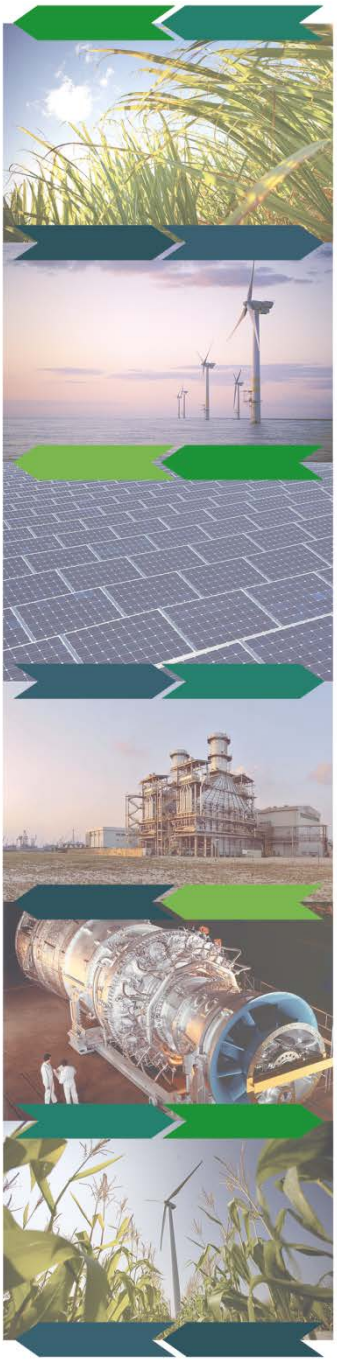
NAVIGATING THE ROADMAP FOR CLEAN, SECURE AND EFFICIENT ENERGY INNOVATION



Policy briefing on

Innovation Systems and the SET Plan

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SET-Nav
Strategic Energy Roadmap

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1 Introduction

This policy briefing uses a systemic perspective on energy innovation to inform the EU's Strategic Energy Technology (SET) Plan. The briefing makes five high level recommendations each of which is supported by a series of specific research insights. These insights are set out in a longer policy report which provides extensive examples, arguments, and links to relevant research literature.[i]

2 Why is a Systemic Perspective on Energy Innovation Needed?

The European Commission has stated "*the ambition to achieve ... a fundamental transformation of Europe's energy system*".[ii] This transformation requires solutions and policies informed by systemic analysis of energy innovation. As the OECD explains: "*If problems are systemic, solutions must operate at the system-level, rather than at some part of it*".[iii]

A systemic perspective on innovation (right panel of Figure 1) emphasises that innovation stages and processes like R&D and market diffusion are supported by a broader innovation environment comprising knowledge, actors & institutions, resources, and adoption & use.[iv] A systemic perspective also identifies structural and transformational failures that provide a strong rationale for policy.[v] Innovation system policies involve a diverse range of policy instruments.[vi] A systemic perspective on innovation emphasises multi-stakeholder governance of innovation processes, and enabling frameworks or conditions to direct innovation activity.

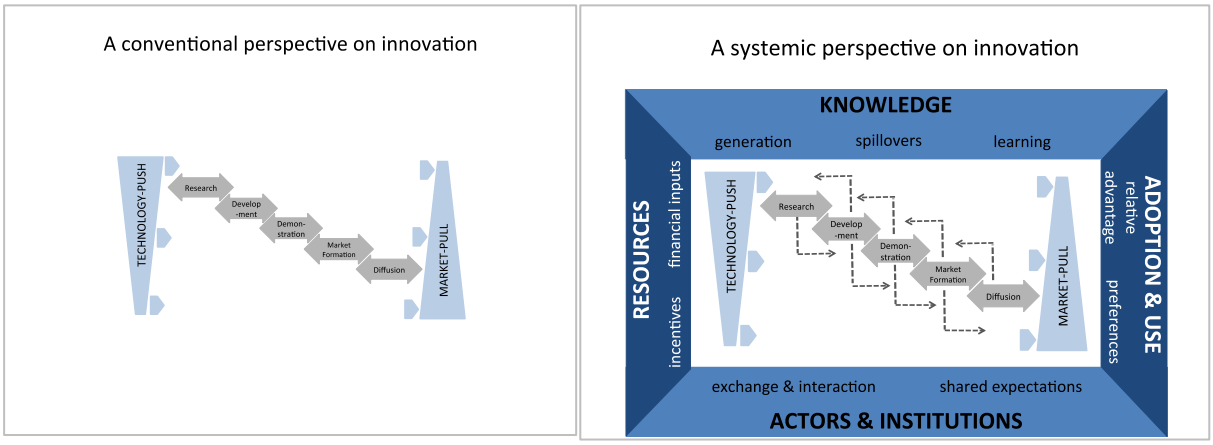

Figure 1. Conventional vs. systemic perspectives on energy innovation.[vii]

3 How can Research on Innovation Systems Inform the SET Plan?

1. Ensure the SET Plan is directed by a shared vision towards clear goals.

System transformations to solve societal problems require a clearly communicated purpose and sense of direction, with strong and visible political leadership. Shared visions establish the legitimacy and credibility of directed system transformations, and should be articulated by a wide range of social and political actors. Policymakers play coordinating, facilitative, and also entrepreneurial roles in system transformations. Central administrations should set key priorities for directed system transformations and monitor progress. Foresight and roadmapping tools provide detail on goals, risks, and required policy support.

2. Ensure the SET Plan builds strong networks among diverse innovation actors.

Networks between innovation actors support the availability and flow of information within an innovation system. Knowledge exchange enables collaboration, learning and helps build effectively functioning innovation systems. Actor networks also support more distributed decision making and coordinated governance. The balance between collaboration and competition in actor networks changes as innovation systems become more established.

3. Ensure the SET Plan aligns institutions and builds user demand for technological innovations.

Formal and informal institutions are important elements of innovation systems which can be shaped by policy. Coordinated and aligned institutions complement technological innovation; misaligned institutions stagnate innovation. A common form of misalignment lies in the vested interests of incumbent actors which resist change; transitional assistance can help overcome this. Market demand for low-carbon innovations needs to be actively created among prospective users. Users play different roles in transitions, including as producers, legitimators, and participatory citizens.

4. Ensure the SET Plan coordinates an effective mix of stable innovation policies matched to specific innovation needs.

A mix of policies is necessary to address the diverse structural and transformational failures in innovation systems. Policy mixes contain technology-push and market-pull instruments. Effective policy instruments are tailored to the needs of specific technologies and innovation contexts. Stable long-term policy frameworks establish clear expectations and provide strong signals to investors. Appropriately timed and sequenced innovation policies match the changing needs of innovations through development and diffusion. Policy support can be reduced as innovation systems become self-sustaining.

5. Ensure the SET Plan generates policy intelligence to support learning and adaptation.

Policymaking for energy innovation is open-ended and uncertain. Policy intelligence helps anticipate emerging opportunities, risks of failure, and alternative options. Systematic monitoring and evaluation enables learning for future policy improvement. Monitoring data is needed on the structure, functions and performance of different innovation systems and on the impact of innovation policy. Addressing structural and transformational failures in innovation systems are important evaluation criteria for innovation policy.

4 How do the Policy Recommendations Apply to the SET Plan?

Table 1 maps the five high-level policy recommendations onto the main elements of the SET Plan. These elements are grouped under strategy, governance, and mechanisms. The mapping in Table 1 identifies how and where the SET Plan can incorporate the policy recommendations provided by a systemic perspective on energy innovation.

Table 1. Policy recommendations mapped onto SET Plan elements.

Notes: shade of green denotes strength of mapping (dark = strong correspondence … light = weak correspondence).

		STRATEGY		GOVERNANCE		MECHANISMS	
Ensure the SET Plan …		**priority areas and actions**	**action-specific targets and roadmaps**	**steering group and management**	**stakeholder networks**	**monitoring and reporting**	**funding mechanisms**
1	*… is directed by a shared vision towards clear goals.*						
2	*… builds a strong network among diverse innovation actors.*						
3	*… aligns institutions and builds user demand for technological innovation.*						
4	*… coordinates an effective mix of stable innovation policies matched to specific innovation needs.*						
5	*… generates policy intelligence to support learning and adaptation.*						

1. Ensure the SET Plan is directed by a shared vision towards clear goals.

The SET Plan must be articulated in a clear vision for system transformation, communicated through strong and visible political leadership, and shared among a wide range of innovation actors. The vision and purpose of the SET Plan should be consistent with broader EU energy objectives for the internal market, competitiveness, energy security and climate change.[viii] The SET Plan should also embed a clear rationale for policy interventions to address structural failures blocking system transformation. The strategic direction of the SET Plan is articulated in the priority areas and their actions, each of which is further developed through roadmaps. The portfolio of actions should align clearly with the goals of the SET Plan. Portfolios should target technologies which support green growth, increase international competitiveness, or are resilient to future shocks.[ix] The SET Plan should also strategically target

technologies in which individual Member States under-invest. The SET Plan steering group is an important structure for setting priorities, coordinating activities, and evaluating progress towards the overall vision. SET Plan policymakers must be involved not just in co-ordinating and facilitating roles, but also in entrepreneurially leading the required system transformation.

2. Ensure the SET Plan builds a strong network among diverse innovation actors.

Setting targets and elaborating roadmaps for each of the actions provides a formal mechanism for the SET Plan to build stakeholder networks. These may be specific to an action, or span actions if related to common strategic elements such as coordinating between Member State and EU-level policy. SET Plan networks should involve many different innovation actors in knowledge exchange. Entrepreneurial risk-takers and those involved in establishing market niches play particularly important roles in forming new innovation systems. Available funding mechanisms to support specific SET Plan activities provide an additional basis for interaction between stakeholders.

3. Ensure the SET Plan aligns institutions and builds user demand for technological innovations.

Identifying requirements for institutional change and alignment is an important part of the SET Plan, both strategically and at a more specific implementation level. Action-specific roadmaps, informed by diverse stakeholders, provide the most relevant opportunity for identifying these system challenges. Policies should target institutional misalignments, including weak market demand and resistance to change by incumbent interests. The SET Plan's indicators and reporting function allows institutional alignment and market demand to be monitored on an ongoing basis.

4. Ensure the SET Plan coordinates an effective mix of stable innovation policies matched to specific innovation needs.

A mix of policies is needed to address the range of market and structural failures in the EU's energy innovation system. A diverse policy mix requires coordination to ensure policies are aligned with one another and with strategic goals articulated in the SET Plan's action-specific roadmaps. The SET Plan steering group and management structures provide the locus for this coordination role. Funding mechanisms linked to the SET Plan provide a specific means of aligning policy objectives with available public resources. Monitoring further supports the responsiveness of SET Plan policy mixes to the changing needs of innovation actors as innovation systems mature.

5. Ensure the SET Plan generates policy intelligence to support learning and adaptation.

Innovation systems are dynamic. Experience provides opportunities for learning. Systematic monitoring using appropriate indicators informs adaptive policymaking. Monitoring and reporting is a key element of the SET Plan. The SET Plan's steering group and management should embed learning in its governance. The broader shared vision for the SET Plan should be robust to future change. However, policy mixes identified in the SET Plan's action-specific roadmaps, and the scope of available funding mechanisms, may need adapting to changing circumstances. Stakeholder networks both enable effective monitoring, and provide additional insight into policy effectiveness.

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[ii] EC, Communication from the Commission C(2015) 6317 final. Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation. 2015, European Commission (EC): Brussels, Belgium.

[iii] OECD, System Innovation: Synthesis Report. 2015, Organisation for Economic Cooperation and Development (OECD): Paris, France.

[iv] Wilson, C., et al., Marginalization of end-use technologies in energy innovation for climate protection. Nature Climate Change, 2012. 2(11): p. 780-788.

[v] Weber, K.M. and H. Rohracher, Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. Research Policy, 2012. 41(6): p. 1037-1047.

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[ix] Ruester, S., et al., A post-2020 EU energy technology policy: Revisiting the strategic energy technology plan. Energy Policy, 2014. 66: p. 209-217.

SET-Nav
Strategic Energy Roadmap

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About the project

SET-Nav aims for supporting strategic decision making in Europe's energy sector, enhancing innovation towards a clean, secure and efficient energy system. Our research will enable the European Commission, national governments and regulators to facilitate the development of optimal technology portfolios by market actors. We will comprehensively address critical uncertainties facing technology developers and investors, and derive appropriate policy and market responses. Our findings will support the further development of the SET-Plan and its implementation by continuous stakeholder engagement.

These contributions of the SET-Nav project rest on three pillars: modelling, policy and pathway analysis, and dissemination. The call for proposals sets out a wide range of objectives and analytical challenges that can only be met by developing a broad and technically-advanced modelling portfolio. Advancing this portfolio is our first pillar. The EU's energy, innovation and climate challenges define the direction of a future EU energy system, but the specific technology pathways are policy sensitive and need careful comparative evaluation. This is our second pillar. Ensuring our research is policy-relevant while meeting the needs of diverse actors with their particular perspectives requires continuous engagement with stakeholder community. This is our third pillar.

Who we are?

The project is coordinated by Technische Universität Wien (TU Wien) and being implemented by a multinational consortium of European organisations, with partners from Austria, Germany, Norway, Greece, France, Switzerland, the United Kingdom, France, Hungary, Spain and Belgium.

The project partners come from both the research and the industrial sectors. They represent the wide range of expertise necessary for the implementation of the project: policy research, energy technology, systems modelling, and simulation.