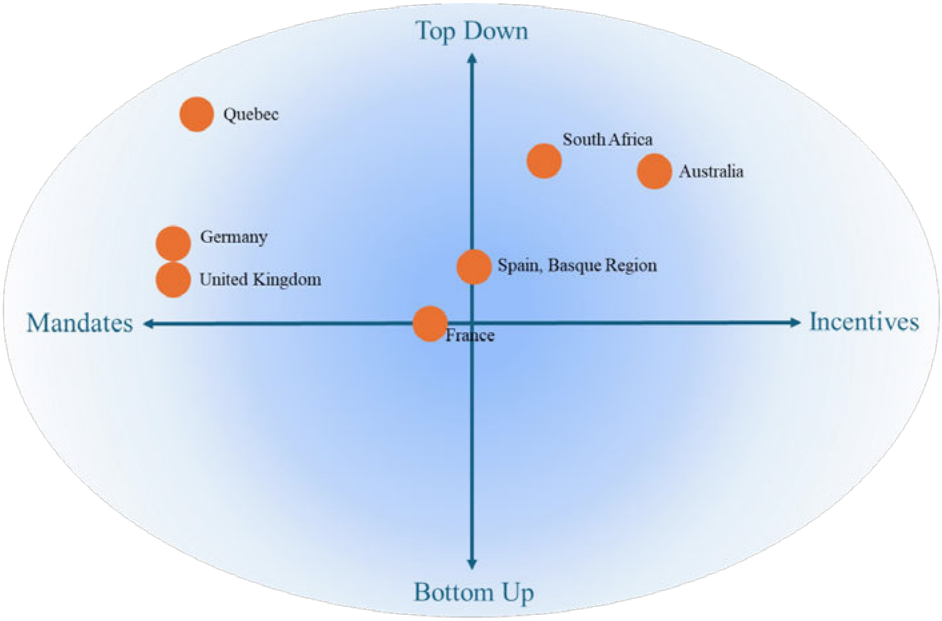
for manufacturing (for example, solar panels, inverters, towers, blades, and batteries), using the pairing of renewable energy development zones and special economic zones to co-locate factories with generation areas, and leveraging renewable energy procurement programmes to favour Black-owned and community-based enterprises in coal-transition regions. The UK's national strategic spatial energy planning methodology explicitly treats economic value as a core pillar, using economic land zones to align energy infrastructure with existing industrial clusters and regeneration areas, and anticipating that spatial energy plans will guide the targeting of contracts-for-difference, capacity market participation, and network investment to support regional economic strategies.

Notwithstanding these shared commitments, **the cases also highlight trade-offs in how regional energy economy planning is structured.** More centralised, legally prescriptive systems — such as France's combination of national energy and regional spatial plans, South Africa's national renewable energy master plan, and, to some extent, Germany's spatial energy planning and New South Wales's electricity roadmap — can provide strong policy certainty, clear capacity and localisation targets, and the ability to direct investment to priority regions, but they risk over-reliance on national ministries and may struggle with local legitimacy if participation is not meaningful. Conversely, frameworks that give substantial autonomy to regional and local authorities — such as Germany's states and municipalities, the Basque Country, and the United Kingdom's envisaged regional and local energy plans — can better tailor strategies to local resource conditions and socio-economic needs, but require robust coordination mechanisms and compatible incentive structures to avoid fragmentation or misalignment with system-wide decarbonization requirements. The German experience with area-based mandates for wind and other renewables suggests that legally binding land-share requirements can unlock stalled renewable deployment by forcing spatial planning authorities to designate sufficient land, but also underscores the importance of careful sensitivity mapping, conflict management, and early consultation to maintain social license. Similarly, South Africa's renewable energy development zone framework shows that streamlined environmental approvals and spatial prioritization can accelerate project pipelines, yet the effectiveness of just transition and community benefit objectives depends on implementation capacity and the strength of local institutions.

Figure 1 provides our assessment of the various frameworks according to the degree to which they are top down versus bottom up and the degree to which they promote energy planning on the basis of mandates versus incentives. All of the frameworks remain decisively in the top-down half of the diagram, with none representing a fully bottom-up, incentive-led model. The United Kingdom, Germany and Québec sit closest to the top-down/mandate-oriented quadrant, reflecting their reliance on legislated targets, formal planning obligations and compatibility requirements that bind regional and local actors, even as these actors retain some scope to adapt implementation to local conditions. South Africa and New South Wales (Australia) also exhibit predominantly top-down architectures, but they lean more toward incentive-based steering: national legislation and masterplans define zones, governance structures and strategic direction, while procurement programs, localization requirements, special economic zones and

benefit-sharing schemes are used to pull investment into priority regions and to advance just-transition and industrial policy objectives. Spain's Basque territorial plan for renewable energy is positioned slightly closer to the centre of the mandate–incentive axis and only mildly on the top-down side of the vertical axis, since it is anchored in a clear legal and strategic hierarchy but relies heavily on suitability mapping, guidance tools and socio-economic criteria to steer projects toward areas where resource potential, grid capacity and local development priorities align, leaving notable room for regional tailoring and negotiation. France sits between top-down and bottom-up because, while its national energy and climate framework is anchored in law and national targets, it delegates substantial responsibility to regions to interpret and adapt those targets to their own territorial conditions. On the mandate–incentive axis, France combines both tools but leans slightly toward mandates because the primary levers are regulatory. The absence of frameworks in the 'bottom-up' quadrant reflects the focus of this study on national or, in the case of Québec, provincial formalized planning systems. Our focus on institutionalized regional energy economy planning frameworks serves to highlight how such approaches can be accelerated and scaled through incentives and mandates.

Figure 1 *Governance Modes in Regional Energy Economy Planning*



Source: *Authors' own elaboration based on analysis of the case studies.*

Across frameworks, **community engagement and social inclusion mechanisms are central, but uneven.** In Germany and France, participation is anchored in planning law, with formal opportunities for public comment on regional plans and land-use plans, revisions to national energy strategies, and regional spatial and development plans, and, in France, the use of public debates and regional climate conferences to structure broader deliberation. New South Wales introduces region-specific Aboriginal guidelines co-developed with local communities, which set expectations for consultation, benefit-sharing, and culturally appropriate engagement within each renewable energy zone, and embeds regional development authorities and local governments within governance structures for planning

and procurement. South Africa's national renewable energy master plan builds on existing electricity regulation and renewable energy zone processes to require extensive consultation and economic participation of local communities, including through public forums, feedback cycles, and municipal involvement, and uses procurement rules to promote inclusion of Black-owned and small enterprises. The United Kingdom's national strategic spatial energy planning process is explicitly framed as a national dialogue about the future energy system, with the national system operator tasked with delivering structured, accessible routes for stakeholders to shape both national spatial pathways and regional plans. Despite these mechanisms, the frameworks collectively reflect earlier literature findings that social innovation and democratisation of energy are not automatic outcomes of decentralisation or distributed technologies; instead, they must be deliberately designed into planning processes, ownership structures, and financial arrangements.

Technology and resource choices differ across jurisdictions, but the comparative analysis underlines **a converging emphasis on large-scale wind and solar, complemented by storage and, in some cases, nuclear, hydropower, biogas, and hydrogen infrastructures, with spatial planning used to reconcile resource potential with environmental constraints and land-use competition.** Spatial energy planning in Germany and the Basque territorial plan for renewable energy demonstrate the use of suitability mapping to identify areas for wind and solar that minimise conflicts with protected areas and competing uses, while also enabling industrial clustering and grid-efficient siting. France's national and regional planning frameworks must navigate a system where nuclear remains the backbone of generation yet still plan for significant expansion of onshore and offshore wind, solar photovoltaics (including agrivoltaics and brownfield deployments), biogas, and geothermal resources, with territorial deployment strategies linked to regional plans and grid adaptation. New South Wales' roadmap, South Africa's national renewable energy master plan, and the United Kingdom's national strategic spatial energy plan all foreground storage and system flexibility: New South Wales through explicit tenders and long-term service agreements for pumped hydro and batteries; South Africa through battery manufacturing as a core localisation objective; and the United Kingdom through integrated planning of long-duration storage, hydrogen production, and anticipatory network investment. These choices reinforce the idea that regional energy economy planning is not technology-neutral: it is inherently about selecting and spatially organising a portfolio of technologies that can simultaneously meet climate targets, respect land and sea constraints, and underpin viable regional value chains.

Taken together, the frameworks analysed in this report offer a set of **design principles for regional energy economy planning**. They show that effective regional energy economy planning is built on:

1. Clear, legally anchored provincial, national or supra-national targets that can be translated into spatial and capacity obligations

2. Multi-tier governance structures that connect national system planning with regional and local spatial plans and economic strategies

3. Spatially explicit instruments — from acceleration areas and REZs to sectoral territorial plans and economic land zones — that co-ordinate generation, networks, and industrial development

4. Financing and procurement tools that convert planning signals into bankable projects and localized value creation, and

5. Robust mechanisms for community engagement, Indigenous participation, and just transition, particularly in regions facing industrial restructuring.

For regions such as those in Canada that are seeking to align electrification, renewable build-out, and regional economic development, these comparative lessons demonstrate that regional energy economy planning is both feasible and adaptable, provided that planning systems are reoriented from primarily technical optimization toward integrated, place-based strategies that treat energy infrastructure as a central lever of regional development policy (Table 2).

Table 2 *Comparative overview of regional energy economy planning frameworks*

FRAMEWORK NAME	PRIMARY OBJECTIVE	GOVERNANCE MODEL	COMMUNITY ENGAGEMENT LEVEL	ECONOMIC INTEGRATION
Germany: Spatial Energy Planning (SEP) -Evolved since 1990s; Wind Area Requirements Act 2023	Embed national decarbonization (2050) into spatial planning; designates 2% land for renewable acceleration areas by 2032	Federal-state-municipal multi-level; counter-flow (top-down and bottom-up); 16 federal states develop contextually appropriate plans within national targets	Formal and mandatory at regional/local levels; early participation in planning process; regulated under ROG and BauGB	High - regional plans steer industrial clustering (manufacturing, ports, service hubs); supports SME development, municipal utilities, energy cooperatives; local ownership encouraged via Brgerenergieschaften
France: Multiannual Energy Programming (PPE est. 2015) + SRADDET (est. 2019)	National energy roadmap linked to long-term climate goals; regional spatial plans embedding energy with transport, land use, and biodiversity	Multi-level coordination through PPE-SRADDET-PCAET compatibility chain; regions coordinate local authorities on energy; binding force on local planning	Structured through territorial compatibility requirements; regions recognized as leaders for coordinating local authorities	Tailored to local resources and socioeconomic conditions; allows regional variation within national framework

FRAMEWORK NAME	PRIMARY OBJECTIVE	GOVERNANCE MODEL	COMMUNITY ENGAGEMENT LEVEL	ECONOMIC INTEGRATION
Australia, New South Wales, Electricity Infrastructure Roadmap + Renewable Energy Zones (REZs), Adopted 2020 (via Electricity Infrastructure Investment Act 2020)	20-year strategy for transition to affordable, reliable, low-carbon electricity; designate REZs for coordinated generation, storage, and transmission; replace retiring coal plants with 12 GW renewable generation and 2 GW storage by 2030	Centralized strategic control; decentralized regional implementation via REZs; EnergyCo NSW coordinates planning and delivery; statutory bodies include AEMO, AER, IPART, RDAs	Structured consultation on REZ designation; benefit-sharing schemes; Aboriginal consultation guidelines (general and region-specific); Strategic Benefit Payments for landholders	REZs as regional growth engines; $77 billion private investment projected by 2035; 7,000 direct construction jobs + 4,400 ongoing jobs; landholders receive estimated $1.5 billion in lease payments by 2042
Spain, Basque Region, Territorial Sectoral Plan for Renewable Energies (TSP-RE), Provisional approval 2023	20-30-year strategic alignment of renewables with long-term climate goals and territorial development; sequence 2030 energy strategy, long-term climate-energy legal framework (LTECC), and spatial plans	Strategy hierarchy: 2030 strategy > LTECC > TSPRE; integrates state and regional departments, provincial councils, municipalities; legal framework connects tiers and sectors	Explicitly links renewables to job creation and local value added; TSPRE steers projects toward areas where socioeconomic benefits overlap with grid and resource conditions	High - TSPRE used to hardwire local economic development into energy siting; links energy strategy to job creation and value-added opportunities
South Africa, Renewable Energy Masterplan (SAREM), Finalized March 2025	Aligns national energy and economic priorities with accelerated renewable energy development; support just energy transition by locating opportunities in coal-affected regions; address inequality and apartheid legacies	Government-led (DMRE, DTIC) via Executive Oversight Committee; includes labour and business partners; working groups on demand, industrialization, inclusion, capabilities; links to Renewable Energy Development Zones (REDZs) and Special Economic Zones (SEZs)	Explicit focus on historically marginalized and rural communities as priority sites; direct community involvement in REDZs through forums and participatory processes; emphasis on community ownership models and enterprise development	Very high - integral to framework; local content requirements, preferential procurement, employee ownership transformation funds, public-private partnerships; connects SAREM to manufacturing value chains and industrial hubs via REDZs and SEZs

FRAMEWORK NAME	PRIMARY OBJECTIVE	GOVERNANCE MODEL	COMMUNITY ENGAGEMENT LEVEL	ECONOMIC INTEGRATION
Québec, Canada, Integrated Energy Resources Management Plan (PGIRE), Final draft April 1, 2026 (scheduled)	Plan electricity, gas, biomass, and future vectors (hydrogen) over 25-year horizon; align with Hydro-Québec Action Plan 2035 and 2050 net-zero target; optimize resources across sectors	Centralized strategic direction via MEIE (Ministry of Economy, Innovation and Energy); regulatory/ operational implementation delegated to independent and state-owned entities; top-down approach with stakeholder consultation	Engagement with municipalities, Indigenous communities, industry groups, and public during plan development; stakeholder involvement methods specified but details limited in public documentation	Explicitly designed to tie energy infrastructure to local jobs and value chains; promotes energy and economic development of Québec and regions; enables direct electricity distribution to adjacent industrial consumers; leverages existing hydropower and manufacturing strengths
United Kingdom, Strategic Spatial Energy Plan (SSEP), Expected completion 2026	Long-term (to 2050) GB-wide spatial strategy for clean, affordable, secure energy infrastructure; align national energy transition and climate targets across all government levels; first national blueprint for generation, storage, networks buildout	Three-tier system: SSEP (national) informs RESPs (regional) and LAEPs (local); collaboration between UK government, Scottish/Welsh governments, Ofgem, NESO, and private industry; supports net zero by 2050	Structured through RESPs and LAEPs; emphasis on collaborative stakeholder engagement to synchronize energy and regional growth objectives; public views integrated into planning	Economic factors core pillar; seeks cost-efficient system development via 17 economic land zones aligned with existing geographies and industrial clusters; targeted public co-investment and prioritised grid connections in economically strategic locations

Source: *Authors' own elaboration based on comparative analysis of case studies.*

Conclusion

Regional energy–economy planning is no longer a niche technocratic exercise but a core instrument for linking decarbonization, industrial policy and territorial development in practice. For Canada, the central implication is that meeting climate goals while strengthening regional economies is advanced by similarly integrated, spatially explicit and multi-level planning frameworks that treat energy infrastructure as a deliberate lever for jobs, value chains and just transition rather than as a standalone sector. Taken together, the international cases suggest that provincial and federal governments now face a strategic choice: *whether to rely on often fragmented, project-by-project decisions, or to consciously build regional energy–economy planning systems that can align electrification, competitiveness and social license at the scales for community benefit and wealth creation.*

Part II

REGIONAL ENERGY ECONOMY PLANNING: CASE STUDIES

Part II turns from the broad conceptual and comparative discussion in Part I, to detailed case studies of how regional energy economy planning is being put into practice. It examines a set of international and one Canadian example that show, in concrete terms, how governments are using energy investments to shape regional development, manage land use, and support community well-being. Each case highlights different institutional choices, planning tools, and governance arrangements, illustrating the range of options available to jurisdictions that want to align decarbonization with regional economic strategy. These case studies provide a practical reference for Canadian provinces, Indigenous governments, municipalities, and regional agencies as they consider how to design their own regionally grounded energy planning frameworks.

In this report, the term ‘region’ is used in a pragmatic, functional sense rather than as a constitutional category, and therefore differs from how regions are defined in European unitary states or in federations such as Germany where regional tiers have formal legal status and planning competences. For the purposes of Canadian regional energy–economy planning, a region is understood as a sub-provincial scale at which functionally connected communities share energy systems, infrastructure, labour markets,

and development pathways. At this scale, neighbouring municipalities, Indigenous governments, and other local authorities collaboratively convene energy and economic planning, aligning local priorities with provincial energy mandates and other nested policy frameworks so that decisions about generation, transmission, land use, and industrial development are coordinated across levels of governance.

This study has employed a qualitative, comparative case study design grounded in an extensive literature review of academic publications and government policy documents on regional energy planning and regional economic development in selected international jurisdictions. Cases were purposively selected to illustrate how regional energy and spatial planning frameworks integrate decarbonization, infrastructure development, and industrial or regional development objectives in different institutional and territorial contexts. For each case, source materials were identified through targeted keyword searches in relevant languages, with non-English documents translated using digital translation tools to support consistent cross-case analysis. Case documentation proceeded iteratively and was considered complete once saturation was reached, that is, when additional sources no longer yielded substantively new information on governance structures, planning instruments, or implementation practices.

Framework I:
Germany's Spatial Energy Planning Approach

An integrated planning framework for aligning local action and EU mandates to result in green energy growth in Germany

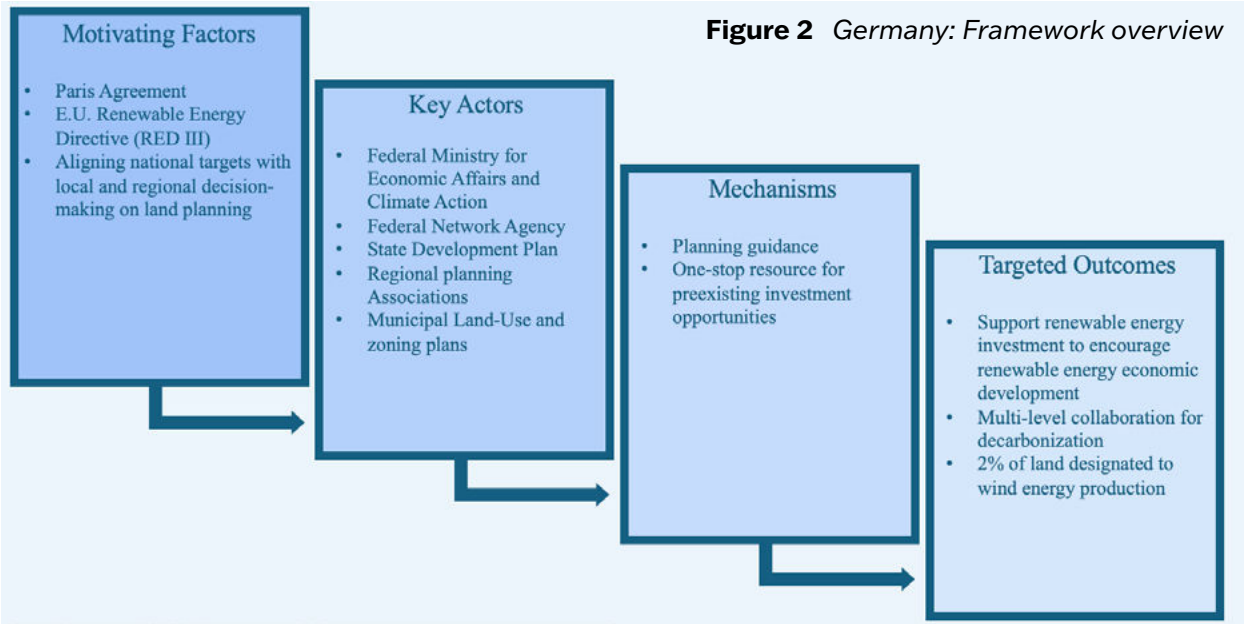


Figure 2 *Germany: Framework overview*

Table 3 *Germany: Summary of plans*

Acronyms

ACRONYM	FULL NAME	ORIGINAL LANGUAGE NAME / NOTES
SEP	Spatial Energy Planning	Not a formal legal title; refers to Germany's spatial energy planning approach as a whole.
EEG	Renewable Energy Sources Act	Erneuerbare-Energien-Gesetz; federal law setting support and rules for renewable energy.
WindBG	Wind Energy Area Requirements Act	Windenergieflächenbedarfsgesetz; federal law requiring states to designate a minimum share of land for wind and other renewables.
ROG	Federal Spatial Planning Act	Raumordnungsgesetz; national framework law for spatial planning.
LEP	State Spatial Development Plan	Landesentwicklungsplan (sometimes Landesentwicklungspläne); state-level spatial development programme.
Regionalplan	Regional Plan	Regionalplan / Regionalpläne; regional-level spatial plan within each state.
Flächennutzungsplan / B-Plan	Municipal Land-Use and Zoning Plans	Municipal land-use plan and binding development plan; set local zoning and project approvals.

Framework Summary

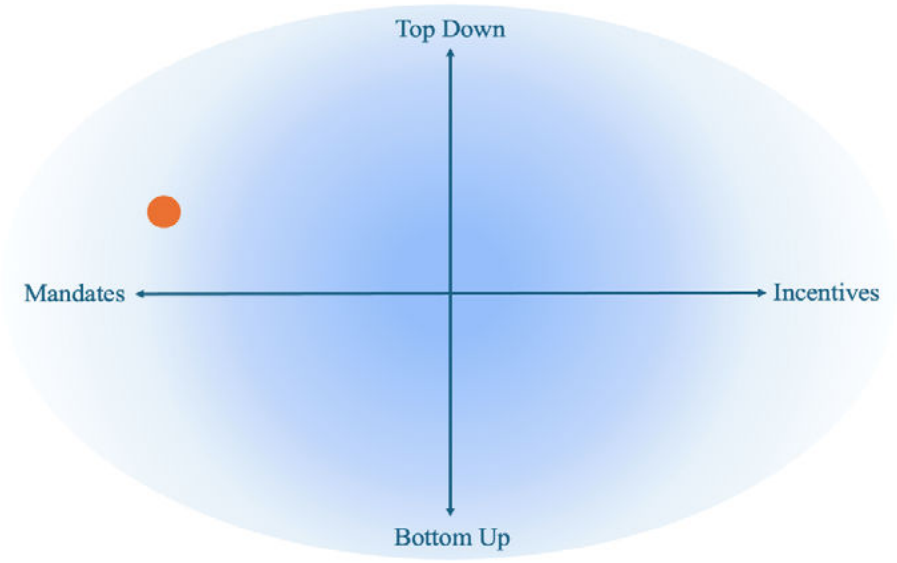
While many EU countries seek to strengthen the coherence between energy and land-use plans, Germany is often cited as a leading example in terms of both regulatory integration and participatory practices (Nadin & Fernández-Maldonado, 2023). Germany's RED III[1]–driven Spatial Energy Planning (SEP) approach shows how they have been able to embed Nation-level decarbonization requirements into existing spatial planning structures, aligning regional development goals, while still managing land-use conflicts and environmental protection can be achieved.

To achieve its targets for accelerated renewable energy development, the German government has set out a federal mandate called the *Windenergieflächenbedarfsgesetz* or "WindBG" as its national strategy to set aside 2% of total landcover in Germany as areas to be designated "renewable acceleration areas" or RAAs for the accelerated development of wind energy infrastructure (Schlotterbeck et al., 2023; Wingenbach et al., 2024a). Through the designation of Renewable Acceleration Areas (RAAs) targets at the state level, Germany integrates EU "acceleration areas" into its federal planning law, targeting a defined land share for renewables (for example, onshore wind) and prioritising co-location of generation and storage, with simplified and time-limited permitting in these zones.

Within this, existing Länder spatial plans, municipal zoning and national targets are being aligned with RED III mapping obligations (coordinated spatial mapping under Article 15b) so that acceleration areas sit within broader land-use strategies, not as a parallel system (Wingenbach et al., 2024b). RAAs are then also explicitly steered toward artificial, degraded or multiple-use sites, while excluding core protected areas, with guidance and NGO scrutiny used to keep expansion "nature-positive". The German SEP approach treats renewables as an overriding public interest, introduces digital and time-bound permitting in acceleration zones, and clarifies how repowering and grid connections fit into planning law (Wiehe, Von Haaren, et al., 2020a; Wingenbach et al., 2024b).

1 The RED III Mandate requires all E.U. Member States (MSs) to support a more rapid deployment of renewable energy (RE) projects and establish Renewable "acceleration areas". These areas within each Member State represent regions where the development of renewable energy projects can be fast tracked, typically as a result of changes to zoning, favourable policy, incentives, or even cutting red tape for developers. (Wingenbach et al., 2024a).

Figure 3 *Governance Modes: Germany*



SEP is now being used throughout the WindBG to align the federal targets set by the German government throughout regional spatial energy planning mandated down to each of the 16 federally recognized states within the country. In doing so, each state is being given the autonomy to develop its own *Landesentwicklungsplan* or "State development plan" and its *Regionalpläne* or "Regional plan" so long as each states plans aligns with the national decarbonization deadline of 2032 and satisfies the threshold for designation of 2% total landcover for RAAs (Brandes et al., 2024; Wingenbach et al., 2024a). Using this method, the SEP approach encourages an integrated planning perspective and provides a planning approach which requires land-use decisions for renewables to be coordinated across levels of government with the respective economic, infrastructural, and environmental objectives (Wingenbach et al., 2024a).

Background

During the 2015 Paris Climate Conference Germany committed itself to reducing greenhouse gas emissions by 80 to 95% by 2050 (BMUB, 2016; Wingenbach et al., 2024a). To achieve this, the government decided to fundamentally restructure the energy system, as the energy industry accounts for around 40% of German emissions (BMUB, 2016). The resulting necessary expansion of renewable energies by 2050 must then scale these technologies more efficiently and work to find a deeper acceptance in society. As there already exists a strong competition for land use in both rural and urban areas, this also means that renewable energies in Germany must be expanded to the most efficient extent to save space (BMUB, 2016).

Past strategies for implementing the expansion of targets for renewable energies have not been efficient enough and have typically involved incentive-oriented policies without spatially specific targets. These spatially unspecific incentives have caused environmental impacts and met with resistance among local stakeholders (Wiehe, Von

Haaren, et al., 2020b). However, since suitable technologies are now available and studies show that the potential area of land needed in Germany to achieve its energy targets using renewable energy is sufficient, the lack of energy expansion until recently is largely assumed to be related to the planning and allocation processes responsible for developing these technologies, rather than the technologies themselves (Wiehe, Von Haaren, et al., 2020b).

Thus, the goal of Germany's SEP approach is rooted in the principle of aligning its climate targets at national level with decisions about where and how local planning decisions are made at the state, regional, and local levels (including where renewable energy plants are located, how local economic benefits are realized, and including the voices of citizens in the planning process) (netzausbau.de, 2025; Osorio-Aravena et al., 2020a; Wiehe, Von Haaren, et al., 2020a; Wingenbach et al., 2024b).

Framework Factors

What is it?

Spatial Energy Planning (SEP) itself specifically refers to the coordinated, spatially explicit process of integrating energy transition goals, such as renewable energy expansion, grid development, and decarbonization, into territorial and land-use planning frameworks at multiple governance levels (Wingenbach et al., 2024a). SEP is inherently not a single policy or plan, but rather a planning approach embedded within and across federal, regional, and local systems of spatial planning. When applied to energy, SEP ensures energy and grid development are consistent with regional planning objectives and uses spatial data to identify areas suitable for wind, solar, biomass, and grid infrastructure while considering environmental protection, settlement patterns, and land-use conflicts (notably under the amended EU Renewable Energy Directive – RED III) (Brandes et al., 2024; Wiehe, Von Haaren, et al., 2020a; Wingenbach et al., 2024b).

As the plan's integration is typically iterative, relying on elements like regional sensitivity mapping and regulatory consultation involving stakeholders, the SEP approach is flexible to changing conditions and supports contextually appropriate planning (Nadin & Fernández-Maldonado, 2023; Wiehe, Von Haaren, et al., 2020a; Wingenbach et al., 2024b). By aligning these planning frameworks, it allows multiple levels of government to coordinate renewable infrastructure deployment, community engagement, grid upgrades, and economic development simultaneously in line with national priorities (Wingenbach et al., 2024a).

It is important to note here that Germany does not have a single national "SEP"; rather, spatial energy planning for renewables has evolved stepwise since the 1990s through federal building and spatial planning law and state/regional plans (Biehl et al., 2021; VASAB, 2025). A crucial federal step for wind and other renewables was the introduction of "privileged" status for renewable energy facilities in the Federal Building Code *BauGB* in 1997, which required planners to make sufficient space for wind energy and triggered systematic spatial planning for wind at regional and local levels (Biehl et al., 2021). Since

then, national frameworks such as the Spatial Planning Act *ROG* and, more recently, the Wind Area Requirements Act of 2023, have progressively tightened requirements for Länder (German federal states) to designate sufficient land (around 2% by 2032) for wind energy, reinforcing spatial energy planning rather than marking a single initial approval moment (Biehl et al., 2021). In doing so, each of Germany's 16 federally recognized states have designed contextually appropriate approaches to integrating SEP approaches into each state's plans.

Governance and stakeholder structures

The German SEP planning approach operates within a federal framework and is characterized by decentralized decision-making across multiple levels of government. At the national level, the German federal government and 16 federal states hold legislative authority in spatial planning matters. This system then follows a "counter flow principle" where it integrates both top-down and bottom-up elements into its planning processes This decentralized approach aims to ensure coherence within the planning system while accommodating variations across regions (Wingenbach et al., 2024a).

Table 4 *Coordination within German spatial energy planning*

LEVEL	INSTRUMENT / PLAN	ENERGY INTEGRATION	ECONOMIC INTEGRATION	COMMUNITY INVOLVEMENT
Federal	Renewable Energies Act (EEG/ WindBG), German Planning Act (*Raumordnungsgesetz)*, Grid Plans	National targets, grid corridors	R&D, innovation funding	Legislative consultation
State (Länder)	LEP (*Landesentwicklungspläne)*	RE zones, infrastructure	Industry cluster development	Public consultation
Regional	Regional plan (*Regionalpläne)*	Spatial allocation, grid integration	SME support, land-based jobs	Regional dialogues
Municipal	Land-use and zoning plans	Local projects, cooperatives	Tax revenue, local ownership	Public hearings, coops

Sources: *(Krieger et al., 2025; Mostegl et al., 2017; netzausbau.de, 2025; Schlotterbeck et al., 2023; Tasch, 2024; Wiehe, Von Haaren, et al., 2020b; Wingenbach et al., 2024a)*

Germany's spatial energy planning (SEP) approach itself is anchored in the *Raumordnungsgesetz* (Spatial Planning Act), state-level *Landesentwicklungspläne* (state spatial development programs or "LEPro") and regional *Regionalpläne* (Regional plans) requires that land-use decisions for renewables be coordinated with economic, infrastructural, and environmental objectives (Mostegl et al., 2017; netzausbau.de, 2025; Wiehe, Von Haaren, et al., 2020a). In addition to this, at the national level, higher level

planning objectives typically set out targets and standards (such as the Renewable Energies Act (*Erneuerbare-Energien-Gesetz*, EEG) or the *Windenergieflächenbedarfsgesetz* (WindBG)). In doing so, each of the federal states are then responsible for developing spatial development plans that implement these plans into practice (Wiehe, Von Haaren, et al., 2020b). These state or regional plans in turn may then also impose guidelines on lower levels of government. By doing so, municipalities operate as primary actors who also play a significant role in local planning, particularly in developing land-use and development plans for each unique region (netzausbau.de, 2025; Tasch, 2024).

With the SEP approach, regional plans (*Regionalpläne / Landesraumentwicklungs-programme*) are used to identify areas suitable for renewable energy development (onshore wind, solar and offshore development) and can also be used to effectively exclude conflicting land uses. By doing this explicitly within a region's planning documents, regions can steer where industrial activity (e.g., manufacturing, service hubs, port upgrades for offshore wind) should cluster, further enabling targeted regional economic development and supporting long-term infrastructure investment (BMUB, 2016; BMWE, 2023; Tasch, 2024; Wiehe, von Haaren, et al., 2020; Wingenbach et al., 2024a). While it is a negotiated, legalistic, and sometimes conflict-heavy process, SEP enables local, regional, and national priorities remain connected in the energy transition (Wingenbach et al., 2024a).

Community engagement

The extent and timing of public participation in spatial energy planning processes vary depending on the level of planning being conducted, whether it's regional planning or preliminary land-use planning or binding land-use planning (Mostegl et al., 2017). The involvement of stakeholders, including affected individuals and relevant organizations, is crucial in providing feedback on non-final drafts for regional plans or preliminary land-use plans, as well as in offering comments on alterations during the planning process (Mostegl et al., 2017). Participation is typically initiated "as early as possible", within the SEP approach, ensuring that stakeholders have ample opportunity to contribute to the planning process (Krieger et al., 2025).

Within Germany specifically, public participation in all spatial planning processes is enabled and regulated in sub-section 9 of the German Planning Act (Raumordnungsgesetz, ROG) and sub-sections 2, 3, 4 of the Building Act (Baugesetzbuch, BauGB) (Krieger et al., 2025; Wingenbach et al., 2024a). Under these acts, a framework for public participation in regional and urban land-use planning is structured. Formal participation is obligatory and overseen by the respective approval or planning authority in each given locality (Mostegl et al., 2017). At the regional planning level, stakeholders can participate in the development of regional plans. In urban land-use planning, participation is available for both preliminary land-use plans and urban development plans. Additionally, informal participation is encouraged through voluntary provisions of information and dialogue by project developers (Mostegl et al., 2017).

Integration with economic development

The multi-level, legally-backed nature of the German Spatial Energy planning approach implements direction from federal targets down to local land use and established the stability needed for investment and economic development through the spatial planning process (BMUB, 2016; Tasch, 2024; Wiehe, Von Haaren, et al., 2020b). Because the federal government sets capacity and grid targets (e.g., via the Network Development (*Netzausbau*) processes and the National Grid (*Bundesbedarfsplan*)), those national targets are then able to drive faster permitting, grid investments and the prioritization of space for generation and transmission within planning processes (netzausbau.de, 2025). This approach gives states and regions a clear demand signal that they must spatially accommodate this development, which in turn enables local economic actors (manufacturers, installers, service firms, municipal utilities) to plan (with far greater certainty) investments and jobs. From here, respective states can form regional spatial plans to formally designate specific "priority areas" (*Vorranggebiete / Vorrangzonen*) and on and offshore site plans for renewable energy development. Those designations are then the main mechanism that ties energy siting into regional land-use planning (Tasch, 2024).

In doing so, grid planning and spatial planning are coordinated to protect local economic benefits and enable new value chains. Within Germany, the "Netzausbau" or National Grid plans include specifically spatial coordination (onshore/offshore grid corridors and connection points) (netzausbau.de, 2025). When spatial planning identifies realistic connection locations and capacities, local municipalities and industry can pursue these hubs as sites for industrial diversification (e.g., turbine assembly, ports servicing offshore wind, green hydrogen hubs), thereby linking land-use choices within the regions spatial plans to job creation and municipal revenues (netzausbau.de, 2025).

Further supporting this, the development of policy incentives (plus any legal changes required) to encourage local ownership and municipal participation can also be utilized as a powerful tool of the SEP process to keep economic benefits local. Germany's strong history of energy co-operatives and municipal utilities (Bürgerenergie, Stadtwerke, energy co-ops) means many projects as a part of the SEP planning approach are at least partly locally owned (Krieger et al., 2025; State Portal Schleswig-Holstein, 2025b). Ensuring that the spatial planning approaches secures sites and streamlines energy projects (and the associated peripheral industries), permitting increases the attractiveness of local investment and keeps revenue and jobs in the region. Ensuring local ownership models are explicitly supported in policy discussions ensures these SEP planning processes can be a major driver of regional economic benefits from renewables (Krieger et al., 2025; Wiehe, von Haaren, et al., 2020).

Finally, spatial energy planning can be used to reduce conflicts and accelerate project deployment; this in turn reduces project uncertainty and unlocks local investment. By designating priority areas and integrating environmental constraints early on, regions reduce approval delays and legal uncertainties (Krieger et al., 2025). Faster, more predictable permitting encourages developers, equipment suppliers and financiers to commit locally, creating sustained regional supply chains.

Technology and resource considerations

In a systematic review of papers considering the SEP planning approach, Osorio-Aravena et al. (2020a) highlight that solar photovoltaic (PV) has been the most frequently considered technology in the SEP context, being present in almost half of the studies, followed by wind onshore (in 27% of the studies), wind offshore, biopower, and hydropower technologies (each of them in 9% of the studies) (Osorio-Aravena et al., 2020b). SEP applied within Germany has largely focussed on on- and offshore Wind and Solar PV as these are the dominant forms of renewable energy under development in Germany, with wind a particular priority federally (Krieger et al., 2025). In addition to this, the development of green hydrogen infrastructure in conjunction with many of these wind and solar generation sites has been a recent emphasis of many regions, that has been met with strong support (Krieger et al., 2025).

Financing and implementation mechanisms

In terms of implementation, Germany has demonstrated a new method of achieving RE targets by incorporating area targets in the federal states by introducing the WindBG mandate. This led to accelerating the spatial planning activities for onshore wind energy, which was stagnant beforehand. This forced the federal states to start designation processes and even led to federal states deciding on area targets for other forms of renewable energy infrastructure appropriate for their region (Mostegl et al., 2017; Wiehe, von Haaren, et al., 2020; Wingenbach et al., 2024a).

While the SEP provides no specific funding, several financing mechanisms exist across federal, state, regional, and municipal levels to support the planning and development of renewable energy infrastructure. The EEG (*Erneuerbare-Energien-Gesetz*) remains the cornerstone for renewable investment as it provides guaranteed grid access and market premiums for renewable producers, ensuring economic feasibility within the spatially designated zones (BMWE, 2023). Since 2021, EEG legislation also requires financial participation of municipalities which in turn fosters local acceptance and links spatial siting with local fiscal benefits (BMWE, 2023).

Each Land or region (e.g., Schleswig-Holstein) also maintains state-level energy transition funds, often integrated into their *Landesentwicklungsplan* (state spatial plan) (Tasch, 2024). At a local level Citizen-Owned and Cooperative Financing such as that provided by *Bürgerenergiegenossenschaften* (citizen energy cooperatives) are a cornerstone of decentralized implementation. They mobilize private capital for local RE projects within spatially designated zones, often supported by: KfW low-interest loans, State subsidies for community-owned installations, and partnerships with municipal utilities (Stadtwerke). Finally, Public-Private Partnerships (PPPs) also offer municipalities and regions the ability to partner with industry consortia and grid operators to develop local energy infrastructure and share benefits from projects with local enterprises (BMWE, 2023).

Case: Schleswig-Holstein Region — Wind energy clustering and efforts towards a decarbonized port economy

Figure 4 *Regional map: Schleswig-Holstein, Germany.*

The Northernmost of Germany's 16 federal states, Schleswig-Holstein has some of Germany's most advanced "priority areas" (*Vorranggebiete*) for onshore and offshore wind, embedded in its *Landesentwicklungsplan* (LEP) and *Regionalpläne*. This integrated planning in response to the federal WindBG policy has allowed this region to rapidly identify wind-priority areas, integrating them into their regional spatial plans. The spatial designation of priority areas explicitly concentrates wind energy in locations with compatible land use and strong grid connections (Landesportal Schleswig-Holstein, 2023; Wingenbach et al., 2024a).

For Schleswig-Holstein to meet federal targets and expand its land allocation for wind energy from two to around three percent of the region's total land (increasing the capacity from wind energy to 15 gigawatts by 2030), first, the Land Development Plan (LEP) for the region was amended. This change altered the criteria for priority wind development areas and municipal wind energy, making them priority objectives of spatial planning (State Portal Schleswig-Holstein, 2025a, 2025b; Tasch, 2024). In conjunction with this, an update of the state development plan on the topic of onshore wind energy, which the state planning authority initiated in December 2023 and for which an initial public participation procedure was carried out in summer 2024 occurred. Public participation for this partial re-write of the LEP took place from May to July 2025 (Tasch, 2024).

In terms of local economic integration, the ports of Brunsbüttel and Husum have become renewable industry hubs, hosting turbine component manufacturing, maintenance operations, and hydrogen pilot projects (State Portal Schleswig-Holstein, 2025b; Tasch,

2024). In addition to this, the deliberate spatial clustering around the "Westküste 100" hydrogen project which links wind power generation to local industry (cement, chemicals, aviation fuel) is sustaining new regional jobs and creating training pathways for local workers (Berger, 2024). In this region, spatial planning has enabled an industrial symbiosis whereby the local renewables directly power local industries, and the infrastructure investments have supported both energy development and employment goals (Landesportal Schleswig-Holstein, 2023).

Framework Takeaways

For other regions considering regional energy-economy planning, the German SEP approach demonstrates the value of:

- Starting from clear high-level or national targets and translating them into area-based obligations (e.g. minimum land share or mapped capacity corridors);
- Combining top-down mapping (RED III coordinated areas and RAAs) with bottom-up regional and municipal planning instruments; and
- Using legal status (declarations of overriding public interest, defined RE acceleration zones) and strict permitting deadlines to turn defined regions into faster, more predictable areas which support project delivery, while also embedding environmental safeguards from the outset.

Further Resources– German SEP

Wind BG Law. (2023). **Windenergieflächenbedarfsgesetz Plan**

All Schleswig-Holstein Spatial Planning Plans **- (Landesportal Schleswig-Holstein, 2023; Wingenbach et al., 2024)**

Spatial Planning for Wind Energy Use in Schleswig-Holstein

Schleswig-Holstein Partial drafting of the Regional Plan for Planning Area I

Bundesamt für Seeschifffahrt und Hydrographie (BSH). (2021). **Spatial planning in the German Exclusive Economic Zone** — accompanying document (Maritime Spatial Plan).

Framework II:
France's Multiannual Energy Programming and Regional Planning Framework

Mechanisms for public consultation and investment during France's energy transition

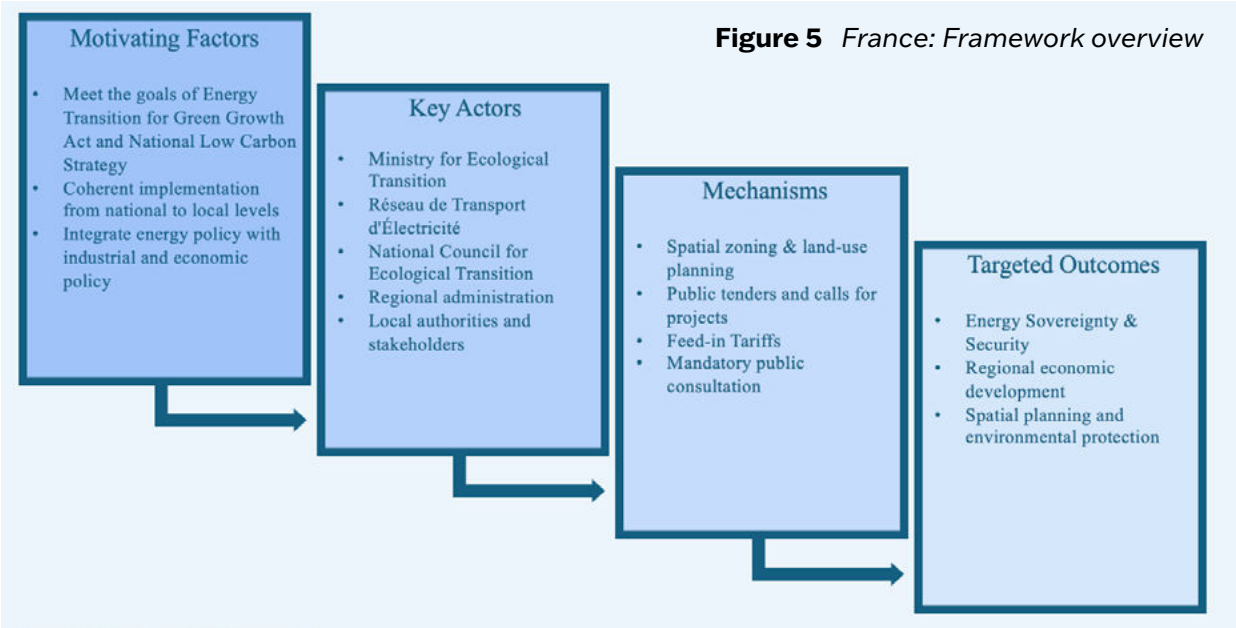


Figure 5 *France: Framework overview*

Table 5 *France: Summary of plans*

Acronyms

ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
PPE	Multiannual Energy Programming	Programmation Pluriannuelle de l'Énergie; national multi-year energy plan that sets energy mix and investment priorities.
SRADDET	Regional Plan for Spatial Planning, Sustainable Development and Territorial Equality	Schéma Régional d'Aménagement, de Développement Durable et d'Égalité des Territoires; strategic regional planning framework that integrates land use, transport, energy, climate, housing, environment.
SNBC	National Low-Carbon Strategy	Stratégie Nationale Bas-Carbone; long-term national strategy for greenhouse gas reduction and climate neutrality.
PCAET	Territorial Climate-Air-Energy Plan	Plan Climat-Air-Énergie Territorial; local or inter-municipal plan for climate, air quality, and energy, which must be compatible with the regional SRADDET and consider national energy and climate goals.

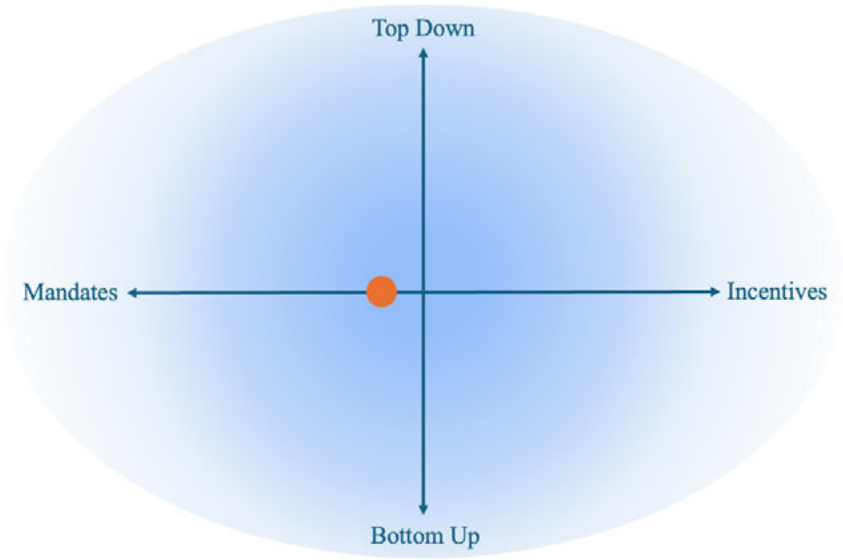
ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
SRCAE	Regional Climate, Air and Energy Scheme (earlier generation of plans)	Schéma Régional Climat Air Énergie; older regional-level climate-air-energy plans that have been integrated into or superseded by SRADDET in many regions.
SCoT	Territorial Coherence Plan	Schéma de Cohérence Territoriale; inter-municipal strategic land-use plan that must be compatible with SRADDET and other higher-level frameworks.

Framework Summary

France's Multiannual Energy Programming (*Programmation pluriannuelle de l'énergie*, PPE) and the regional planning framework (*Schéma régional d'aménagement, de développement durable et d'égalité des territoires,* SRADDET) together form a multi-level system where national energy decarbonization targets are translated into spatially explicit regional land-use and infrastructure strategies, making them a strong example of spatial energy–economy planning. Their integration demonstrates how long-term national energy and climate objectives can be operationalised through territorial planning rules that govern where energy production, infrastructure, networks, housing, transport and ecological protections are located in space.

The PPE sets 10-year quantitative targets and investment priorities for the whole energy system (generation mix, demand, networks, and efficiency) and must be compatible with France's long-term National Low-Carbon Strategy (SNBC). This gives all regions and sectors a stable national reference for decarbonization pathways, technology choices and timing. The SRADDET translates the PPE and SNBC into medium and long-term objectives for land use, infrastructures of regional interest, transport, energy savings and climate action at regional scale. Local planning documents (urban plans, mobility plans, local climate-air-energy plans) must be compatible with SRADDET rules, which makes regional spatial energy choices binding down to municipal level.

Figure 6 *Governance modes: France*



While the creation of the SRADDET slightly predates the PPE, with its establishment, the PPE now provides the overarching policy spine for energy transition in France. With this, regional and local plans (like SRADDET) are then able to align from a national level down to regional planning harmonizing a coherent national-to-local decarbonization targets *(Ministère de la Transition écologique et solidaire*, 2019). Currently, the 11 metropolitan regions that are subject to producing a regional plan for spatial planning, sustainable development and equality (SRADDET) have adopted a strategy as of 2019. However, all 18 French regions, on the mainland and overseas, have carried out this exercise in a format that predates the SRADDET and all of them possess GHG emissions data at the scale of their territory (Climate Chance, 2021).

Background

The need for the PPE (*Programmation Pluriannuelle de l'Énergie*) plan was first established in France's 2015 Energy Transition for Green Growth Act (LTECV) which was designed in conjunction with the nations climate commitments alongside the 2015 Paris accord (*Ministère de la Transition écologique et solidaire, 2019)*. The initial PPE for metropolitan France was approved by ministerial decree and published in the Journal Officiel on October 28, 2016, covering two periods: 2016–2018 and 2019–2023. After substantial public debate and revision, the current PPE covering 2019–2028 was definitively adopted on April 21, 2020 by government decree (Ministère de la Transition écologique et solidaire, 2019). This plan was developed as the initial steps which would allow France to meet its National Low Carbon Strategy (*Stratégie Nationale Bas-Carbone*, SNBC) which outlines the French roadmap for reducing greenhouse gas emissions to net zero by 2050 *(Ministère de la Transition & écologique et solidaire*, 2024).

Since the recent transposition of the European Unions RED III directive in 2023, the PPE's most up to date iteration also takes into account the need for all member states to designated renewable acceleration areas or RAA's for the expedited development of the infrastructure needed to meet decarbonization targets (Ministère de la Transition & écologique et solidaire, 2024). The French energy transition is thus part of a much wider movement to create a European internal market and European energy transition. The European union's member states have collectively set ambitious energy and climate goals which France looks to achieve by means of the PPE.

The SRADDET (or *Schéma Régional d'Aménagement, de Développement Durable et d'Égalité des Territoires*) was first created by France's Law 2015-991, known as the NOTRe law, passed on August 7, 2015 (Demaziere, 2021a). This law aimed to modernize and simplify regional planning, merging several previous sectoral plans into a single strategic document. Regions across France began developing their respective SRADDETs shortly after, with the first formal regional adoptions occurring around 2019 (Demaziere, 2021a). The SRADDET is structured around strategic orientations for the region (e.g., strengthening governance, connecting urban and rural areas, energizing the regional economy) and includes environmental and impact considerations. It is intended to guide regional decisions and coordinate with intercommunal plans (SCoT) and other sectoral policies, ensuring consistency across governance levels (Demaziere, 2021a).

Framework Factors

What is it?

The "Multiannual Energy Plan" (*Programmation pluriannuelle de l'énergie,* or "PPE") now forms France's national energy development plan and exists as a binding operational tool for the public authorities in France. It consists of a national ten-year energy programming framework that sets national government priorities for energy policy in two consecutive five-year periods. It sets out and defines broad objectives, energy mix targets, and action priorities to guide public authority action across all energy sectors in Metropolitan France (Direction générale de l'énergie et du climat, 2024). It covers all energy types and all of the cornerstones of energy policy (managing energy demand, promoting renewable energies, safeguarding security of supply, controlling energy costs, developing networks in a balanced manner, etc.), and makes it possible to forge a coherent and integrated vision of the role of energies (Direction générale de l'énergie et du climat, 2024).

The PPE's approach to governance mixes technical expertise with ministerial and political decision-making; economic integration occurs via industrial assessments and alignment with regional development goals; community engagement is delivered through formal public consultations and the operational role of regional/local authorities (Direction générale de l'énergie et du climat, 2024). The creation of the PPE enables is a consistent and complete picture of the role of each energy type within the nation and its desired progression in French society. By doing so, the PPE dictates energy targets policy as a measure of the implementation of the strategic national plan, rather than dictating a single vision for each unique region of France (Direction générale de l'énergie et du climat, 2024).

Aligning with the goals of the PPE, the SRADDET is France's strategic regional planning framework, created under the *Loi NOTRe* (2015), and aims to coordinate sustainable development, land use, energy, mobility, housing, and environmental protection across each region. It replaces and merges multiple pre-existing regional schemes into a single strategic document. This form of territorial planning plays a strategic role in the integration of sectoral plans and strengthens the role of the regional institution to formulate a political vision of its priorities in terms of regional/territorial planning (Ministère de la Transition écologique et solidaire, 2019).

Each SRADDET is developed and approved by the respective Regional Council, in coordination with the State (Préfecture), inter-municipal authorities, and regional stakeholders (Demaziere, 2021b; legifrance.gouv.fr, 2023; Olei, 2023). The plan ensures vertical integration between national objectives, the *Programmation Pluriannuelle de l'Énergie* (PPE) and *Stratégie Nationale Bas-Carbone (SNBC),* and local implementation through *PCAETs* (Ministère de la Transition écologique et solidaire, 2019). The objectives of each region SRADDET are then imposed on local urban planning documents (SCoT and local urban development plans, urban travel plans, territorial climate-air-energy plans, regional nature park charters) in a consideration report. These same local documents must then be compatible with the general rules set out in the SRADDET (Direction générale de l'énergie et du climat, 2024). It also then defines long- and medium-term regional objectives across themes such as housing, transport intermodality, economic development, land use, energy, climate action, biodiversity, waste, and regional equity (Ministère de la Transition écologique et solidaire, 2019).

How these plans then come to complement one another in practice is in the way that regional authorities map national PPE priorities into SRADDET objectives, ensuring energy efficiency, timely renewable energy deployment, and climate goals are embedded in regional planning choices (Olei, 2023). The PPE provides the national policy skeleton for energy transition, while SRADDET operationalizes sustainable development, territorial balance, and energy planning at the regional level. Together, they ensure energy policy is integrated with land use, transport, housing, and environmental protections (Consultationspubliques, 2025; Ministère de la Transition écologique et solidaire, 2019). Regions also develop SRCAE (Regional Climate, Air and Energy Plans) that feed into SRADDET, and interplays exist with local intercommunal plans (SCoT) and departmental or national energy strategies (Consultationspubliques, 2025; Demaziere, 2021b; Ministère de la Transition écologique et solidaire, 2019). The result of these systems is a multi-layered governance framework where PPE sets national direction and SRADDET translates it into regional action.

Governance and stakeholder structures

In terms of governance and stakeholder structures, within both the PPE and SRADDET planning systems they represent a diverse cross section of the French planning landscape and at each level of this system account for varying perspectives and needs.

Table 6 *Overview of stakeholders and decision-making for PPE, SRADDET, and PCAET*

LEVEL	INSTRUMENT	MAIN STAKEHOLDERS	HOW IT CONNECTS
National	PPE	Ministries, advisory councils, industry, public	Sets strategic energy policy and targets, feeds into SRADDET requirements.
Regional	SRADDET	Regions, local authorities, civil society, experts, public	Adapts PPE to territorial context; ensures regional compliance, paves way for local policies.
Local	PCAET, sectoral plans	Local governments, intercommunal structures, stakeholders	Must be compatible with SRADDET and consider PPE, implementing detailed local actions.

Sources: *(Demaziere, 2021b; Direction générale de l'énergie et du climat, 2024; European Commission, 2023; International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019)*

At the national level, the development and revision of the PPE involve ministries, the National Council for Ecological Transition, the Higher Council for Energy, industry experts, civil society, and broad public consultations (including public debates organized for each PPE revision) (Direction générale de l'énergie et du climat, 2024; European Commission, 2023; Ministère de la Transition écologique et solidaire, 2019). Additionally, the PPE calls for consistency within regional planning instruments (SRADDET, S3RENR) and supports a "territorialization" approach: regional plans and departmental actors translate national capacity objectives into local potential and connection planning. Prefects and regional authorities then play integral roles in implementing network connections and permits.

As for each SRADDET, governance and decision-making is dictated based upon the respective local authorities involved within those regions planning processes. Decisions within a SRADDET (Schéma Régional d'Aménagement, de Développement Durable et d'Égalité des Territoires) are made through a regional, participatory governance process led by the elected regional council and structured around several key steps that ensure transparency, technical rigor, and stakeholder involvement (Climate Chance, 2021; Demaziere, 2021a, 2021b; International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019). This includes:

Community engagement

PPE drafts are published for public consultation on the government's consultation portal; comments are collected and can lead to modifications (the consultation records show changes made in response to public input). This is the formalized route the French government has established for NGOs, companies, citizens and local authorities to contribute to iterations of the PPE (Consultationspubliques, 2025). Implementation of the plan then relies heavily on local actors: regions and departmental prefectures interpret and operationalize PPE objectives through their planning documents and permitting roles. The PPE therefore creates national obligations of consistency, rather than bypassing local planning authorities (Consultationspubliques, 2025).

Regions themselves are then responsible for each drafting their own SRADDET. This leads to broad stakeholder engagement that includes elected representatives, regional administrations, intercommunal authorities, economic actors, environmental NGOs, social partners, rural and urban interests, as well as technical agencies and experts. New stakeholder forums, like regional "COPs" (Conferences of Parties), also bring together diverse actors for bottom-up deliberation of local priorities, challenges, and solutions, feeding directly into regional planning and aligning with PPE-aligned national strategies (Consultationspubliques, 2025; Demaziere, 2021b). Local authorities contribute through the preparation of PCAET and sectoral plans (mobility, habitat, waste), which must interface with SRADDET and thus, indirectly, with PPE objectives. Monitoring and adjustment involve ongoing interinstitutional dialogue and shared responsibility, with public reporting, regular evaluation, and opportunities for updated stakeholder input (Direction générale de l'énergie et du climat, 2024; European Commission, 2023)

Integration with economic development

France's Multiannual Energy Program (PPE) targets the creation of green jobs along with support for regional businesses within the French energy transition (Ministère de la Transition écologique et solidaire, 2019). The PPE sets quantitative targets (e.g., volumes of renewables, biomethane injection, load management capacity) that feed the timing and volume of public procurement (tenders, calls for projects) and regulatory incentives. Investors and industrial policy are then shaped by those cadence signals (Direction générale de l'énergie et du climat, 2024; Hamdi-Cherif et al., 2022). What that means is the PPE ultimately exists a bridge between French energy targets and national/sectoral economic policy.

The PPE's focus on territorialization encourages alignment with regional development strategies (SRADDET) so that projects (e.g., large renewables, biogas plants, storage) are linked to local economic benefits permitting, procurement, supply-chain development and workforce planning, and coordinated regionally. This reduces a potential mismatch between national targets and local feasibility (Direction générale de l'énergie et du climat, 2024; Ministère de la Transition écologique et solidaire, 2019).

Each of France's regions are then able to use the SRADDET framework to design a unique and contextually appropriate plan which will allow them to foster economic diversification around the energy transition—renewable energy production, energy storage, green building, and digitalization of territories. In this way, PPE objectives guide the scale and timing of these investments, ensuring regional ecosystems develop in step with national decarbonization timelines (e.g., grids, storage capacity, and demand-reduction measures) and financing opportunities (Direction générale de l'énergie et du climat, 2024; Hamdi-Cherif et al., 2022). By embedding PPE targets into these regional objectives, the SRADDET creates a coherent framework where energy investments stimulate regional economies (jobs, value chains) while meeting climate goals(Hamdi-Cherif et al., 2022).

Technology and resource considerations

As nuclear energy remains the backbone of France's power system (~70% of total generation), the PPE has many specific considerations for this technology type (International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019). However, as the PPE is a national strategic steering document, it also addresses additional forms of low-carbon energy infrastructure and includes the components outlined in Table 3(Direction générale de l'énergie et du climat, 2024; International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019).

Table 7 *PPE Technological Considerations*

TECHNOLOGY	RESOURCE BASIS	KEY CONSIDERATIONS IN PPE
Onshore wind	Wind potential, land availability	Integration into regional SRADDET and S3REnR plans; visual/environmental impacts; grid connection capacity
Offshore wind	Coastal/marine zones	Coordinated maritime spatial planning (with *documents stratégiques de façade*); industrial port capacity; environmental monitoring
Solar PV	Insolation, rooftop/ land potential	Territorial deployment strategies (agri-PV, brownfield PV); distribution grid adaptation; recycling of PV modules
Hydropower	River basin hydrology	Environmental flow maintenance; refurbishment of existing dams; limited new potential due to saturation
Biogas/ Biomethane	Agricultural and waste resources	Local feedstock supply; rural economy integration; grid injection capacity; sustainability certification
Geothermal	Geothermal potential zones	Resource mapping, regional geological constraints, risk management for seismicity

Sources: *(European Commission, 2023; International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019).*

Financing and implementation mechanisms

PPE informs national public investment and subsidies targeting decarbonization, while SRADDET identifies regional investment priorities and project pipelines. This enables coherent access to public funds (e.g., regional development programs, energy efficiency incentives) aligned with PPE timelines and regional development plans (Direction générale de l'énergie et du climat, 2024; Hamdi-Cherif et al., 2022). While the PPE does not directly allocate any funds, the targets and trajectories it sets determine (European Commission, 2023; International Energy Agency, 2021; Ministère de la Transition écologique et solidaire, 2019), including:

- The volume and timing of public tenders for renewables and low-carbon technologies,
- The budget envelope for support schemes (e.g., feed-in tariffs, contracts for difference),
- The investment priorities of public financial institutions.

Case: Brittany (Bretagne) – Energy Autonomy and Wind Development

Figure 7 *Regional map: Saint-Brieuc/Southern Brittany, France.*

Adopted by the Brittany Regional Council in December 2020 and made legally binding in March 2021 after approval by the region, the Bretagne SRADDET emerged from the "Breizh COP," a large-scale participatory process involving local governments, economic actors, NGOs, and citizens (Region Bretagne, 2024). The SRADDET consolidates five previous regional schemes: ecological coherence, climate-air-energy, intermodality, infrastructures/ transport, and waste management. It also sets out 38 objectives and a series of binding measures that local planning documents must follow, but leaves local authorities the freedom to determine the ultimate means of implementation (Region Bretagne, 2024)

The Regional Council of Bretagne prioritized broad involvement of its partners in the development of the document, going beyond what the law requires. More than simply consulting the stakeholders mentioned by law (the Departments, the metropolitan areas, the public bodies responsible for Territorial Coherence Schemes (SCOTs), the inter-municipal bodies (EPCIs), the Regional Economic, Social and Environmental Council (CESER), and the chambers of commerce), the Region implemented a co-construction approach that gave full voice to the territories and other stakeholders (Region Bretagne, 2024).

Bretagne's SRADDET provides an excellent example of a French region aligning its development goals directly with PPE targets. It does so by promoting growth in offshore wind production, biomass, and hydrogen mobility. The recently completed ~500MW Baie de Saint-Brieuc offshore wind farm, capable of generating enough clean energy for 835,000 people, is a prime example of a project resulting from Bretagne's SRADDET (Iberdrola, 2024). The region has also developed Bretagne Énergies to coordinate local authorities, EDF, and RTE on regional grid reinforcement—essential to integrate the PPE's renewable energy goals into regional infrastructure (Region Bretagne, 2024). Other strategic objectives of the regions SRADDET includes:

- Boosting renewable energy production (multiply by 7 by 2040), energy efficiency, and cutting energy consumption by 39%.
- Achieving climate resilience and adaptation, with sea-level rise and "factor 4" targets (GHG emissions divided by four by 2050).
- Zero construction in ecological continuity zones and combatting urban sprawl.
- Developing innovative and sustainable maritime, rail, and logistics infrastructure.
- Commitment to territorial equality, rural inclusion, and local economic development.

Action plans issued for each strategic commitment serve as reference roadmaps for regional and local authorities in implementing the SRADDET, and help mobilize funding, partnerships, and regulatory support.

The Bretagne SRADDET develops economic opportunity by aligning territorial investment (business clusters, rural revitalization, ports, innovation zones) with the energy transition, aiming for job growth, new industries, and resilient supply chains. Spatial planning within the SRADDET guide land use for housing, infrastructure, mobility, and renewable energy, enforcing environmental protection (e.g., restricting construction in biodiversity corridors and factoring water resources into new projects) (Region Bretagne, 2024).

Framework Takeaways

France's combination of the national Multi-Annual Energy Plan (Programmation pluriannuelle de l'énergie, PPE) and the regional SRADDET plans offers a strong example of multi-level, spatially integrated energy planning for the transition. Regions as a result are then recognised as "leaders" for coordinating local authorities on energy issues and for aligning territorial climate-air-energy plans (PCAET) with SRADDET and PPE priorities. This structured compatibility chain (PPE → SRADDET → PCAET and local plans) creates vertical coherence while still allowing territories to tailor solutions to local resources and socioeconomic conditions.

For other regions conducting regional energy economy planning, the French framework demonstrates the value of:

- A national energy roadmap (such as the PPE) legally linked to long-term climate goals.
- Regional spatial plans (like the SRADDET) that embed energy and climate alongside transport, land use and biodiversity, with binding force on local planning.
- Formal compatibility requirements that ensure local climate and land use decisions collectively deliver national transition targets, rather than working at cross-purposes.

Further Resources

Ministère de la Transition écologique et solidaire. (2019). PPE Executive summary.

European Commission. (2023). **France—National Energy Climate Plan.**

Region Bretagne. (2024). **Bretagne SRADDET-2024.**

Framework III:
Australia's Electricity Infrastructure Roadmap and Renewable Energy Zones

A 20-year strategic plan for regional energy transition in Australia's state of New South Wales

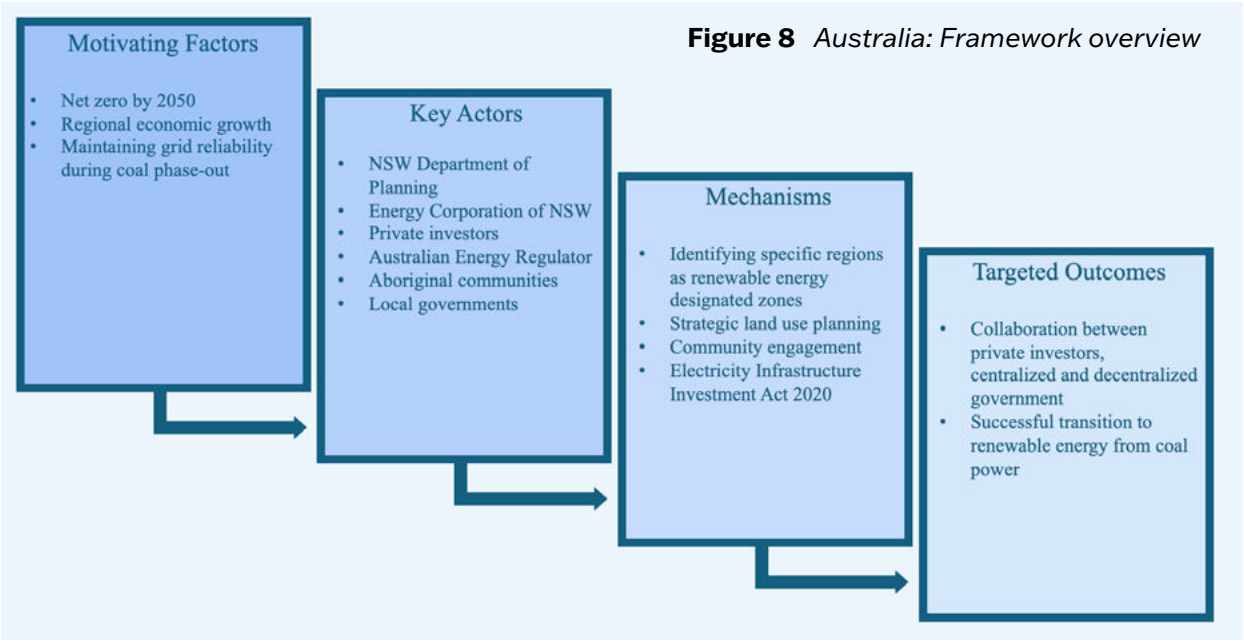


Figure 8 *Australia: Framework overview*

Table 8 *Australia: Summary of plans*

Acronyms

ACRONYM	FULL NAME (ENGLISH)	NOTES / ROLE IN THE FRAMEWORK
REZ	Renewable Energy Zone	A designated geographic area in regional New South Wales where large-scale renewable generation and storage are concentrated and coordinated with transmission investment.
EII Act	Electricity Infrastructure Investment Act 2020 (New South Wales)	State legislation that creates the legal and governance framework for delivering the New South Wales Electricity Infrastructure Roadmap, including the establishment of new institutions and powers.
NSW	New South Wales	Australian state implementing the Electricity Infrastructure Roadmap and Renewable Energy Zones.
EnergyCo NSW	Energy Corporation of New South Wales	Statutory body that leads planning, design, and delivery of the Electricity Infrastructure Roadmap and Renewable Energy Zones, and coordinates major infrastructure procurement.

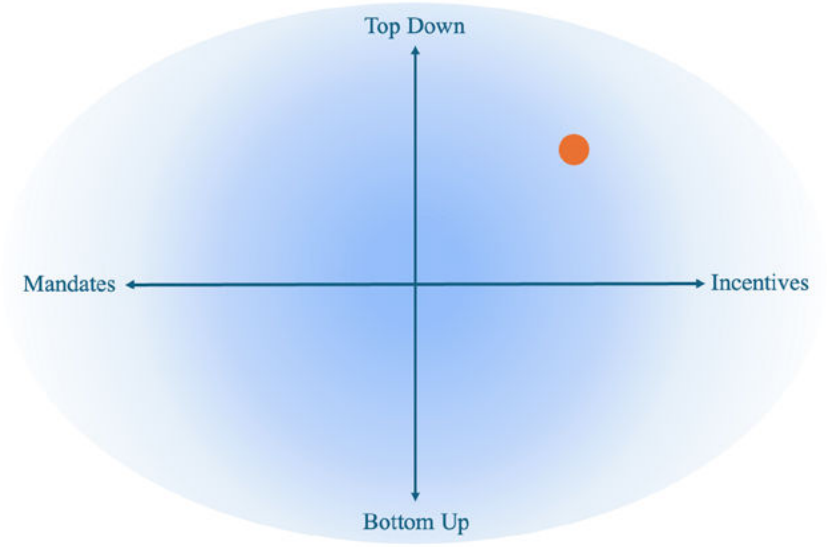
ACRONYM	FULL NAME (ENGLISH)	NOTES / ROLE IN THE FRAMEWORK
AEMO	Australian Energy Market Operator	National market operator; in this framework, works with EnergyCo and others on system planning, and its Consumer Trustee role oversees long-term investment pathways and tenders.
AER	Australian Energy Regulator	Economic regulator overseeing energy networks and markets; ensures projects and network investments comply with national regulatory standards.

Framework Summary

The New South Wales (NSW) Electricity Infrastructure Roadmap ("The roadmap") and its network of Renewable Energy Zones (REZs) exemplify integrated spatial energy planning that actively incorporates local economic development into the broader regional energy transition for New South Wales. The roadmap itself consists of a 20-year strategy guiding the state's transition to affordable, reliable, and low-carbon electricity. To achieve its targets, the NSW roadmap identifies and sets out the development of five initial large regions known as "Renewable Energy Zones" where good resources, grid access and community benefits can be easily concentrated, explicitly planning generation, storage and transmission together rather than project-by-project.

This zonal approach reduces connection risk for projects, gives investors a clear map of priority areas to focus development, and supports coordinated network upgrades instead of ad hoc reinforcements. This emphasis on strategic land use planning, community engagement and benefit sharing helps maintain social licence, a critical lesson for other regions seeking to cluster large amounts of new infrastructure (Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020).

Figure 9 *Governance modes: New South Wales*



Although the planning and regulation within the roadmap is highly centralized, project delivery is decentralized through the establishment of regional REZs in conjunction with local governments, Indigenous partnerships, and the financial backing and support of private developers. The roadmap integrates economic and community development by positioning REZs as regional growth engines and embedding requirements for consultation, benefit sharing, and First Nations engagement within its development plans (NSW Department of Planning, Industry and Environment, 2020). This framework represents a centrally coordinated yet regionally implemented approach to spatial energy planning, balancing state-level strategic control with localized execution, economic development, and community participation.

Background

The NSW Government first adopted a "net zero by 2050" target in 2016 through the NSW Climate Change Policy Framework released that year. This 2016 framework formally set the objective for the state to achieve net zero emissions by 2050 and to make NSW more resilient to climate change (AdaptNSW, 2023). To assess how these goals might be met, in 2019 Australia's energy market operator (AEMO) undertook a study which estimated that approximately $5.1 billion of long duration storage and between $22.4 to $33.6 billion of wind and solar investment would be required to meet the energy requirements of NSW and maintain a reliable supply as it looks to reach net zero by 2050 (AEMO, 2019; NSW Department of Planning, Industry and Environment, 2020). AEMO confirmed that the necessary replacement of generation in NSW is likely to be made up of a mix of wind, solar, gas, and storage.

Based on these assessments, the New South Wales Government developed the "NSW Energy Strategy" in 2019 as its overarching plan to deliver a reliable, affordable and sustainable electricity system while supporting economic growth and emissions reduction. Building on that, to implement these changes the NSW Electricity Infrastructure Roadmap

was introduced in November 2020 through the Electricity Infrastructure Investment Act 2020 to carry out key elements of the strategy over the following two decades and diversify and strengthen the NSW energy sector (NSW Climate and Energy Action, 2024).

As the NSW government currently faces the retirement of several large coal-fired stations, this creates a risk of supply gaps, especially during peak demand events such as summer heatwaves. Without coordinated replacement by new generation and storage, the state could breach reliability standards and face higher risks of blackouts (Australian Energy Council, 2023). Because the state's current fleet of coal-fired generation plants took ~30 years to plan and build, there is now the need to replace four out of five of these plants within the next 12 years while simultaneously ensuring that the states commitments to the roadmap are carried out. The creation of the NSW Energy Roadmap is the States response to the AEMO assessment and represents the strategic plan to address and secure its future energy needs.

Framework Factors

What is it?

The NSW Energy Roadmap is a planning document which builds on the framework set out in the NSW Electricity Strategy. which takes an integrated approach to all demand and supply options, including action by households and small businesses, demand management, and investment in large-scale, affordable and reliable generation (NSW Department of Planning, Industry and Environment, 2020; NSW Parliment, 2020). The roadmap lays out the rationale for the policies and programs that are specifically designed to attract and secure that large-scale investment in new electricity infrastructure. It is also supported further by actions to streamline project development such as a case management service to support projects in navigating planning and approvals processes (NSW Department of Planning, Industry and Environment, 2020). In doing so, it aims to replace several retiring coal plants throughout the region, with at least 12 GW of renewable generation and 2 GW of long-duration storage by 2030 (AdaptNSW, 2023; NSW Department of Planning, Industry and Environment, 2020).

The roadmap concentrates new generation, storage and transmission within designated Renewable Energy Zones located in regional NSW, explicitly treating them as "priority areas" for infrastructure that also support broader regional growth. By clustering projects in REZs rather than scattering them, the policy enables coordinated route selection, visual impact management, and mitigation of land-use conflicts such as with prime agricultural land (Betta Value Renewable Energy, 2024; EnergyCo, 2025; NSW Department of Planning, Industry and Environment, 2020). The areas designated as REZ's typically cluster energy generation and storage projects specifically located in areas with:

- High-quality renewable resources (solar, wind)
- Suitable land availability
- Access to transmission capacity or planned transmission upgrades

Spatial planning guidance for REZ transmission and generation also emphasises routing and siting that avoid large population centres, minimise use of prime agricultural land, limit vegetation clearing, and avoid significant Aboriginal cultural sites where possible (AEMO, 2019; AER, 2025; Betta Value Renewable Energy, 2024). By doing so, this integrates the Roadmap with broader land-use objectives by promoting things such as continued farming on easement land, and using already disturbed areas where feasible, along with managing cumulative landscape and biodiversity impacts at a corridor and zone scale rather than taking a piecemeal approach (AER, 2025; EnergyCo, 2025; NSW Department of Planning, Industry and Environment, 2020). This planning process balances energy, agricultural, visual amenity, heritage, and mining priorities, aiming to give communities increased certainty and engagement regarding project locations and timelines (NSW Department of Planning, Industry and Environment, 2020). The roadmap is also viewed as a key tool for achieving the state's long-term net zero emissions goals by 2050 along with driving local economic investments, positioning NSW as a major clean energy "superpower."

Governance and stakeholder structures

The roadmap is enabled by the Electricity Infrastructure Investment Act 2020 (NSW) (EII Act). This Act creates the legal framework and governance frameworks necessary for delivering the NSW Electricity Infrastructure Roadmap by establishing new institutions, powers and accountability mechanisms to plan, procure and oversee generation, storage and transmission projects. It is designed to coordinate government, market bodies and private investors while simultaneously managing risks and protecting consumers (NSW Department of Planning, Industry and Environment, 2020; NSW Parliment, 2020). In doing so, the NSW Government, through the Energy Corporation of NSW (EnergyCo NSW), is able to coordinate the planning, investment, and delivery of the NSW Electricity Infrastructure Roadmap (2020) (AEMO, 2019; NSW Department of Planning, Industry and Environment, 2020; NSW Parliment, 2020).

This statutory body was established to coordinate and lead the development, design, and delivery of REZs, partnering with stakeholders and communities to ensure infrastructure is built efficiently and with community benefit in mind. The agency also oversees competitive tenders for designing, building, financing, operating, and maintaining REZ transmission projects, selecting which renewable energy and storage projects connect to the grid (EnergyCo, 2025; NSW Department of Planning, Industry and Environment, 2020). The corporation works alongside other stakeholders such as the AEMO Consumer Trustee, the Australian Energy Regulator, Transgrid, distribution network service providers, and state and federal agencies to ensure projects meet NSW and national regulatory standards (EnergyCo, 2025; NSW Department of Planning, Industry and Environment, 2020).

While EnergyCo is responsible for many aspects of the implementation of the NSW Electricity Infrastructure Roadmap, the governance and decision-making of many aspects of plan, including within designated Renewable Energy Zones (REZs), involve a structured framework of statutory bodies, regulators, advisory boards, and government ministries

(EnergyCo, 2025; NSW Department of Planning, Industry and Environment, 2020). Each actor plays a specialized, often legally mandated, role in delivering the roadmap's objectives, outlined in Table 4.

Table 9 *Governance structure across NSW energy roadmap and REZ's*

ACTOR	KEY ROLES & RESPONSIBILITIES
Minister for Energy	Ultimate authority: declares REZs, appoints entities, directs tenders, and reviews legislation. Oversees all Roadmap implementation.
Energy Corporation of NSW (EnergyCo)	Infrastructure Planner; leads planning, technical design, delivery, and coordination of REZs and associated network projects. Engages stakeholders and manages procurement for major infrastructure contracts.
Consumer Trustee (AEMO Services/ASL)	Ensures actions align with long-term interests of NSW consumers. Designs and runs competitive tenders for generation and storage; develops and updates infrastructure development plans; authorizes network projects; appoints and oversees the Financial Trustee.
Australian Energy Regulator (AER)	Economic regulator: scrutinizes project costs, annual contributions, and approves risk management. Ensures value for consumers, revenue determinations, and reviews tender rules.
IPART (Independent Pricing and Regulatory Tribunal)	Conducts performance audits, reports annually, and makes recommendations on sector plans and consumer protection.
Regional Development Authorities (RDAs)	Regional engagement and community consultation; co-design processes; participation agreements with energy companies; long-term regional accountability.
Aboriginal Communities	Input on energy transition plans; Aboriginal interests' representation; consultation on impacts and benefits.
Local Government	Planning consultation; local impact assessment; community liaison; benefit-sharing implementation.

Sources: *(NSW Climate and Energy Action, 2025; NSW Department of Planning, Industry and Environment, 2020).*

Indigenous engagement

The NSW Government has explicitly stated that they are committed to creating more jobs and income opportunities for Aboriginal communities in NSW, ensuring that they share the benefits from the state's "once-in-a-generation" energy transition (NSW Department of Planning, Industry and Environment, 2020). The Minister for Energy has issued guidelines on consultation and negotiation with local Aboriginal communities for

energy infrastructure delivered under the Electricity Infrastructure Roadmap as required under section 4(1) of the *Electricity Infrastructure Investment Act 2020* (EII Act). These guidelines set out the expectations for respectful engagement with local Aboriginal communities for the purpose of increasing employment and income opportunities for Aboriginal people in the construction and operation of new electricity infrastructure projects, delivered under the roadmap (Norman et al., 2023; NSW Department of Planning, Industry and Environment, 2020).

The revised general guidelines support local Aboriginal communities to achieve long-term income and job opportunities through renewable energy projects, aligning with their goals for self-determination and economic independence. The guidelines recommend that project proponents be required to prepare an Industry and Aboriginal Participation Plan documenting the engagement approach and the agreed commitments with Aboriginal people and businesses (Norman et al., 2023; NSW Department of Planning, Industry and Environment, 2020).

The general guidelines are then also supported by region-specific guidelines for each of the five identified Renewable Energy Zones (REZs). The region-specific guidelines outline the local Aboriginal communities' goals and aspirations for income and employment opportunities, as well as their preferred method of engagement with Roadmap project proponents and Government. The region-specific guidelines provide clear guidance for Roadmap project proponents to consult and negotiate with local Aboriginal communities in the Renewable Energy Zones (Betta Value Renewable Energy, 2024; Norman et al., 2023; NSW Department of Planning, Industry and Environment, 2020). Each region-specific guideline is co-developed with representatives from the local Aboriginal communities, with assistance from Aboriginal consultants to ensure engagement and consultation is culturally appropriate and that content is community driven and relevant to the needs and opportunities of the Aboriginal people and businesses of that region (Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020)

Community engagement

The NSW Electricity Infrastructure Roadmap integrates community input primarily by means of structured consultation around its designation and implementation of Renewable Energy Zones (REZs), statutory requirements in the Electricity Infrastructure Investment Act 2020 (NSW), and ongoing engagement processes run by Roadmap delivery bodies. This is intended to give affected communities real influence over project design, benefits and impacts rather than just being informed after decisions are made (NSW Department of Planning, Industry and Environment, 2020). By using strategic, upfront land-use planning EnergyCo NSW is also able to ensure a strategic approach to electricity infrastructure development. By working on the ground with communities and collaborating with a range of NSW Government entities and other parties to get the most up-to-date data layers and develop the most appropriate plans possible when preparing to declare a REZ (Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020).

Additionally, as a measure of the roadmap it is expected that all project proponents involved in the development of related projects and infrastructure implement coordinated community benefit-sharing schemes within REZs, pooling developer contributions into community enhancement funds that support social infrastructure such as health, education and local amenities (AER, 2025; Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020). In parallel to these initiatives, the Strategic Benefit Payments Scheme provides long-term indexed payments per kilometre of transmission easement to private and eligible Aboriginal landholders hosting major transmission infrastructure, explicitly recognising their role in the energy transition (AER, 2024; Betta Value Renewable Energy, 2024; Norman et al., 2023; NSW Department of Planning, Industry and Environment, 2020).

Integration with economic development

The roadmap and its REZ's are structurally designed to promote wide-ranging local economic growth and participation at their core. One of the primary goals of the roadmap is in large part to give the region's energy industry and investors the certainty they need to invest in the infrastructure required for the region's transition. AEMO and EnergyCo estimate that more than $77 billion of private sector investment set to be potentially injected into the NSW economy through this plan by 2035, the roadmap seeks to clear the path to realize these investments (NSW Department of Planning, Industry and Environment, 2020). The Electricity Infrastructure Roadmap also looks to help to facilitate new and diversified income streams for landholders that host this electricity infrastructure. For instance, landholders hosting renewable energy generation projects could be expected to receive an estimated $1.5 billion in lease payments by 2042 (AER, 2024; Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020).

The creation and operation of REZs across NSW as a measure of the energy roadmap are also forecasted to generate nearly 7,000 direct construction jobs and more than 4,400 ongoing jobs in regional areas, particularly in manufacturing, transport, retail, and energy services. Local businesses will be empowered with easier access to work packages within REZs, supporting supply chain growth, investment, and regional confidence (AER, 2024; NSW Department of Planning, Industry and Environment, 2020). Dedicated community and employment benefit programs will allocate hundreds of millions over several decades to fund skills training, workforce development, and infrastructure upgrades directly tied to energy transition projects (SGS, 2024). This also include numerous tangible community benefits, from telecommunications upgrades to local distribution improvements, each of which are embedded in major infrastructure rollouts through the roadmap (AER, 2025; Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020).

Technology and resource considerations

The NSW Electricity Infrastructure Roadmap focuses on a mix of variable renewables, firming/storage technologies and enabling network infrastructure, chosen to maintain reliability while cutting emissions and costs. This includes a projected 12 gigawatts of new renewable electricity generation, such as wind and solar, and 2 gigawatts of long-duration

storage (Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020). It also considers resource quality and location by using Renewable Energy Zones that cluster projects where wind, solar and land availability are strongest (NSW Department of Planning, Industry and Environment, 2020).

The roadmap centres its technological focus on large-scale wind and solar PV as the primary new generation sources, reflecting their falling costs and strong resource in NSW. Long-duration storage (such as pumped hydro) and shorter-duration batteries are key technologies to firm variable renewables and meet "energy security target" requirements. The framework explicitly procures firming and storage through dedicated tenders and Long-Term Energy Service Agreements so enough dispatchable capacity is available during peak and low-renewables periods (Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020).

Financing and implementation mechanisms

The Roadmap is enabled by the Electricity Infrastructure Investment Act 2020 (NSW) (EII Act). That Act creates the legal framework and roles used to plan, procure, and fund Roadmap projects. The roadmap uses purchaser/underwriting contracts and commercial arrangements to provide revenue certainty to firming, storage, and generator projects to de-risk investment (AEMO, 2019; AER, 2025; Betta Value Renewable Energy, 2024; NSW Department of Planning, Industry and Environment, 2020). Additionally, REZ's (five REZs identified across NSW) are planned as "package" areas where coordinated transmission + generation + storage aims to de-risk projects and attract large private investment—bringing construction jobs, ongoing operations jobs and local supply-chain opportunities.

To further support development the State of NSW has also established the "Electricity Infrastructure Fund" which is a state fund (charged to consumers under a jurisdictional scheme subject to AER arrangements) who pay scheme costs (network payments, underwriting costs, administrative costs) (AER, 2024). Power Purchase Agreements (PPAs) facilitate direct connections between local councils, businesses, and renewable generators, furthering community energy independence and supporting net-zero goals (NSW Department of Planning, Industry and Environment, 2020).

Case: Central-West Orana Renewable Energy Zone

Figure 10 *Regional map: Central-West Orana REZ/New South Wales, Australia.*

The NSW Government is currently in the delivery phase for the state's first renewable energy zone (REZ) in the Central-West Orana region. The Central-West Orana REZ is made up of approximately 20,000 square kilometers centered by Dubbo and Dunedoo, on the land of the Wiradjuri, Wailwan and Kamilaroi peoples (EnergyCo, 2024; Livingston, 2024). This REZ is scheduled to initially unlock at least 4.5 gigawatts of new network capacity by the late-2020s, with new transmission infrastructure that will enable generators (such as solar and wind farms) participating in the REZ to export electricity to the rest of the regional network. (EnergyCo NSW, 2024).

Early project pipelines in the REZ have attracted substantial private investment, supporting employment in construction, engineering, planning and associated services, and encouraging upgrades to local roads and enabling infrastructure. Over time, the clustering of generation and transmission assets is expected to support secondary industries such as advanced manufacturing, services and potentially energy-intensive processing that can leverage abundant low-cost renewable power. Currently Central-West Orana has one major transmission project underway plus a portfolio of large generation and storage projects that have now secured access rights and are progressing through development and approvals. EnergyCo lists the following major projects in development that have secured access rights (EnergyCo, 2024):

- Birrawa Solar and Battery Energy Storage System – ACEN Australia – up to 600 MW – battery energy storage and up to 600 MW – solar farm.
- Valley of the Winds – ACEN Australia – up to 919 MW – wind farm.
- Tallawang Solar Hybrid – Potentia Energy – up to 500 MW – solar plus battery hybrid project.

- Cobbora Battery Energy Storage System – Pacific Partnerships – up to 400 MW – battery energy storage.
- Cobbora Solar – Pacific Partnerships – up to 700 MW – solar farm.
- Sandy Creek Battery Energy Storage System – Lightsource bp – up to 700 MW – battery energy storage.
- Sandy Creek Solar – Lightsource bp – up to 700 MW – solar farm.
- Spicers Creek Wind Farm – Squadron – up to 700 MW – wind farm.
- Liverpool Ranges Wind Farm – Tilt Renewables (TILT) – up to 1,332 MW – wind farm.

EnergyCo estimates that the designation of the Central-West Orana REZ is expected to ultimately attract up to $25 billion in private investment and forecast that it will support an annual average of about 1,850 direct jobs in the local area during construction, and about 930 ongoing operational jobs from 2034 onwards. As a result of the REZ, it will also create the additional demand for all requisite associated workers in local manufacturing, retail, transport, and the supply of goods and services to support the large-scale development in the region (EnergyCo NSW, 2024).

Framework Takeaways

This framework supports a region reliant on aging fossil fuel infrastructure to carry out a targeted energy transition and shift to low-carbon energy alternatives. The NSW energy roadmap takes a centralized, top down, planning approach to align regional needs with dedicated land use and zoning policy measures that create the necessary environment to encourage mass private investment in renewable energy infrastructure.

For other regions conducting regional energy economy planning, the Australian framework demonstrates the value of:

- Defining priority zones that combine strong resource potential with planned grid capacity.
- Creating dedicated institutions, funding mechanisms, and market certainty to coordinate transmission, generation and storage within those zones over a long-term timeline (10–20-year horizon).
- Embedding these priority zones in a clear planning framework along with Indigenous and community engagement processes, so spatial energy planning is integrated with broader land use decisions rather than sitting apart from them.

Further resources

NSW Government. (2020). NSW Electricity Infrastructure Roadmap.

REZ zone location interactive map.

Framework IV:
Spain and the Basque Territorial Sectoral Plan for Renewable Energies

The Basque Regions integrated planning strategy for decarbonization.

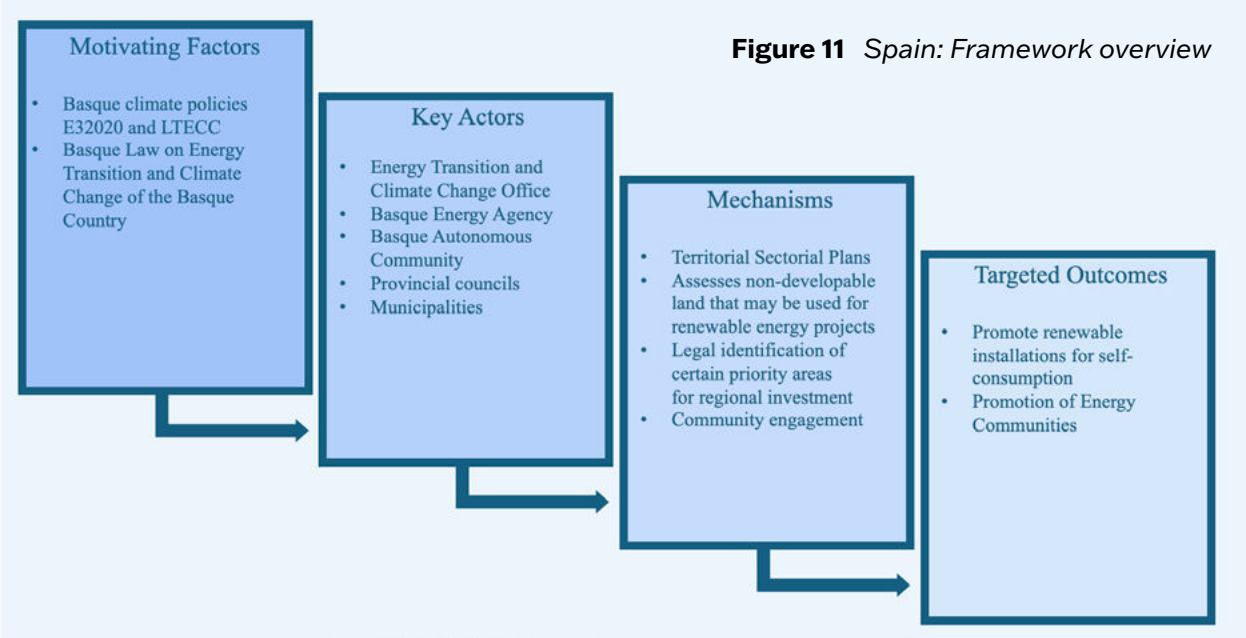


Figure 11 *Spain: Framework overview*

Table 10 *Spain: Summary of plans*

Acronyms

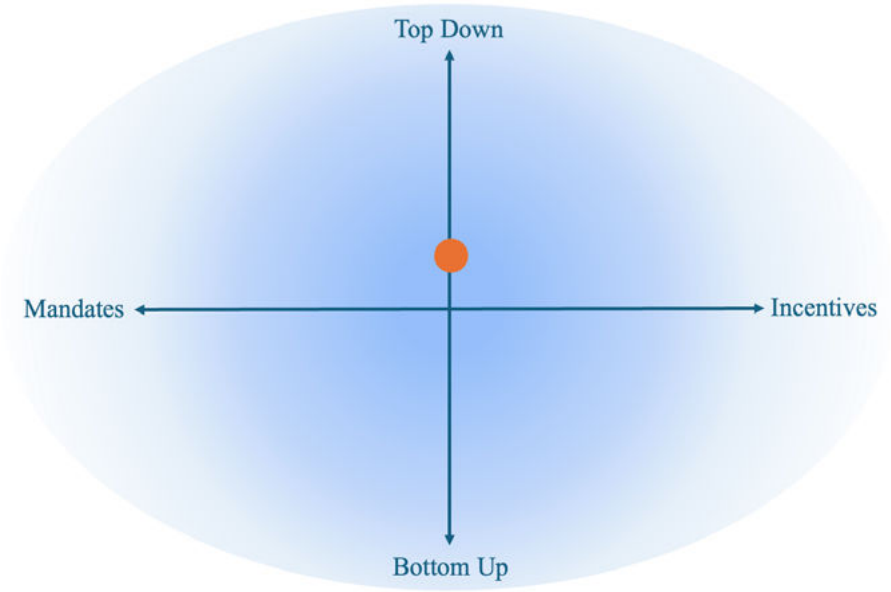
ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
TSP-RE	Territorial Sectoral Plan for Renewable Energies	Plan Territorial Sectorial de Energías Renovables; Basque regional plan that maps where large-scale renewable projects can be developed on mainly rural, non-developable land.
KLIMA 2050	Basque Climate Change Strategy 2050	Estrategia de Cambio Climático KLIMA 2050; sets long-term climate and emissions-reduction goals for the Basque Country.
3E2030	Basque Energy Strategy 2030	Estrategia Energética de Euskadi 2030; regional energy strategy with 2030 targets for renewables, efficiency, and energy security.
LTECC	Law on Energy Transition and Climate Change of the Basque Country	Ley de Transición Energética y Cambio Climático; regional law to accelerate decarbonization and align with Spanish and European climate regulations.

ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
TSP (other)	Territorial Sectoral Plans (e.g., Coastal, Agroforestry)	Planes Territoriales Sectoriales; thematic spatial plans (coastal, agroforestry, etc.) that the renewable energy plan must coordinate with.

Framework Summary

The Territorial Sectoral Plan for Renewable Energies or "TSP-RE" (in Spanish, "*Plan Territorial Sectorial de Energías Renovables*" or "PTS-ER") is an integrated spatial energy plan and suitability model developed by the Basque government which analyzes the renewable energy potential of the entirety of the Basque region for development (onshore wind & solar PV) and sets out where and how infrastructure projects might be deployed in an organized, integrated, and sustainable manner (Basque Government, 2023a). This plan ensures the compatibility of renewable energy development with the natural and cultural elements of the Basque Country, as well as with planning and development instruments, the TSP-RE seeks to establish appropriate territorial zoning, by integrating, from the planning phase, all the elements that will determine the promotion of renewable infrastructure in the region.

Figure 12 *Governance modes: Basque Country*



The TSP-RE supports the implementation of several Basque climate policies including the E32020 and LTECC by turning them into spatially defined targets. In doing so, these Basque strategic documents describe the TSP-RE as the instrument that "determines the areas where renewable energy facilities can be installed and targets met", integrating wind, solar and emerging marine energies within a single territorial, regional logic (Irekia, 2024; Urkidi Azkarraga & Gurrutxaga, 2024). To do this, the TSP-RE explicitly links energy

system objectives (renewable generation volumes, contribution to climate neutrality) with specific spatial criteria such as resource potential, grid access, land-use constraints, local landscape, ecological corridors, and biodiversity protection.

Background

The Basque region has historically represented a significant energy consumer within Spain, with the autonomous region consuming ~95% of its energy from outside of the region. While efficient in terms of energy use, the Basque energy system currently is also mostly based on fossil fuels (between 80-90% over the 2000-2015 period), posing a significant challenge for decarbonization (Acha et al., 2021; Arateko, 2018). In addition to this, energy prices have increased over the last decade, and particularly so when it comes to electricity prices which experienced a 63% increase for medium sized businesses and an 110% increase for households in the 2005 to 2015 period. This has led to an increase in the percentage of household income devoted to energy expenses, in turn leading more households into energy poverty (Acha et al., 2021; Arateko, 2018).

In response to these challenges, the recently updated Basque energy strategy now consists of a central climate plan (known as 3E2030 or Energy Strategy of the Basque Country 2030) which has taken on several iterations and has been updated to reflect a longer horizon for its planning timelines (the initial draft was created in 2011 with a timeline until 2020) (Basque Government, 2019). The 3E2030 sets out quantitative sectoral targets, strategic objectives, areas of activity, and initiatives for the Basque Country including increased efficiency, the production of renewables and security of supply, each of which have become the main reference for sectoral energy policy (Basque Government, 2019).

Building on the 3E2030, in March of 2024, the Law on Energy Transition and Climate Change of the Basque Country (the “LTECC”) was published in the Official State Gazette, with the aim of establishing a stable legal framework to achieve climate neutrality and a fair energy transition by 2050. With this regulation, the Basque Autonomous Community accelerates the decarbonization process and facilitates the alignment of the Basque Country with the rest of the state and European regulations and plans focused on achieving climate neutrality (Osbourne Clarke, 2024). To this end, a series of goals have been established in the LTECC that refer to the prioritisation of energy saving and efficiency, the use of renewable energies and those that enable decarbonization, guaranteeing the security and competitiveness of supply, economic development, the quality of employment and social welfare within the framework of a sustainable model (Osbourne Clarke, 2024). The LTECC, with its 2050 focus, serves as the long-term legal climate energy reference for subsequent spatial planning work.

The TSP-RE is now embedded in the wider set of Basque climate planning frameworks (KLIMA 2050 and the 3E2030 Energy Strategy) that set quantitative objectives for emissions reduction, energy savings and renewable shares in final consumption by 2030 and 2050 (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; OECD, 2025a; Urkidi Azkarraga & Gurrutxaga, 2024). The TSP-RE will also

align the goals of the Law on Energy Transition and Climate Change of the Basque Country (the "LTECC"). With this regulation, the Basque Autonomous Community accelerates the decarbonization process and facilitates the alignment of the Basque Country with the rest of the state and European regulations and plans focused on achieving climate neutrality by 2050 (Osbourne Clarke, 2024). In doing so, the TSP-RE aims to be a planning tool that establishes a defined renewables map, giving room to all the modalities that allow the available technologies (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021).

Framework Factors

What is it?

In Spain, autonomous communities each have their own competences in spatial planning; for instance, control over the creation of unique Territorial Sectorial Plans (TSPs) for sectoral actions at regional or subregional levels (Urkidi Azkarraga & Gurrutxaga, 2024). The impetus behind the creation of the TSP-RE stems from the need to operationalize the regions climate targets into spatially representative plans which explicitly lay out where and how the region will meet its climate targets (Saenz, 2024). The TSP-RE aims to simultaneously promote various renewable energy sources within the region while increasing Basque energy security and addressing the European Union's targets set out in both the RED II & RED III mandates.

The Territorial Sectoral Plan for Renewable Energies or "TSP-RE" of the Basque Country (Spain) aims to organize the deployment of large-scale projects for multiple energy sources, on rural, non-developable land and on a regional scale (OECD, 2025a). The plan's purpose is to guarantee "orderly, planned" deployment of renewables so that projects proceed with legal certainty for developers while remaining compatible with environmental conservation and territorial resilience. It is conceived as a sectoral territorial plan under Basque spatial planning law, so it must coordinate with land-use designations, Natura 2000 and other protected areas, and municipal planning instruments (OECD, 2025a; Urkidi Azkarraga & Gurrutxaga, 2024).

The TSP-RE assesses non-developable land (91.5 % of the territory) to identify excluded areas and those most fitting for the development of medium or large-scale renewable generation projects (Urkidi Azkarraga & Gurrutxaga, 2024). This plan uses environmental/territorial exclusion criteria factors such as whether the area contains protected natural spaces, flora or fauna species of relevance, elements of cultural heritage or certain scenic landmarks, as well as its proximity to population centers. Moreover, the TSP-RE applies the spatial categories of other Sectorial Plans such as the Coastal or the Agroforestry TSPs to the consideration of its spatial planning approach (Basque Government, 2023a; Irekia, 2024; Urkidi Azkarraga & Gurrutxaga, 2024). In doing so, the plan will be one of the first in Spain to order the simultaneous deployment of large-size projects for multiple RE sources, on rural nondevelopable land and at a supra-local scale. It combines the delimitation of environmentally protected areas with energy potential maps, an approach which is often overlooked in energy planning, at

least in formal regulatory plans (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; Urkidi Azkarraga & Gurrutxaga, 2024).

Governance and stakeholder structures

Multi-level governance is central to the TSP-RE's implementation. Different public administrations (Basque Autonomous Community, provincial councils, municipalities) approve their own regulations and management plans "within their sphere of competence" to promote renewables while maintaining balanced development, implying continuous inter-institutional coordination around how the TSP-RE is operationalised (Basque Government, 2023a; Irekia, 2024).

At the territorial level, the different public administrations approve, within their sphere of competence, regulations and management plans that, by promoting the use of renewable energies, including marine renewable energies, are compatible with balanced industrial and social development (OECD, 2025b; Urkidi Azkarraga & Gurrutxaga, 2024). Civil society and stakeholders are engaged through established participatory structures and specific processes associated with major planning instruments and strategies (Urkidi Azkarraga & Gurrutxaga, 2024).

Table 11 *Basque TSP-RE stakeholder and decision-making structure*

ACTOR / BODY	FORMAL ROLE IN TSP-RE SYSTEM	MAIN RESPONSIBILITIES (INDICATIVE)
Basque Government	Political leadership and plan approval	Approves the TSPRE as a sectoral territorial plan; ensures consistency with Klima 2050, the LTECC and other energy climate strategies; sets targets for renewable deployment and just transition.
Department of Economic Development, Sustainability and Environment	Lead energy climate department	Leads energy transition and climate change policy, including drafting and steering of the Territorial Plan for the Renewable Energy Sector; promotes renewable deployment, self-consumption and storage; integrates industrial and environmental objectives.
Energy Transition and Climate Change Office	Technical coordination and follow-up	Supports implementation of the energy transition and climate change law; coordinates planning instruments (including the TSP-RE and 2050 Roadmap); monitors progress and supports mainstreaming across sectors.
Basque Energy Agency (EVE)	Technical and analytical support	Provides energy system analysis and input to the Territorial Sectoral Plan for Renewable Energy and related strategies; supports design of electrification and renewable deployment pathways.

ACTOR / BODY	FORMAL ROLE IN TSP-RE SYSTEM	MAIN RESPONSIBILITIES (INDICATIVE)
Provincial councils (Álava, Bizkaia, Gipuzkoa)	Intermediate territorial implementation	Develop regulations, land use decisions and support schemes within their competences to implement the TSPRE in each territory, ensuring compatibility with balanced industrial and social development.
Municipalities and local climate energy initiatives	Local planning and project interface	Prepare local climate and energy plans, adjust municipal planning instruments to align with TSPRE zoning, and interface with project developers and citizens, including promotion of self-consumption.
Stakeholders and civil society (through participatory forums)	Consultation and social legitimacy	Engage in participatory processes and deliberative initiatives related to energy transition, helping to inform siting decisions, social acceptance and just transition measures linked to the TSPRE.

Sources: *(Basque Government, 2023a; Irekia, 2024; OECD, 2025a; Saenz, 2024; Urkidi Azkarraga & Gurrutxaga, 2024).*

Indigenous engagement

Indigenous engagement does not exist within the current application of this framework. However, the distinct cultural identity of the Basque country is a critically important aspect of the TSP-RE and its implementation at local levels. Consideration for the cultural identity of the region was one of the most frequently emphasized aspects of community engagement with the establishment of this plan and its approval hinged on explicit considerations for this identity in all renewable development moving forward (Basque Government, 2024a).

Community engagement

The Basque Energy Transition and Climate Change Law already requires that public administrations promote citizen participation in renewable projects, explicitly supporting energy communities and other participatory schemes linked to the TSPRE rollout (Basque Government, 2024b). For projects over 5 MW, at least 20% of plant capacity is to be offered for citizen investment and long-term offtake agreements with Basque companies, ensuring that large sites designated in the TSPRE embed local ownership and corporate purchasing power (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; Basque Government, 2024b).

For the TSP-RE, the Citizen Participation Plan is the document that defines the public participation strategy of the Basque Government, during the process of elaboration of the Sectoral Territorial Plan of Renewable Energy and develops this participation within each of the phases of the drafting process (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; OECD, 2025b; Urkidi Azkarraga &

Gurrutxaga, 2024). In this way, the opinion of the citizens of the Basque Country about the instrument of territorial planning that is intended to be approved can be clearly and concretely included (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021). The procedure for the creation of the TSP-RE started in 2021 with an initial approval of the plan reached in May of 2023. In response to numerous public concerns surrounding the land designation within the TSP-RE, a new revised draft of the plan has been adopted by the Basque state government as of December 20th, 2024 (Urkidi Azkarraga & Gurrutxaga, 2024).

Integration with economic development

Basque Green Deal and energy transition documents frame renewables as a driver of industrial competitiveness, innovation and employment, not only as a climate measure (Saenz, 2024). The 3E2030 and LTECC set state climate goals and legal mandates, such as quantitative targets for renewables, emissions and efficiency, plus qualitative aims like just transition, rural development and reindustrialisation. What the TSPRE does is translate these targets into explicit mapping and zoning rules that prioritise areas where renewable projects are not only suitable, but build on existing industrial clusters, expediting their production, supporting achieving regional targets, growing regional economies, or facilitate just transition regions. In doing so, spatial planning becomes an active economic policy tool rather than a purely environmental filter (Basque Government, 2023a, 2023b).

Working in conjunction with the TSP-RE, the recent LTECC 2050 climate laws also makes explicit within the Basque legal framework several points which tie the TSP-RE into economic development as a measure of energy transition efforts (Basque Government, 2024b; Osbourne Clarke, 2024; Saenz, 2024). In doing so, the LTECC sets out in law:

- The implementation of the TSP-RE, which should serve to guarantee the orderly development of renewable energies, so that all relevant actors involved in the process can manage the processing and implementation of projects with set guarantees.

- Promote renewable installations for self-consumption and development of these technologies by the respective public administrations. Specifically, the implementation of financing mechanisms and participation by the administrations in innovative projects is envisaged, accompanying private initiatives or directly with their own investments. Similarly, they should encourage and promote the development and implementation of renewable electrical and thermal energy storage systems locally.

- Promotion of Energy Communities to bring the use of renewable energies closer to the most vulnerable areas and to encourage citizen participation in renewable technology projects and support locally realized economic benefits from energy projects.

- To advance in the process of decarbonization of the economy, the generation of alternative fuels from renewable sources will be supported, considering their technical characteristics, their low environmental impact and their economic viability for each respective region.

The TSP-ER is also linked to programmes such as Gauzatu Energy (supporting clean energy investments by Basque firms and municipalities) and additional 3E2030 objectives for energy savings and indigenous renewable production, which aim to reduce energy import dependence and create robust and locally based value chains (Arateko, 2018; Irekia, 2024; Saenz, 2024; Urkidi Azkarraga & Gurrutxaga, 2024).

Technology and resource considerations

Since the plan's advance document states that onshore wind and photovoltaic medium-to-large-scale projects have the greatest territorial impact, these are the focus of the present plan. The plan does not include offshore wind energy, large hydroelectric plants (no new projects are foreseen), nor self-consumption or small-scale facilities. With the full development of the selected zones, the installed capacity would increase by 2500 MW for photovoltaic energy and by 1100 MW for wind energy, augmenting the share of endogenous renewable generation in end consumption by 11.5 % (Urkidi Azkarraga & Gurrutxaga, 2024)

Financing and implementation mechanisms

The TSP-RE sets the "where and how", not the "who pays" or "how to build". While the TSP-RE itself does not include funding, implementation depends on parallel sectoral and institutional mechanisms. Energy projects identified in the TSP-RE are often co-developed by EVE (the Basque Energy Agency) and private utilities (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; Basque Government, 2023a). Many TSP-related projects (especially energy and mobility) are co-financed via: EU Structural and Cohesion Funds / NextGenerationEU / REPowerEU / Basque ERDF regional programs / National energy-transition mechanisms (IDAE grants) (Basque Department of Industry, Energy Transition and Sustainability & Energy, 2021; Basque Government, 2023a).

While the TSP-RE does not address aspects of financing energy projects, the LTECC explicitly establishes the legal identification of certain priority areas for regional investment. Article 64 of the law states that various actions directly related to the promotion of renewable energies, such as energy storage, repowering of wind farms, hybridization of renewable energy installations, energy communities, etc., will be considered priority and urgent investments for the purposes of planning, administrative processing and allocation of public aid will be made (Osbourne Clarke, 2024; Saenz, 2024). In addition to this, the creation of a renewable energy tax along with the implementation on undeveloped land of generation facilities (wind farms and photovoltaic solar parks) will be taxed with a renewable energy fee for the adverse effects and impacts on the environment (Osbourne Clarke, 2024)

Case: Basque Region, Spain

Figure 13 *Regional map: Basque Autonomous Region, Spain.*

Because of the nature of the TSP-RE as a spatial planning and energy suitability guide, this plan has supported a range of projects spanning from large scale utility and municipally developed infrastructure to small scale locally focused energy communities and cooperatives. Currently at a project level, since the approval of the preliminary TSP-RE in December of 2023, more than 600 MW of installed capacity has already been permitted (Basque Government, 2023a; Irekia, 2024; Urkidi Azkarraga & Gurrutxaga, 2024).

One such project, the Labraza wind farm, has seen the Basque Government and Iberdrola España jointly invest in the first major wind project to be developed in the Basque Country since 2006 (Iberdrola España, 2025). The project, with an investment of €59 million, will be delivered through a public–private partnership and aims to support the region's wind energy supply chain. The 40MW wind farm will consist of eight Siemens Gamesa SG 5.0-145 turbines, each rated at 5MW. The project is explicitly set to be constructed by local industry and act as a springboard for regional energy infrastructure development (Iberdrola España, 2025). The Gearboxes for the turbines will be manufactured at Siemens Gamesa's facility in Asteasu, Gipuzkoa, while the substation will be built by EDS Ingeniería y Montaje in Galdakao, Bizkaia. Labraza will connect to the grid via the existing substation used by nearby wind farms in Aguilar de Codés, Navarra, avoiding the need for new grid infrastructure. Once operational, the wind farm is expected to generate approximately 99,679MWh per year, equivalent to the annual consumption of 30,000 households. Construction is scheduled to begin in the final quarter of 2025, with commissioning planned for late 2026 (Iberdrola España, 2025).

Framework Takeaways

Other regions can draw from the Basque TSP-RE, LTECC and 3E2030 that energy-economy planning works best when long-term climate-energy goals, spatial rules, and local development instruments are explicitly linked and co-designed. These frameworks show how to move from abstract decarbonization targets to mapped zones, governance arrangements and investment mechanisms that bind renewable deployment to territorial cohesion, industrial strategy and community benefit.

For other regions conducting regional energy economy planning, the Basque approach demonstrates the value of:

- Start with a clear strategy hierarchy: The Basque approach sequences a 2030 energy strategy (3E2030/E-2030), a long-term climate-energy legal framework (LTECC) and territorial sectoral spatial plans (TSP-RE), so that spatial decisions always sit inside quantified transition pathways.

- Use governing and policy structures that connect tiers and sectors: The Basque E32030/TSP-RE/LTECC structure integrates state and regional departments, provincial councils and municipalities, with the legal measures, regional energy strategy, and sets common objectives and the territorial plan providing a shared spatial reference.

- Hard-wire local economic development into energy siting: In the Basque case, the energy strategy and LTECC explicitly link renewables to job creation and local value added, and the TSP-RE is used to steer projects toward areas where socio-economic benefits, grid conditions and resource potential overlap.

Further Resources

Basque Government. (2024). **Aprobada la versión inicial del Plan Territorial Sectorial de Energías Renovables** [Initial Version of the Renewable Energy Sectoral Territorial Plan Approved]

All associated planning docs for the TSP-RE

Basque Territory Overview Map

TSP-RE Suitability Map

Framework V:
The South African Renewable Energy Masterplan, Renewable Energy Development Zones and Special Economic Zones

How industrialization and localization are supporting South Africa's just low-carbon energy transition.

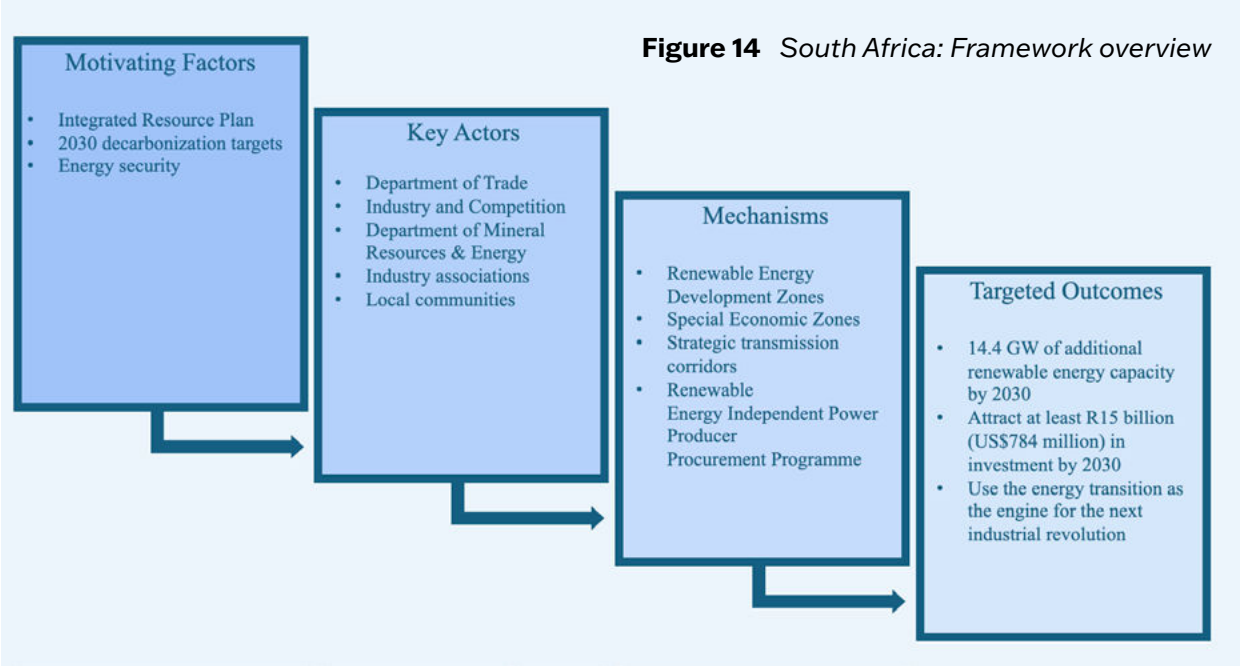


Figure 14 *South Africa: Framework overview*

Table 12 *South Africa: Summary of plans*

Acronyms

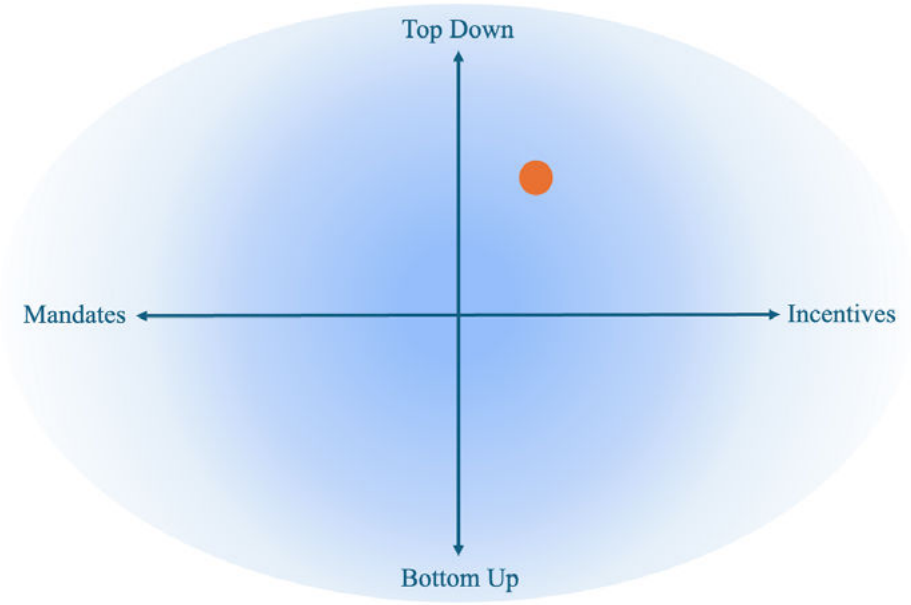
ACRONYM	FULL NAME (ENGLISH)	NOTES / ROLE IN THE FRAMEWORK
SAREM	South African Renewable Energy Masterplan	National industrial and energy strategy that sets renewable capacity targets and localization goals for manufacturing components such as solar panels, inverters, towers, blades, and batteries.
REDZ	Renewable Energy Development Zone	Designated area where large-scale wind and solar projects are concentrated; environmental approvals are streamlined and investment is prioritized to support just transition "hotspots."
SEZ	Special Economic Zone	Area designated to drive industrial development, offering tax incentives, infrastructure support, and streamlined regulation, often linked to manufacturing for renewable energy value chains.

ACRONYM	FULL NAME (ENGLISH)	NOTES / ROLE IN THE FRAMEWORK
IRP	Integrated Resource Plan	National electricity planning document that sets out South Africa's future generation mix and underpins capacity targets used in SAREM.
DTIC	Department of Trade, Industry and Competition	National department responsible for industrial policy and for overseeing Special Economic Zones in coordination with SAREM.

Framework Summary

The South African Renewable Energy Masterplan (SAREM) is a centralized, top-down action-oriented industrialization plan for renewable energy and storage value chains, designed with a timeline for development until 2030. The plan is aligned with South Africa's National Development Plan and just transition objectives, with its primary aim to leverage the largescale deployment of wind, solar PV and storage to create decent jobs, deepen local manufacturing and support low carbon, inclusive economic growth. The SAREM is one of a suite of sectoral masterplans led by the Department of Trade, Industry and Competition (the DTIC) under the "reimagined industrial strategy" but tailored to the electricity transition and associated supply chains. It explicitly links industrial policy to spatial and social priorities, including directing new investment into "just transition hotspots" where coal and carbon-intensive industry related employment is likely to decline.

Figure 15 *Governance mode: South Africa*



While planning for the SAREM is centralized, its implementation is decentralized through the establishment of both renewable energy development zones (REDZ) and special economic zones (SEZ) (Wu et al., 2015). These spatial designations exist as tools which support the objectives of the SAREM as they serve to explicitly align generation zones with industrial zones, a significant focus of the framework. In doing so, they streamline the permitting process for energy development in each region while actively combining national energy-system targets with spatial zoning, local industrial-value-chain development, socio-economic inclusion, and infrastructure alignment. Community engagement and just transitions are also embedded in the design, though their practical delivery (participation, local benefit, equity), and the localization of each aspect of the SAREM being seen as the key aspect of ensuring the plan supports a just transition.

Background

The South African economy is characterized by deeply entrenched inequalities, a dual economy divided between a small high-skill, high-productivity segment and a large low-skill, low-productivity segment, along with an infrastructure deficit and the spatial and economic legacies of apartheid that created segregated urban geographies and uneven access to economic opportunity (Tamasiga & Mateane, 2025). In addition to this, the South African government has identified urgent need for greater energy security and a broader push for industrial and economic transformation in the context of global climate commitments (GreenCape, 2024)

The South African Renewable Energy Masterplan (SAREM) (published and finalized in March 2025) is designed as a spatial planning tool that will be used to align South Africa's national energy and economic priorities with accelerated Renewable Energy Development, to capitalize on the coming energy transition. The SAREM is explicitly framed as a tool to support South Africa's just energy transition by locating these new economic opportunities in regions negatively affected by the decline of coal and other carbon intensive activities, and the plan calls for prioritising investment in these "transition hotspots", aligning public procurement and industrial incentives with spatial development goals (SA Dept of Mineral Resources & Energy, 2023; sanews.gov.za, 2016; Tamasiga & Mateane, 2025). SAREM represents an opportunity to identify jobs and investment in the renewable energy sector, as well as to articulate how job creation and investment might be optimized and maximized if various impediments were removed, or new supportive policy was designed for a low-carbon energy economy (GreenCape, 2024; SA Dept of Mineral Resources & Energy, 2023).

By doing so, the South African Renewable Energy Master Plan (SAREM) is a declaration of intent to use the energy transition as the engine for the country's next industrial revolution. Its focus on industrialization, localization, inclusive development, and job creation marks a profound shift from a reactive, crisis-driven approach to a proactive, strategic one. It acknowledges that the transition is about fundamentally transforming our economy and society, in addition to changing how power is generated (Deane, 2025).

Framework Factors

What is it?

The South African Renewable Energy Masterplan or "SAREM" is a comprehensive framework designed to facilitate the inclusive industrialization of the South African renewable energy value chain and battery storage, in support of job creation, economic competitiveness, and low-carbon, reliable and affordable energy supply. SAREM sets a national-level framework (vision, pillars, objectives) aligned with the national development plan, the integrated resource plan, localization ambitions, jobs/skills, and industrial value chain (SA Dept of Mineral Resources & Energy, 2023). SAREM's overarching vision is to achieve a well-developed renewable energy and storage value chain that enables a transformed industry and inclusive industrialization. It is underpinned by the localization of key inputs, technologies and systems, based on "the use of actual or anticipated imports to indicate when demand would warrant local production, an explicit emphasis on local production of inputs for export industries and infrastructure as well as final consumer goods, and a focus on restructuring public and private procurement to promote local production, rather than relying primarily on tariff protection (Makgetla, 2023).

The plan sets out a target of 14,4 GW of additional renewable energy capacity by 2030, including 9 GW of solar PV and 5,4 GW of wind, each aligned with the Integrated Resource Plan (IRP). It also outlines the development of local manufacturing capacity for components such as solar panels, inverters, wind turbine towers, blades and batteries, with a goal of creating over 48 000 direct and indirect jobs (Energize, 2025).

Supporting the implementation of the SAREM exists two types of spatial/zoning designation, the Renewable Energy Development Zones or "REDZ" and Special Economic Zones or "SEZ". Both kinds of region "designation" pre-date the SAREM within the national South African planning framework, however they are both important tools used to coordinate the localization of industry through the use of procurement and incentives as they not only identify areas where largescale wind and solar (often with equity stakes for local municipalities and trusts), but streamline approval process, lower environmental risk, and can therefore encourage development at an accelerated rate (SA Dept of Mineral Resources & Energy, 2023; Wu et al., 2015).

Table 13 *Role of REDZ and SEZ in relation to the SAREM*

AREA	PURPOSE & FOCUS	GOVERNANCE & INCENTIVES	ROLE IN SAREM
REDZ	Concentrate renewable energy generation (wind, solar) in priority locations, leveraging existing grid capacity and just transition hotspots	Designated by national policy for accelerated permitting, environmental streamlining, and investment focus for large-scale renewable projects	Enables rapid rollout of renewables and aligns spatial energy planning with social and economic development
SEZ	Drive industrial development and targeted economic activity, often including manufacturing (not limited to renewables)	Governed by SEZ Act and DTIC, offers special arrangements: tax incentives, infrastructure, regulatory support, streamlined government services	Supports local manufacturing (e.g., renewable components), technology transfer, exports, and jobs

Sources: *(DTIC, 2023; SA Dept of Mineral Resources & Energy, 2023; sanews.gov.za, 2016)*

The combination of the SAREM, REDZ, and SEZ provides the South African Government, along with planners, industry proponents, and communities the ability to build renewables in places that make sense spatially, align with grid and land use, connect to manufacturing/value chains, and deliver developmental outcomes. The spatial focus connecting SAREM to other planning instruments, including REDZs and strategic transmission corridors, reflects a key takeaway from the framework as it explicitly aims to translate high-level just transition commitments from the national government into place based industrial outcomes (Oladejo et al., 2025; SA Dept of Mineral Resources & Energy, 2023; Tamasiga & Mateane, 2025).

Governance and stakeholder structures

SAREM is led by the national government, in particular the Department of Electricity and Energy and Department of Trade, Industry and Competition (DTIC) in collaboration with industry-associations (e.g., South African Wind Energy Association) and labor organizations (SA Dept of Mineral Resources & Energy, 2023). For the REDZ, regulatory governance occurs via the environmental regulator which reviewed each of the zones and aligned environmental authorization procedures. The authorization process for zones is streamlined (reduced from full EIA to Basic Assessment for zones) to speed up project deployment (SA Dept of Mineral Resources & Energy, 2023).

The SAREM sits within the national masterplan process overseen by the DTIC, but its political oversight is chaired by the Minister of Mineral Resources and Energy through an Executive Oversight Committee (EOC). This structure reflects the need to integrate industrial policy with energy planning and procurement, given that renewable energy deployment (and thus demand for local manufacturing) is largely driven by the electricity sector (SA Dept of Mineral Resources & Energy, 2023). The governance within the SAREM model follows a social compact approach involving government, business and labour, with sector stakeholders engaged in negotiation and implementation forums. As the full roll-out of the SAREM is currently in development, its implementation is expected to be driven through working groups on demand, industrialisation, inclusion and

capabilities, linked to monitoring frameworks and periodic reviews reported back to Cabinet (SA Dept of Mineral Resources & Energy, 2023). The roles outlined throughout the SAREM in Table 7

Table 14 *SAREM Governance Structure and Stakeholders*

ACTOR/BODY	RESPONSIBILITIES	ROLES IN SAREM
Department of Mineral Resources and Energy (DMRE)	Strategic oversight; policy direction; chairing Executive Oversight Committee (EOC)	Lead SAREM implementation; coordinate with other ministries; guide energy policy and REDZ designation
Department of Trade, Industry and Competition (DTIC)	Industrial policy; secretariat support; stakeholder coordination	Align SAREM with industrial strategy; monitor local content; drive economic and manufacturing initiatives
Local Governments & Municipalities	Community consultation; project permitting; liaising with residents	Coordinate REDZ activities; ensure local participation and benefit sharing
Industry partners (manufacturers, developers, IPPs)	Invest, manufacture, develop projects; comply with local content and transformation criteria	Scale up renewables value chain; invest in infrastructure; help deliver local economic development
Labour & Social Partners	Advocacy; participation in EOC and PSC; skills development	Ensure inclusive policy formation; promote employment and skills in just transition regions
Local Communities	Stakeholder consultation; direct involvement in REDZ	Provide input through forums; participate in jobs & enterprise; help shape project outcomes

Sources: *(Central News, 2025; Department of Environmental Affairs (DEA), 2016; Jardim, 2025; SA Dept of Mineral Resources & Energy, 2023; Tamasiga & Mateane, 2025).*

Indigenous engagement

The SAREM explicitly emphasizes that historically marginalized, black, and rural communities are priority sites for renewable rollout and development. Highlighting this, in the SA Cabinet's approval of the SARAM document their statement includes that "SAREM identify rural and historically marginalized areas as priority sites for project development…with a focus on combining energy access with local economic participation through community ownership models and enterprise development." (Energize, 2025). In addition, the REDZ and REZ selection process includes explicit socio-economic criteria (including need, local authority support, local community employment) when selecting the zones (CSIR, 2019). As South Africa already has a pre-existing just transition framework to ensure that the shift to a low-carbon economy is fair, and does not leave workers, communities or regions behind, the SAREM masterplan aligns with this plan and builds on it (Presidential Climate Commission, 2022).

To support this further, the SAREM will also make use of South Africa's pre-existing Renewable Energy Independent Power Producer Procurement Programme or "REI4P". Launched in 2011, REI4P has played a key role in turning just transition goals into action, and has contributed to building a domestic renewable energy industry while promoting localization and economic empowerment (Tamasiga & Mateane, 2025). The SAREM explicitly backs the use of the "REI4P" to support Black-owned companies and small-scale and community-based initiatives, especially in places affected by the looming loss of jobs in the coal industry by encouraging the participation of small, medium and Black-owned enterprises (with 50 per cent or more shareholding and management control) in renewable energy supply chains (SA Dept of Mineral Resources & Energy, 2023).

Community engagement

The SAREM builds on the South African Electricity Regulation Amendment Act 38 of 2024 (which explicitly introduced new opportunities for municipalities within the South African energy transition), by explicitly integrating local community engagement, particularly in designated Renewable Energy Development Zones (REDZ), where extensive consultation and economic participation are required (SA Dept of Mineral Resources & Energy, 2023). Here, communities are represented through structured stakeholder engagement, including public forums, feedback cycles, and direct involvement with local government representatives in the governance process (SA Dept of Mineral Resources & Energy, 2023; Tamasiga & Mateane, 2025).

SAREM will additionally prioritize local hiring, skills development, and support for businesses, small enterprises (paying particular attention to those which are black-owned), and those impacted by coal sector restructuring, with sustained efforts to build capabilities among women and youth. In addition, considerations for community concerns and proposals which inform both the location and the operational details of industrial development, ensuring that REDZ governance responds to local needs and supports inclusive economic development (SA Dept of Mineral Resources & Energy, 2023; Tamasiga & Mateane, 2025). In a statement from the Ministry of Electricity and Energy, they emphasize a particular focus on the "upskilling and active participation of young people and women." This consideration within SAREM is a direct response to the socio-economic risks of the transition, which has the potential to displace up to 200,000 individuals directly employed in the coal industry (Deane, 2025).

Integration with economic development

The SAREM masterplan explicitly aims to attract at least R15 billion (US$784 million) in investment by 2030 and train "green workers" for employment in a projected 25,000 direct jobs because of the framework. These roles range from factory work and logistics to engineering and construction (SA Dept of Mineral Resources & Energy, 2023). The plan is designed as an industrial and trade strategy that integrates renewable energy expansion with broader economic development, especially manufacturing, jobs and regional diversification. Economic integration within the plan rests on building local value chains around solar, wind and battery storage, and linking these to national industrial, trade and just transition agendas (SA Dept of Mineral Resources & Energy, 2023).

While the plan does not create an entirely new set of economic development instruments, it serves to bundle and target a suite of industrial, trade, investment and skills policies specifically at renewable energy and battery value chains. This is intended to shift regional development from ad hoc localisation to a coordinated industrial strategy linked to the RE build-out (Deane, 2025; SA Dept of Mineral Resources & Energy, 2023), including:

- The introduction or tightening of localisation requirements and local content targets in procurement for solar, wind and storage projects, backed by clearer designation of components for local manufacture.
- Support for cluster development and industrial hubs (including potential special economic zones) focused on renewable components, with coordinated infrastructure, permitting and support services.
- Targeted incentives for manufacturing (e.g. tax allowances, grants, concessional finance) aimed at priority components such as PV modules, mounting structures, towers, blades, inverters and batteries.
- Adjustment of tariff and trade policy to protect and nurture nascent local manufacturing in selected components while maintaining competitive project costs.
- Long-term, transparent procurement pipelines (e.g. multi-year bid windows and embedded generation signals) to give manufacturers demand certainty.
- Use of blended finance from development finance institutions and public funds to de-risk private investment in new plants and technologies.

To support the SAREM, the designation of REDZ allows generation zones to be aligned with manufacturing hubs / industrial parks / special economic zones (SEZs). For example, the plan refers to “an emphasis on increasing industrial hubs and special economic zones focused on renewable energy manufacturing and services” in SAREM (SA Dept of Mineral Resources & Energy, 2023). The link between SAREM’s industrialization/localization mandate and REDZ’s spatial designation means manufacturing hubs, component supply, services, logistics can be co-located or aligned with generation zones. For example: “industrial hubs and special economic zones focused on renewable energy manufacturing and services” in SAREM (SA Dept of Mineral Resources & Energy, 2023).

Technology and resource considerations

One of the primary targets in SAREM is the re-localization of associated manufacturing industries for renewable energy infrastructure. This includes solar panels, inverters, wind towers, blades, and batteries, each of which will play a pivotal role in the SAREM’s ability to deliver on both the South African national climate targets and support local economic development goals (SA Dept of Mineral Resources & Energy, 2023).

In regard to the technology that the SAREM outlines as its priority, specific emphasis has been placed on the industrial scale development of Solar, Wind, and Battery storage as the industries which make up the proposed energy mix for the countries energy transition (SA Dept of Mineral Resources & Energy, 2023). The focus on these technologies is in direct response to studies conducted on the most appropriate energy sources for the country.

Financing and implementation mechanisms

SAREM uses a comprehensive set of financing and implementation mechanisms to encourage project development and support local energy initiatives in South Africa. These are designed to attract investment, support local manufacturing, de-risk projects, and ensure broad participation. The SAREM looks to provide clear annual targets for renewable energy procurement and industrial development, creating market confidence for investors and developers. Table 8 outlines the financing mechanisms.

Table 15 *SAREM mechanisms for financing*

MECHANISM	DESCRIPTION	ROLE IN PROJECT AND LOCAL DEVELOPMENT
Policy & Market Certainty	Annual targets for procurement and industrial growth, stable frameworks	Attracts investment, provides developer confidence, signals long-term commitment
Tax Incentives & Special Economic Zones	Tax breaks and Special Economic Zones for renewables and storage	Reduces investor risk, supports local manufacturing, fosters hubs in strategic areas
Development Finance Institution (DFI) Support	Concessional loans, equity, and guarantees from South African DFIs	De-risks projects, expands access to capital for developers and local businesses
Public Funding	Green incentives and transformation funds via Reserve Bank and other channels	Supports inclusive participation, local ownership, and enterprise development
Local Content Requirements	Mandatory thresholds for locally made components	Grows domestic industry, secures jobs, and enables value chain expansion
Preferential Procurement	Schemes with community, ownership, content, and employment criteria	Maximizes local benefits, drives skills, jobs, and transformation in REDZ
Employee Ownership & Transformation Funds	Ownership and financial pooling mechanisms for inclusion	Enables community and worker benefit from energy projects, supports just transition

MECHANISM	DESCRIPTION	ROLE IN PROJECT AND LOCAL DEVELOPMENT
Public-Private Partnerships	Stable policy and financial support for mixed investment models	Leverages private investment, boosts infrastructure, funds community energy

Sources: *(IEJ, 2022; Jardim, 2025; SA Dept of Mineral Resources & Energy, 2023; sanews.gov.za, 2016)*

Case: Coega Green Amonia and the Coega Special Economic Zone (SEZ)

Figure 16 *Regional map: Nelson Mandela Bay/Eastern Cape, South Africa*

The flagship project, developed by Hive Hydrogen South Africa (a joint venture between Hive Energy UK and BuiltAfrica), called “Coega Green Ammonia” is set to produce over one million tonnes of green ammonia annually, primarily for export markets in Europe and Asia. The Eastern Cape hydrogen project is an initiative set to become operational in South Africa’s Nelson Mandela Bay by 2029. Focused on large-scale green hydrogen and green ammonia production using renewable energy, with its core facilities, including local development and manufacturing, being in the Coega Special Economic Zone (SEZ). The designation of a SEZ here acts as a strategic economic hub, providing the vital infrastructure and logistics for exporting green hydrogen products globally (HTW, 2025).

The power for the project comes from more than 3.6 GW of dedicated renewables (wind and solar) all linked to major new generation and transmission infrastructure being developed locally in the region. This also includes the largest ever Solar PV Cluster to date in South Africa (~1430MW) which reached its development phase in June of 2025 and will supply 40% of the plant’s power requirements (Evans, 2025). The hydrogen initiative features a 1.2 GW electrolyser, integrated desalination plants, bulk ammonia storage, and a terminal leveraging the deep-water harbour at Coega SEZ (HTW, 2025).

The project is expected to avoid 2.6 million tonnes of CO_2e emissions annually by displacing grey ammonia and will enable up to 20 GW of additional renewable energy to connect to the national grid. It is also expected to create over 20,000 jobs across the Eastern, Western and Northern Cape during construction and operation, while advancing skills development and infrastructure investment in the region (HTW, 2025).

Framework Takeaways

South Africa's SAREM, together with Renewable Energy Development Zones (REDZ) and energy oriented Special Economic Zones (SEZs), is a strong example of how to connect spatial energy planning with industrial policy and a just transition agenda. Taken together, the SAREM–REDZ–SEZ approach shows how an integrated spatial energy plan can simultaneously steer where renewables are built, where economic value chains grow, and where social and economic benefits of the transition are targeted.

For other regions considering their own regional economic transitions, key best practices that can be taken from the South African case include:

- Integrating industrial and economic policy with spatial energy planning: using a masterplan like SAREM to tie renewable buildout to local manufacturing, skills and supplier development, rather than treating power plants and factories as separate conversations.
- Using analytically defined development zones: applying transparent "pull" and "push" mapping (resources, grid, land, biodiversity, communities) to designate zones like REDZ that guide both project developers and grid planners and then aligning these with long-term resource plans (e.g. IRP) and just transition priorities.
- Leveraging SEZs and industrial hubs: clustering incentives, permitting support, and infrastructure inside SEZs and hub areas linked to the zones, so investors see a complete ecosystem (land, ports, skills, testing, trade facilitation) rather than isolated sites.
- Embedding just transition and regional development: explicitly directing manufacturing, green hydrogen initiatives and new renewable projects toward coal regions and other vulnerable areas, using the REDZ–SEZ framework to channel public and private capital into diversified local economies.

Further Resources

SA Dept of Mineral Resources & Energy. (2023). **South African Renewable Energy Masterplan** *(SAREM)*.

Republic of South Africa Presidencey. (2023). **South Africa Just Energy Transition Implementation Plan** *2023–2027*.

Emerging Framework I:
Québec's Integrated Energy Resources Management Plan

Focusing on green transportation, grid connections, and economic security in Québec

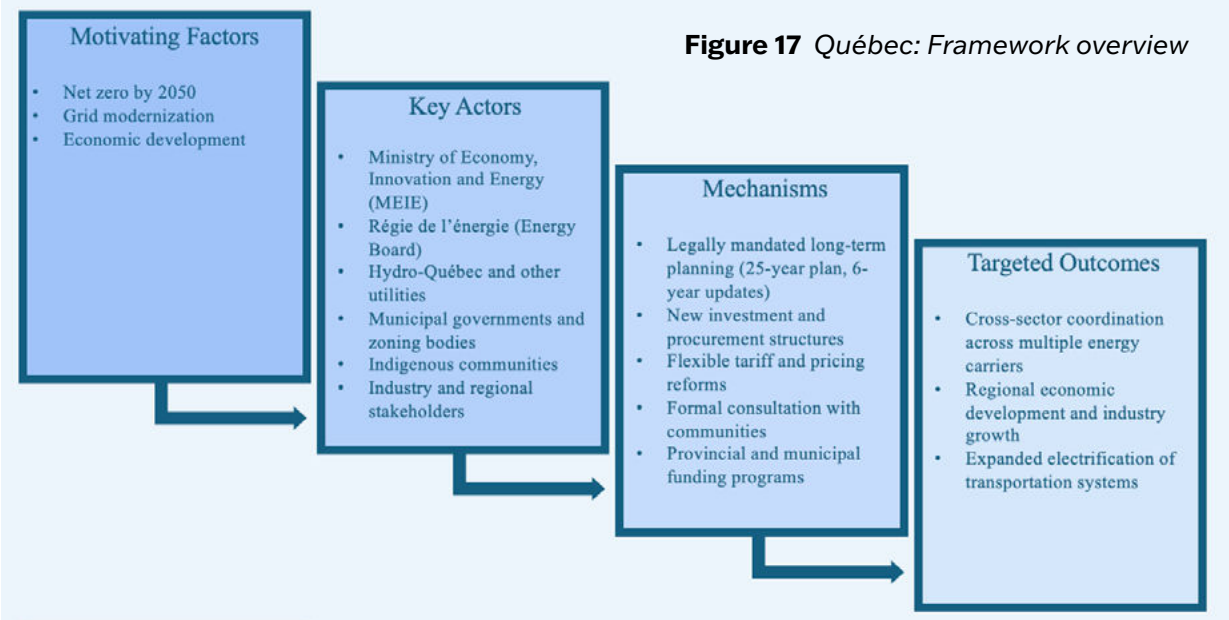


Figure 17 *Québec: Framework overview*

Table 16 *Québec: Summary of plans*

Acronyms

ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
PGIRE	Integrated Energy Resources Management Plan	*Plan de gestion intégrée des ressources énergétiques;* Québec's legislatively mandated, province-wide energy planning instrument established under L.Q. 2025, ch. 24. Refers simultaneously to the structured five-stage planning process and the formal plan document it produces. Covers all major energy carriers (electricity, renewable natural gas, hydrogen, bioenergy, petroleum products, and heat) across all sectors over a 25-year horizon, renewed every six years with a mandatory three-year progress review.
MEIE	Ministry of Economy, Innovation and Energy	*Ministère de l'Économie, de l'Innovation et de l'Énergie*; lead provincial ministry responsible for developing the strategic energy plan and coordinating stakeholder engagement.

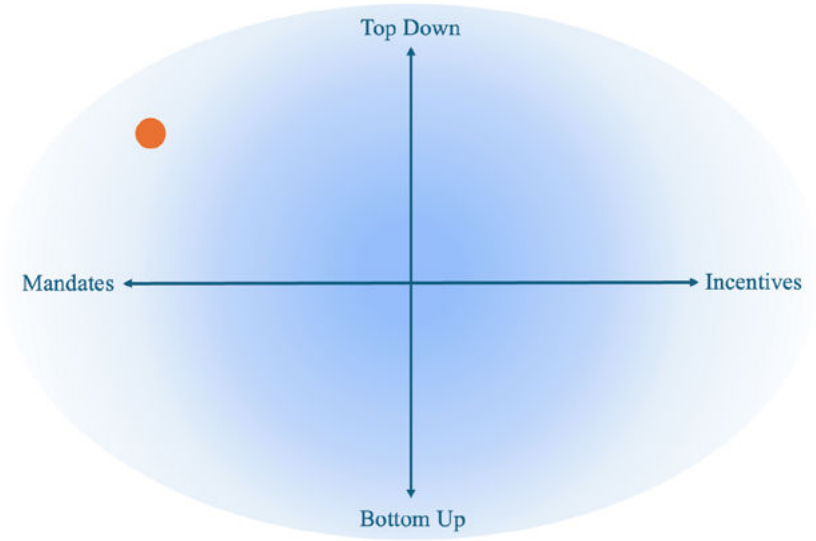
ACRONYM	FULL NAME (ENGLISH)	ORIGINAL / FORMAL NAME AND NOTES
Régie de l'énergie	Energy Board (regulator)	Québec's independent energy regulator. Within the PGIRE process, the Régie provides a mandatory independent advisory opinion on the plan before finalisation; thereafter, its regulatory decisions on tariffs and approvals must conform to PGIRE orientations
Hydro-Québec	Hydro-Québec (provincial utility)	Vertically integrated public utility that owns and operates most of Québec's generation and transmission system and is a key actor within PGIRE.

Framework Summary

The *Plan de gestion intégrée des ressources énergétiques* (PGIRE), or Integrated Energy Resources Management Plan, is a legally mandated provincial planning framework designed to coordinate Québec's energy system across all major carriers and sectors in response to the dual imperatives of energy transition and economic development. Although a provision for formal integrated resource planning (planification intégrée des ressources) was embedded in the Loi sur la Régie de l'énergie as early as 1997, the enabling regulation was never adopted. The PGIRE operationalizes this long-dormant legislative intent, but through a substantially stronger institutional design: it is led by the Ministry of Economy, Innovation and Energy (MEIE) rather than the utility, covers all major energy carriers — electricity, renewable natural gas, hydrogen, bioenergy, petroleum products, and heat — and is legally binding on both energy distributors and the regulator. Unlike its predecessors, it carries a mandatory six-year renewal cycle, a three-year progress review, and a formal accountability reporting requirement, making it the first Québec energy planning instrument with both statutory force and a systematic update mechanism.

The PGIRE was established through Bill 69 — the Act to Ensure the Responsible Governance of Energy Resources (*Loi assurant la gouvernance responsable des ressources énergétiques et modifiant diverses dispositions législatives*, L.Q. 2025, ch. 24) — adopted and assented to by the Québec National Assembly on June 7, 2025 (Gouvernement du Québec, 2024a). This legislation amended the *Loi sur le ministère de l'Économie, de l'Innovation et de l'Énergie* to formally assign the minister responsibility for establishing the PGIRE. Bill 69 establishes a hard statutory deadline requiring the minister to submit the first PGIRE to Cabinet for approval by April 1, 2026. Québec's PGIRE is categorized here as an emerging framework not because the plan lacks legislative foundation — Bill 69 provides a robust statutory basis — but because implementation mechanisms, sub-provincial coordination mechanisms, and real-world outcomes are still being developed and have not yet been tested in practice.

Figure 18 *Governance mode: Québec*



The PGIRE framework is designed to plan electricity, gas, biomass and future vectors such as hydrogen together over a 25-year horizon, aligning with Hydro-Québec's Action Plan 2035 and the province's 2050 net-zero target. By taking a "whole-system" view, this plan aims to optimise resources across sectors, rather than planning power, fuels, buildings and transport in separate silos (Gouvernement du Québec, 2026; Hydro Québec, 2023). The framework will establish a strong, centralized strategic direction through the Ministry of Economy, Innovation and Energy or "MEIE" while delegating regulatory and operational implementation to independent and state-owned entities (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026). It will create a comprehensive, multi-fuel, and multi-sectoral planning mandate.

As the PGIRE's success will be heavily dependent on coordination between multiple stakeholders, and the ability to adapt to rapidly evolving technologies and markets, the framework's top-down nature may also face challenges in ensuring deep community buy-in and adapting to unique regional needs across the vast province (Gouvernement du Québec, 2025b, 2026). To support this, the MEIE has stated that performance and monitoring indicators will be implemented to measure the achievement of the plan's objectives and targets. These indicators (while not yet finalized) will likely cover several dimensions (economic, social, and environmental) and will be designed to be measurable, realistic, and time bound. The MEIE also state that these indicators will be central to a process of collective learning and responsible governance. The presentation of these monitoring results will allow for a transparent assessment of the PGIRE against the objectives set out in the plan. Accountability, under the responsibility of the MEIE, will be carried out in collaboration with all stakeholders involved in energy planning, and these results will provide lessons learned for future updates to this plan (Gouvernement du Québec, 2026).

The PGIRE framework will also be designed to align with Québec's *Plan pour une économie verte* (PEV) 2030—Plan for a Green Economy—and the province's legislated GHG reduction targets. The PEV 2030 is Québec's principal climate policy framework, establishing a large-scale electrification and energy efficiency programme across all sectors of the economy (Gouvernement du Québec, 2020; Hydro Québec, 2023). This aligns with the province's broader target to achieve carbon neutrality by 2050 — defined as net-zero GHG emissions through a combination of deep emission reductions and carbon removal for residual emissions (Gouvernement du Québec, 2026).

Background

Québec currently faces several challenges as the province seeks to shift toward decarbonization including the need to modernize grid infrastructure, improve reliability, integrate growing renewable energy sources, and address increasing electricity demand in sectors such as transportation and industry. With a provincial goal to decarbonize Québec's economy by 2050, (given that approximately 50% of energy consumed still comes from fossil fuels) (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026; Hydro Québec, 2023), the potential opportunities for Québec's energy transition are equally abundant. As the most electrified jurisdiction in North America, Québec has a strong foundation in its vast hydroelectric resources and its large electrified manufacturing base. This expertise positions the province to lead in clean energy exports. However, the more significant infrastructure challenge is the investment required to connect remote generation sites to industrial and population centres via expanded transmission networks (Gouvernement du Québec, 2026).

Achieving a sustainable, electrified economy requires a robust and flexible planning approach that aligns energy supply, infrastructure, and emerging demands. Recognizing these dynamics, Québec's Ministry of Economy, Innovation and Energy (Ministère de l'Économie, de l'Innovation et de l'Énergie du Québec (MEIE) has initiated work on an Integrated Energy Resources Management Plan (PGIRE; *Plan de gestion intégré des ressources énergétiques*). This integrated plan aims to navigate these challenges and opportunities effectively, engaging a diverse set of stakeholders to ensure its success and the provinces energy goals (Gouvernement du Québec, 2026).

Framework Factors

What is it?

Québec's PGIRE framework proposes a comprehensive planning approach led by Québec's Ministry of Economy, Innovation and Energy to modernize the province's energy system amid accelerating electrification and the drive for decarbonization. It offers a roadmap to optimize energy resources, balance supply and demand, and create a sustainable, resilient future energy system for Québec (Gouvernement du Québec, 2026). By explicitly combining comprehensive energy system modelling with iterative opportunities for public consultation and Indigenous community engagement to guide development, the plan seeks to address challenges such as grid modernization,

improved energy reliability, integrating renewable energy sources, and meeting growing electricity demands across sectors (Gouvernement du Québec, 2026). With Québec's strong foundation in hydroelectric power and electrified manufacturing base, the PGIRE also will aim to leverage these strengths while overcoming constraints like transmission infrastructure investment to connect remote generation load centres (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2025a, 2026).

This provincial strategic framework is designed to coordinate the development, supply, and demand of all energy carriers for electricity, renewable natural gas, hydrogen, and thermal energy. This plan spans multiple sectors, including transportation, buildings, and industry. It aims to guide the energy transition in an orderly, predictable, and sustainable manner (Gouvernement du Québec, 2025a, 2026). By integrating multiple energy carriers across sectors like transportation, buildings, and industry, PGIRE enables efficient, resilient, and sustainable energy delivery.

In terms of its spatial scope, the PGIRE operates primarily at the provincial scale, establishing a long-term energy trajectory and binding orientations for energy distributors and the regulatory body. While the plan does not formally integrate municipal land-use plans or zoning frameworks, its scenario analysis accounts for territorial dimensions such as the land footprint of renewable installations, the costs of expanding the transmission network to connect remote generation sites to population centres, and the specific challenges of supplying autonomous networks in northern and remote communities. The plan thereby establishes the provincial strategic framework within which regional and local energy and land-use decisions will need to align, even if the mechanisms for that downward coordination remain to be developed in subsequent implementation steps. It supports the acceleration of renewable energy development by fostering a more streamlined and supportive environment for clean energy investments (Gouvernement du Québec, 2025a, 2026).

Governance and stakeholder structures

As the PGIRE is currently being drafted, information from the Ministry of Economy, Innovation and Energy (*Ministère de l'Économie, de l'Innovation et de l'Énergie,* MEIE) highlight it as the lead authority within the plan. The plan takes a top-down approach, requiring consultation with municipalities, Indigenous communities, industry groups, energy corporations (like Hydro-Québec), and the public during the development of the final plan (Gouvernement du Québec, 2025a, 2026). The *Régie de l'énergie* (Energy Board) acts as an independent regulator, ensuring compliance, setting tariffs, and authorizing projects. This system aims to result in a government-led process that seeks to balance provincial energy transition goals with local economic and social implications (Gouvernement du Québec, 2026)

The PGIRE will also seek to explicitly promote collaboration among a broad array of stakeholders, including government bodies, utilities like Hydro-Québec, grid operators, manufacturers, research institutions, local governments, Indigenous communities, and

civil society groups. This ensures that the planning process is inclusive, balanced, and reflective of diverse expertise and community needs (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026). The process results in a comprehensive energy system roadmap, with periodic updates to adapt to public feedback, technological advances, market changes, and policy shifts, thus maintaining transparency and public accountability (Gouvernement du Québec, 2026). This collective effort ensures that expertise from various domains shapes a resilient and inclusive energy system.

Indigenous engagement

The public documentation for PGIRE identifies Indigenous communities as key stakeholders whose rights, priorities, and land use considerations must be advocated for within the planning process (Gouvernement du Québec, 2025a, 2025b, 2026). Initial efforts to accomplish this included a Québec-First Nations table that was established to provide a forum for technical exchanges and three formal meetings have been held since its inception. Indigenous communities were also invited to participate at each stop of the MEIE's "Energy Vision Tour" which made 14 stops in 14 major regions across Québec (Gouvernement du Québec, 2025a, 2026).

Community engagement

The Ministry of Economy, Innovation and Energy (MEIE) will employ several stakeholder engagement methods before and during the development of the strategic energy plan. The MEIE, as the lead body, is responsible for continued engagement with a diverse set of stakeholders, including municipalities, local communities, and advocacy groups, during the development of the PGIRE (Gouvernement du Québec, 2025a, 2026). Initial community engagement efforts took place on the MEIE Energy Vision Tour which brought together a total of 489 participants across the 14 stops and facilitated discussions with various stakeholders prior to the development of the PGIRE. It provided an opportunity to hear from the target groups about their vision for Québec's energy planning, including objectives, future energy choices, priorities, and expectations for integrated planning. Future pathways for continued community engagement will be made available in the final plan, but have yet to be disclosed (Gouvernement du Québec, 2025a, 2026)

Integration with economic development

The PGIRE framework emphasizes the importance of economic development alongside energy planning. By coordinating with local governments and communities, the PGIRE seeks to maximize local benefits such as job creation, industrial growth in clean energy sectors, and the development of a robust supply chain for renewable technologies. This integrated approach ensures that energy system evolution supports broader socio-economic goals while advancing Québec's climate and clean energy targets (Gouvernement du Québec, 2026)

The PGIRE will be explicitly designed to promote the energy and economic development of Québec and its regions and will aim to tie energy infrastructure directly to local jobs and value chains (Gouvernement du Québec, 2024b). This plan enables direct electricity

distribution from a renewable producer to a single, adjacent industrial consumer, aiming to accelerate project development in remote regions and create anchors for local economic activity. The framework leverages Québec's existing strengths, including its extensive hydropower infrastructure and electrified manufacturing base, positioning the province to lead in clean energy innovation and exports. By guiding investment into renewables, the PGIRE is intrinsically linked to long-term economic diversification and stability (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026; Hydro Québec, 2023).

Technology and resource considerations

The PGIRE explicitly considers cross-sectoral integration, such as using electricity for transportation and heating, and leveraging energy storage and smart grid technologies for grid balancing (Gouvernement du Québec, 2025a, 2026; Quest, 2025). The PGIRE also seeks to leverage emerging technologies that drive the energy transition such as energy storage, electric vehicles, wind, and solar generation. For utilities and independent power producers, these tools enable more accurate demand and renewable generation forecasting, optimize hydroelectric and other generation systems, improve grid balancing, and facilitate early identification of potential failures (Gouvernement du Québec, 2026).

Financing and implementation mechanisms

In the context of rapid evolution of the energy picture, Bill 69 modifies the process of setting distribution and transmission tariffs in order to offer more predictability and flexibility. In particular, amendments are intended to reduce the cycle of setting electricity rates by providing for a tariff revision every three years rather than five years by the Régie de l'énergie while allowing Hydro-Québec to request the latter, at any time, to fix or modify a tariff or conditions of service (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024). The Régie can also authorize Hydro-Québec to use procurement methods beyond calls for tenders (e.g., over-the-counter contracts, self-development) to accelerate project deployment (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026; Quest, 2025). For each of the years of this three-year period, tariffs will now be set by the Energy Board based on the revenues required by the Crown corporation. The main components considered to establish the required income include:

- The cost of supplies (purchases of heritage and post-state electricity);
- Electricity transmission costs for Québec customers;
- Expenditure related to distribution (salaries, depreciation, etc.).

In addition to this, in order to protect domestic consumers, the Act provides that the government will be able to implement an assistance program or establish a maximum rate to limit the increase in rates applicable to domestic consumers (Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), 2024; Gouvernement du Québec, 2026; Quest, 2025)

- A Legally mandated 25-year plan, updated every six years, providing long-term predictability.
- Removes the retail price floor for gasoline and diesel to spur competition and introduces new, flexible pricing and cost-sharing models for renewable natural gas to encourage its production and consumption.
- Enables new arrangements like direct "wire-to-wire" sales between a renewable generator and an adjacent customer as well as prosumsership, accelerating local projects.

Lastly, within Québec, additional pathways for municipal and community funding are also available to support the implementation of projects at regional and local scales (GMF, 2025).

- Funding from the Green Municipal Fund (GMF) supports feasibility studies (up to 50-80% of costs) and capital construction (up to 80% of costs or a maximum of $10 million) for low-carbon and community energy systems.
- Municipal governments, together with Indigenous and not-for-profit partners, are eligible for direct funding, particularly for innovative or community-led renewable energy and energy efficiency projects.

Framework Takeaways

Québec's emerging PGIRE is a valuable case for comparative analysis not only because it provides the most legislatively complete example of integrated energy-economy planning within Canada, but because it demonstrates how long-term decarbonization, multi-fuel energy planning, and provincial economic development strategy can be linked together within a single, legally binding planning framework for the first time.

The PGIRE establishes Québec's provincial energy trajectory and creates binding obligations on energy distributors and the Régie de l'énergie, whose regulatory decisions must conform to its orientations. However, it does not yet contain mechanisms for downward coordination to regional or municipal scales. The plan models Québec as a single territory, municipalities are consulted but hold no formal implementation role, Indigenous communities have a partnership pathway under Bill 69 but not co-governance of plan orientations, and community-scale distributed energy is present as a modelling scenario but not as a structured policy instrument with ownership or benefit-sharing

provisions. This gap between the plan's provincial strategic ambition and the absence of sub-provincial coordination structures represents the central institutional development challenge for the PGIRE's next iterations — and the dimension where comparison with more spatially integrated frameworks, such as Germany's multi-level spatial energy planning system or France's SRADDET-PCAET compatibility chain, is most instructive for Québec's future planning evolution.

For other provinces and territories considering their own integrated energy-economy frameworks, the transferable lessons from the Québec case include:

- Legislate the plan, not just the strategy. The PGIRE's most important innovation over its predecessors is statutory force: the Minister must produce the plan, distributors must align supply plans with its orientations, and the regulator must respect its targets. Non-binding energy strategies, however well-designed, cannot achieve this coordination.

- Plan all major energy carriers and end-uses together in one binding provincial roadmap with a long horizon (25 years), updated regularly (every six years) with a mandatory progress review.

- Explicitly tie energy planning to economic development strategy, so that new clean energy supply and demand directly drive jobs, industrial development, and investment in specific territories, treating energy infrastructure as a locomotive for regional prosperity.

- Design a structured participatory process that gives municipalities, regions, and Indigenous nations a meaningful voice in scenario design and planning priorities, helping to secure social licence and align the provincial trajectory with local development realities, recognising, as Québec's experience illustrates, that consultation alone is insufficient without formal sub-provincial coordination mechanisms.

Québec's experience shows that legislating a provincial plan is a necessary but not sufficient condition for regional energy-economy integration. Significantly, the PGIRE's own scenario analysis already recognises this: the decentralised energy scenario (O4) — emphasising distributed solar, local heat networks, and demand-side flexibility — achieves a lower territorial footprint and reduced transmission network expansion compared to large centralised supply pathways, precisely because generation is embedded closer to communities and industrial loads. Yet the institutional architecture to realise this potential at the sub-provincial scale is not yet present. Future iterations of the PGIRE could close this gap by developing compatibility requirements that link provincial orientations to regional land-use plans and municipal energy strategies, establishing co-design mechanisms for Indigenous communities and municipalities in distributed energy project pipelines, and creating structured benefit-sharing arrangements that anchor community energy in local economic development rather than

treating it as a residual supply option. This would bring Québec's framework closer to the community wealth-creation ambitions that distinguish the most advanced regional energy-economy planning systems examined in this report.

Further Resources

Gouvernement du Québec. (2026). **Rapport préliminaire en vue de l'établissement du Plan de gestion intégrée des ressources énergétiques (PGIRE).**

Fitzgibbon & Le ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE). (2024). **Bill 69 - Assemblée Nationale du Québec.**

Hydro Québec. (2023). **Action Plan 2035 – Towards a Decarbonized and Prosperous Québec**

Emerging Framework II:
The United Kingdom's Strategic Spatial Energy Plan

How the U.K. looks to align its national climate targets with contextual appropriate regional energy infrastructure.

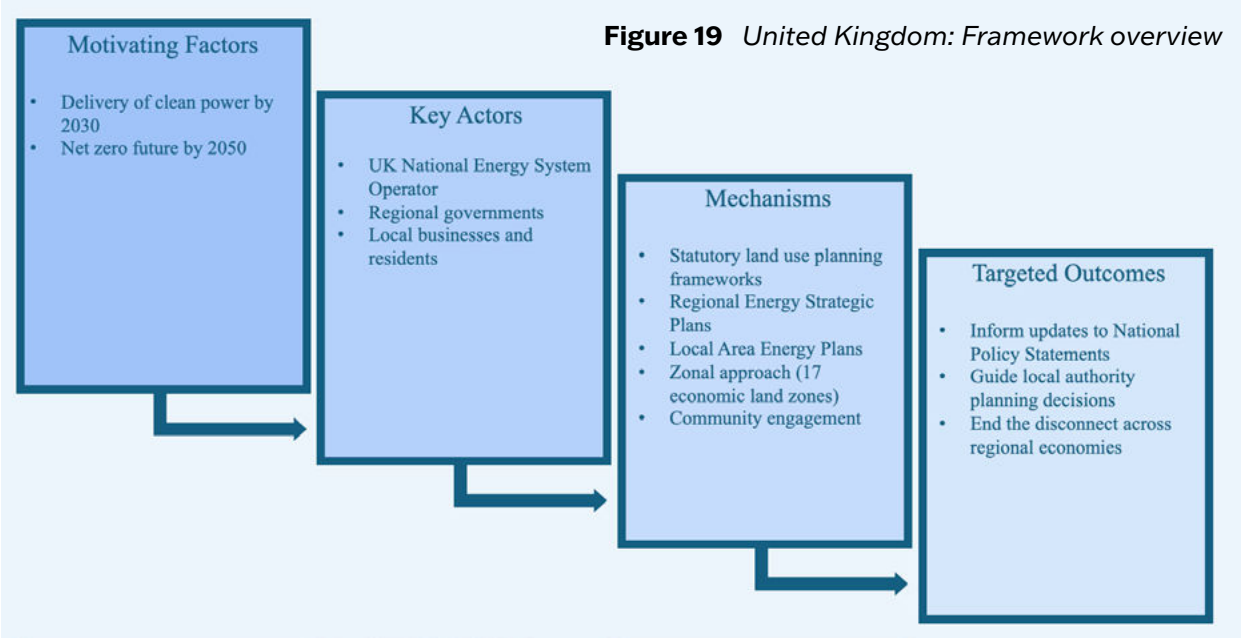


Figure 19 *United Kingdom: Framework overview*

Table 17 *United Kingdom: Summary of plans*

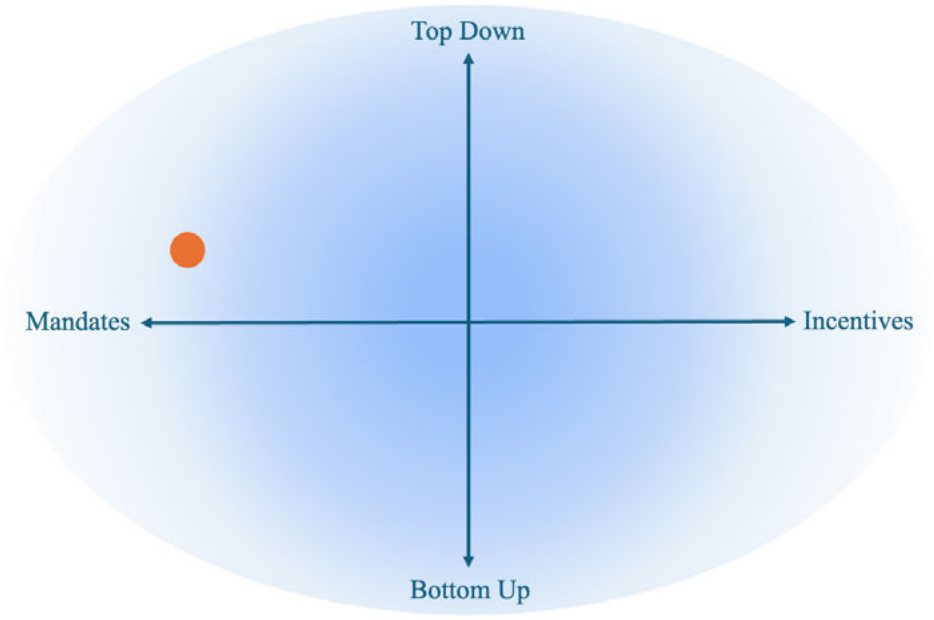
Acronyms

ACRONYM	FULL NAME (ENGLISH)	NOTES / ROLE IN THE FRAMEWORK
SSEP	Strategic Spatial Energy Plan (sometimes called Strategic Sustainable Energy Plan in drafts)	National-level spatial energy plan that maps where generation, storage, networks, and hydrogen infrastructure should go to meet future demand securely and affordably.
RESP	Regional Energy Strategic Plan	Regional-level plans that adapt the national SSEP pathway to regional resource conditions, demand, and economic priorities, and coordinate development of regional distribution systems.
LAEP	Local Area Energy Plan	Local-level plans co-produced with local authorities and stakeholders to design neighbourhood-scale energy solutions, including retrofit, local heat networks, and distributed generation.
NESO	National Energy System Operator	New national body responsible for preparing the SSEP methodology and scenarios, coordinating system-wide planning, and leading public engagement on the national plan.

Framework Summary

The proposed UK Strategic Spatial Energy Plan (SSEP) or "SSEP" is a long-term, GB-wide spatial strategy that sets out what energy infrastructure should be built, where and when, to deliver a secure, low carbon and affordable energy system with a distinct timeline to 2050. It is currently under development by the National Energy System Operator (NESO) and is expected to be completed in 2026 and this section was written prior to the formal release of the final draft. It will act as the first national blueprint for the spatial build-out of generation, storage and networks, especially electricity and hydrogen. The SSEP sets a national "top-down" spatial planning blueprint that NESO then uses (alongside regional energy system plans or "RESPs") to provide "bottom-up" regional insight, to shape contextually appropriate local energy development its Centralised Strategic Network Plan (CSNP) and guide transmission and distribution investment decisions nationally (NESO, 2024). The United Kingdom's Strategic Spatial Energy Plan is categorized here as an emerging framework because the SSEP itself is still being finalized, regional energy strategies are at an early stage of development, and the nested multi-tier system it envisions has not yet been operationalized or tested at scale.

Figure 20 *Governance mode: United Kingdom*



The SSEP mixed approach to its governance components allows the U.K. to align its national energy transition and climate targets across all levels of government and create a resource which supports contextually appropriate energy projects nationally. It provides a comprehensive framework for future U.K. wide energy development and planning and is focused on overcoming regional energy challenges by prioritizing grid innovation, renewable adoption, and optimizing local energy data to support targeted economic investment (Morgan, 2025; NESO, 2024). This model prioritizes collaborative stakeholder engagement to synchronize energy and regional growth objectives.

The plan consists of a countrywide assessment for, and modelling of, potential regions for development along with principles and targets necessary to meet the U.K.'s defined climate targets. It is intended to guide where major generation, storage, hydrogen, carbon capture and network investments should locate and in what sequence, so that network build, industrial clusters and local decarbonization plans align and system costs fall (NESO, 2024). This document provides a centralized point of reference for all respective regional and local energy planning initiatives to both incorporate and base locally guided spatial energy planning upon.

Background

The UK government is on a mission to speed up the transition away from fossil fuels and towards clean energy; a mission that is shared by the Scottish and Welsh governments. The objectives are to deliver clean power by 2030 and accelerate towards net zero, to boost energy independence, protect consumers, and support jobs across the country (NESO, 2024, 2025). This will involve significantly increasing the amount of low carbon electricity generation in the system, as well as new energy sources like hydrogen, while building the associated infrastructure that will enable the system to function (Poulter et al., 2025).

Since the early 2000s, the UK Government has subsidised the development of renewables on the national grid but has provided no direction on where these should be built (Brading, 2025). NESO has been commissioned by the UK government to produce independent advice for delivery of Clean Power by 2030, with expert analysis of the location and type of new investment and infrastructure needed to deliver it (NESO, 2024, 2025). The first Strategic Spatial Energy Plan, due to be published in 2026, will cover the period from 2030 to 2050. The Strategic Spatial Energy Plan will guide regulatory decisions, network investment plans, and planning policy to encourage the cost-efficient development of renewables and energy storage (Pearson & Mostarda, 2024).

Framework Factors

What is it?

The overall goal of the SSEP is to help accelerate and optimize the transition to clean, affordable and secure energy across Great Britain. Its objectives are to then support a net zero future by 2050, maintain security of supply, minimise overall system cost and better coordinate use of land and sea for energy alongside other activities. This goal, and the objectives that support it, will be achieved via a partnership between the UK government, Scottish and Welsh governments, Ofgem, the National Energy System Operator (NESO), and private industry. It will be supported in achieving these goals through work including the CSNP and regional energy plans produced by Regional Energy Strategic Planners (RESPs) (NESO, 2024, 2025).

The SSEP sets out a national framework and establishes explicit objectives for energy policy within the UK. It then aims to address current issues such as energy security, affordability, and sustainability by establishing a national framework to steer energy infrastructure development and investments (Brading, 2025; NESO, 2024). This framework will assess the optimal locations, quantities and types of energy infrastructure required, across a range of plausible futures, to meet future energy demand with the clean, affordable and secure supply. It will take into account public views, environmental considerations, and cross-sectoral demands on land and sea (Brading, 2025; NESO, 2024, 2025). The plan highlights several core components that will drive these goals including a three pronged approach to carrying out planning (Brading, 2025; Harkness, 2023, 2025; NESO, 2024, 2025).

Integration with spatial planning

The plan is explicitly conceived as a spatial strategy, intended to be embedded within statutory land use planning frameworks so that decisions on land and sea use (e.g. consents, zoning) reflect future energy system needs. SSEP outputs are expected to inform updates to National Policy Statements and guide local authority planning decisions, giving planners a clearer national map of priority zones for energy infrastructure.

Integration with energy planning

SSEP is a key part of a new coordinated energy planning framework, sitting above Regional Energy Strategic Plans (RESPs) and Local Area Energy Plans (LAEPs) to link national system design with regional and local energy pathways. Its scenarios and spatial pathways will feed directly into other core energy system plans, such as the Centralised Strategic Network Plan and 2030 Centralised Plan, aligning generation, storage and network investments.

Integration with economic planning

NESO's methodology uses economic factors as a core pillar, seeking cost efficient system development by steering investment to zones where infrastructure can deliver the greatest overall economic value. The zonal approach (17 economic land zones) aligns energy infrastructure with existing economic geographies and industrial clusters, enabling targeted public co-investment, adjusted Contracts for Difference support, and prioritised grid connections in economically strategic locations. The SSEP will contribute to achieving this goal by providing greater clarity to industry, investors, consumers, and the public on the shape of our future reformed energy system. It will also support conversations with stakeholders and the public towards building consensus on how the GB energy system needs to change to enable clean and affordable energy for the future.

Governance and stakeholder structures

This new integrated spatial energy plan introduces a three-tier energy planning system, which includes the national Strategic Sustainable Energy Plan (SSEP), Regional Energy Strategic Plans (RESP), and Local Area Energy Plans (LAEPs) (NESO, 2025). The introduction of this three-tier energy planning system within the SSEP brings several

advantages. It establishes a clear, structured framework for energy policy, assigning roles and responsibilities at each level. This supports national goals while also directly addressing regional and local needs. The system also fosters collaboration creating a more cohesive energy strategy, involving local communities more meaningfully, and encouraging public engagement and support, allowing for innovative solutions that leverage local knowledge to tackle specific challenges effectively (NESO, 2024, 2025; Pearson & Mostarda, 2024).

In drafts of the SSEP, each of the three levels of the strategic plan looks is responsible for its own unique aspects of the national energy system while still leaving room for collaboration and aligning targets within and throughout:

- **The Strategic Sustainable Energy Plan (SSEP):** sets out a national framework and establishes objectives for energy policy within the UK. It aims to address current issues such as energy security, affordability, and sustainability while establishing a national framework to steer energy infrastructure development and investments. The SSEP will assess the optimal locations, quantities and types of energy infrastructure required, across a range of plausible futures, to meet future energy demand with the clean, affordable and secure supply that we need. It will take into account public views, environmental considerations, and cross-sectoral demands on land and sea (NESO, 2024, 2025).

- **Regional Energy Strategic Plans (RESP)**: In addition to the SSEP, regional energy planning efforts aim to adapt the national strategy to fit the unique needs of different areas. This allows for nuanced responses, considering differences in energy demand, resource availability, and economic factors across regions. While regional plans will support the main objectives of the SSEP, they will have the flexibility to address specific local priorities and challenges (Maltby, 2025; NESO, 2024, 2025). A key objective for regional plans will be to support the coordinated development of the distribution system to enable long-term investment. It is intended to be fully "whole system", including electricity and gas – but also potentially heat and hydrogen.

- **Local Area Energy Plans (LAEPs)**: Local Area Energy Plans offer detailed, community focused energy strategies. Created in partnership with local governments, businesses, and residents, these plans are tailored to the specific needs of each area. The goal of LAEPs is to encourage local renewable energy initiatives, enhance energy efficiency in homes and businesses, and facilitate the shift to a low carbon local economy (NESO, 2024, 2025).

Community engagement

The SSEP will be informed by engagement with the British public and interested parties, including industry bodies, NGOs and relevant local government associations (Harkness, 2023; NESO, 2024, 2025). The purpose of this exercise is to ensure that the resulting publication reflects not only technical, environmental, and economic considerations, but

also takes account of dialogue with a wide range of stakeholders. This will include consideration of the cumulative impact of energy infrastructure build on each region (NESO, 2024). This process will be an opportunity to listen and discuss the shape of the future energy system and refine the plan where appropriate. It will seek societal engagement on the SSEP and will help set the context for the public's understanding of the other plans that will flow from it.

At a regional level, RESP development will be supported by NESO's delivery of a place-based engagement function and proportionate support for local authorities. NESO are expected to develop structured, transparent and accessible routes for local actors to engage with and inform the RESP (Harkness, 2025; Maltby, 2025). There have been some concerns in the consultation period about the capacity and role of NESO in terms of engagement with local actors, however the decision firmly establishes that regional and local engagement is a priority of the regional RESP teams (Harkness, 2025; Maltby, 2025)

Integration with economic development

While each level of the SSEP addresses unique aspects of the national energy plan, at a regional level RESPs aim to adapt the national strategy to fit the unique needs of different areas. This allows for nuanced responses, considering differences in energy demand, resource availability, and economic factors across regions. While regional plans will support the main objectives of the SSEP, they will have the flexibility to address specific local priorities and challenges (Harkness, 2023; NESO, 2024; Pearson & Mostarda, 2024). For renewables developers, it sets a clear target for each technology class and each region of the UK, offering clarity on what is required. For real estate developers, it offers a long-term view of upcoming infrastructure upgrades in specific areas, allowing them to plan accordingly and prioritize projects effectively (Harkness, 2023; NESO, 2024; Pearson & Mostarda, 2024).

Technology and resource considerations

The UK Strategic Spatial Energy Plan (SSEP) is designed around a specific set of technological choices (what to build where, and when) and resource constraints (land, sea, grid capacity, and natural resource availability) across Great Britain (NESO, 2024). The commission also makes clear that the SSEP will operate at a broad "zonal" level (identifying optimal areas rather than specific project sites) to respect devolved planning powers and local decision-making. Within the first iteration of the SSEP, the primary focus is on three main categories of assets:

- Electricity generation technologies (onshore and offshore wind, solar PV, nuclear, and other low-carbon generation).
- Electricity storage (short-duration batteries and longer-duration storage, including pumped hydro and other flexibility options).
- Hydrogen production, storage, and transport infrastructure (electrolysers, pipelines, storage caverns, and associated network connections).

These technologies are treated as an integrated system, so the SSEP aims to define optimal mixes, capacities, and deployment timings rather than planning each technology in isolation (NESO, 2024). Additionally, as the SSEP is expressly a land-and-sea spatial plan, so it must work within multiple resource constraints (NESO, 2024, 2025):

- Physical and environmental constraints: existing statutory marine plans, protected sites, biodiversity and habitat protections, and other land uses such as agriculture, housing, and industry.
- Natural resource availability: high-wind areas (onshore and offshore), good solar resource, potential sites for pumped hydro or tidal range, and locations suitable for hydrogen storage or CO_2 transport interfaces.
- Grid access and connection capacity: the plan is expected to support anticipatory network investment to relieve current connection bottlenecks and reduce waiting times for generation and storage projects.

Financing and implementation mechanisms

Projects that emerge from the SSEP and RESPs will not have access any single dedicated "SSEP/RESP fund"; instead, they will plug into a mix of regulated network funding, existing central government support schemes, and local/market finance, all of which are expected to be steered by the spatial plans (Harkness, 2023, 2025). Table 9 outlines some of the identified financing and potential implementation measures within the current UK system.

Table 18 *SSEP and RESP potential implementation and financing mechanisms*

AREA / PROJECT TYPE	IMPLEMENTATION MEASURES	FINANCIAL SUPPORTS AVAILABLE
Transmission network upgrades	Delivery through NESO's Centralised Strategic Network Plan and TO investment plans aligned with the SSEP pathway.	Regulated revenue via transmission price controls (RIIO-T etc.), including allowances for anticipatory and strategic investment.
Large-scale low-carbon generation	Projects developed and consented in zones prioritised by SSEP and enabled by RESP-driven network capacity.	Contracts for Difference, Capacity Market, private project finance and corporate PPAs.
Storage and flexibility (incl. LDES ("long duration electricity storage")	Siting and sizing guided by SSEP/RESP identification of high-value flexibility locations.	Market revenues (wholesale, balancing, ancillary services), LDES support schemes and innovation funds.

AREA / PROJECT TYPE	IMPLEMENTATION MEASURES	FINANCIAL SUPPORTS AVAILABLE
Hydrogen infrastructure	Hydrogen hubs and corridors planned using SSEP, CSNP and RESPs as the core strategic planning documents.	Hydrogen business models and CfD-style contracts, infrastructure funds and private capital.
Local / regional decarbonization projects	Local authorities and partners use RESP priorities to build project pipelines (e.g. heat networks, LAEP-type programmes).	UK-wide grants/loans, local authority borrowing, blended finance, and private partnerships supported by Local Net Zero Hubs.

Sources: *(Great British Energy, 2025; Harkness, 2023, 2025; NESO, 2024, 2025)*

Framework Takeaways

The SSEP–RESP–LAEP framework offers a promising model of how to link national energy transition goals with regional realities through integrated spatial planning, coordinated governance, and aligned investment tools. The UK approach separates but connects roles by establishing the SSEP which sets a GB-wide spatial pathway for generation, networks, storage and hydrogen, while RESPs translate this down into regional supply–demand pathways and LAEPs introducing place-based priorities. This creates a clear hierarchy where local and regional plans influence national network decisions but still sit inside a whole-system decarbonization pathway.

The framework also embeds local economic planning directly into energy planning: policy documents emphasise that RESPs should help “unlock investment,” create jobs and “end the disconnect across regional economies,” by aligning energy infrastructure with regeneration areas, industrial sites and resilience needs, down to neighbourhood scale. In practice, this means using regional energy plans to steer grid upgrades and low carbon projects toward places where they can catalyse new business activity, reduce energy costs for communities, and support just-transition priorities.

For other regions considering their own regional economic transitions, key aspects of the plan that can be taken from the U.K. case include:

- Create a national spatial plan anchored in net-zero and security goals; regional plans that articulate granular place-based needs; and explicit regulatory and market mechanisms that translate these plans into grid and asset investment.

- Use a national spatial plan (like SSEP) to set the overall technical and spatial direction, but pair it with regional plans that can reflect local priorities and economic strategies.

- Give local and regional authorities real governance power over regional plans, backed by formal Strategic Boards and super-majority sign-off, so local economic planning and democratic accountability are embedded in energy decisions.

- Design explicit feedback loops so regional plans feed into regulated network investment and vice versa, ensuring that infrastructure delivers both net-zero outcomes and place-based economic benefits.

Further Resources:

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NESO. (2025). **Strategic Spatial Energy Plan Methodology.**

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i Québec has a long history of energy planning, but prior to the PGIRE it remained fragmented between utility-led electricity supply plans — reviewed by the Régie de l'énergie — and non-binding government energy strategies, the most significant of which were the Stratégie énergétique 2006–2015 and the Plan pour une économie verte 2030. Although a provision for formal integrated resource planning (planification intégrée des ressources) was embedded in the Loi sur la Régie de l'énergie as early as 1997, the enabling regulation was never adopted, leaving the provision a dead letter for nearly three decades. The PGIRE operationalises this long-dormant legislative intent, but through a substantially stronger institutional design: it is led by MEIE rather than the utility, covers all major energy carriers — electricity, renewable natural gas, hydrogen, bioenergy, petroleum products, and heat — and is legally binding on both energy distributors and the regulator. Unlike its predecessors, it carries a mandatory six-year renewal cycle, a three-year progress review, and a formal accountability reporting requirement, making it the first Québec energy planning instrument with both statutory force and a systematic update mechanism.

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