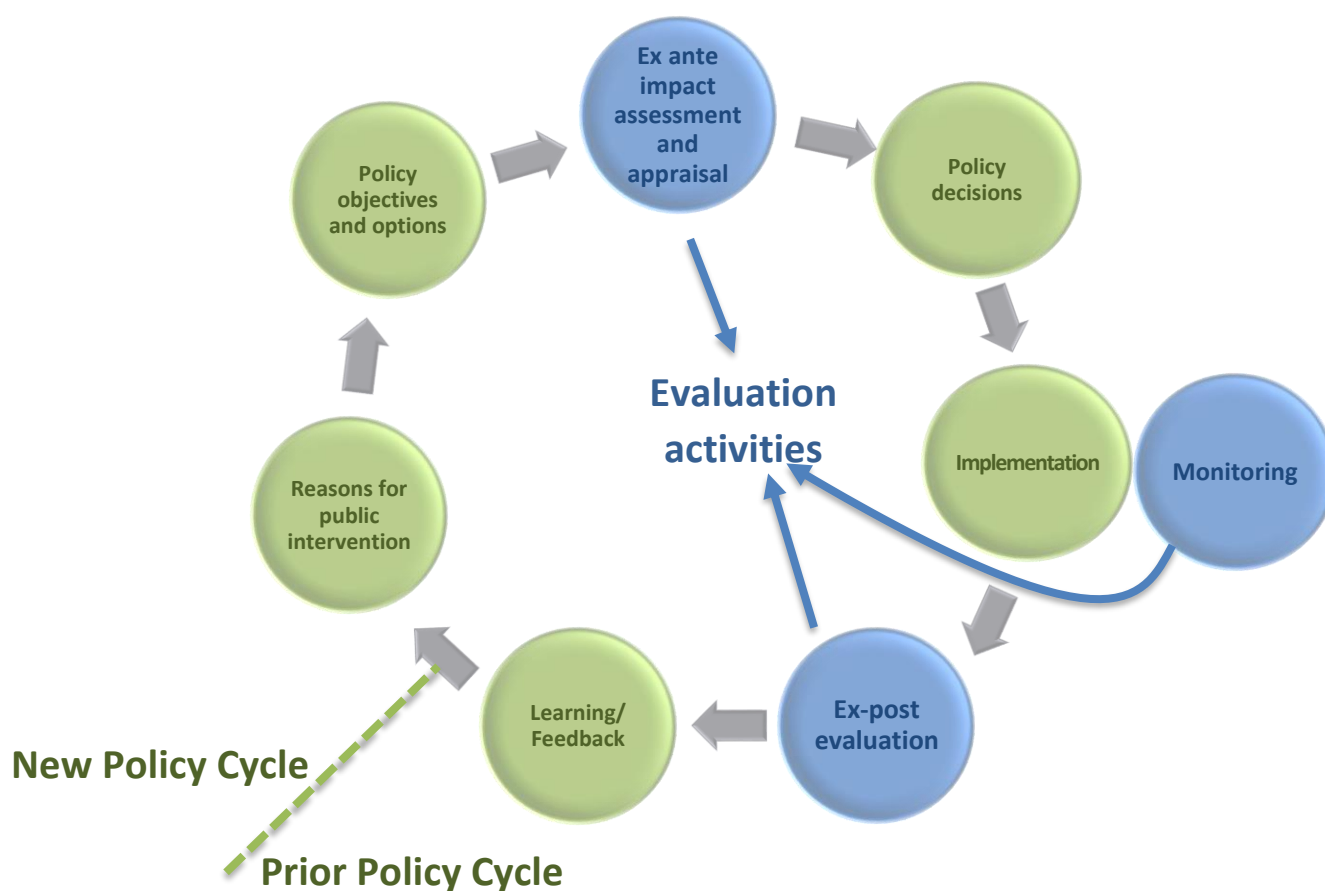


Evaluating the impacts of energy innovation policies

Executive Summary



Adapted from [OECD \(2021\)](#) *International approaches and considerations for innovation policy – A perspective from OECD*, presented by F. Galindo Rueda

Organised by the Expert's Group on R&D Priority Setting and Evaluation (EGRD)

29 October 2021

All presentations are available on the [workshop webpage](#)

Executive Summary

Introduction

On 29 October 2021, the Expert's Group on R&D Priority-Setting and Evaluation ([EGRD](#)) organised an open and virtual dialogue with government delegates of the IEA Committee on Energy Research and Technology (CERT) and various international experts to discuss efficient practices for evaluating R&D programmes and assessing the impacts of energy innovation policies, as a means to promote evidence-based policy-making and to improve the quality of the public interventions in this area. The meeting gathered more than 80 participants from around the world, and featured presentations by six countries – Austria, Brazil, Canada, Japan, Sweden and the United States as well as the European Commission.

Rationale and Background

Evaluation of clean energy innovation policies has risen right to the top of many governments' agendas. A key impetus for this renewed interest is the focus around the world on more ambitious targets for emissions reduction and the recognition that clean energy innovation is critical for reaching the Paris Agreement goals. The IEA report [Net Zero by 2050 – a Pathway for the Global Energy Sector](#) highlights that almost half of the emissions reductions needed for 2050 should come from energy technologies currently in demonstration or prototype stages. The urgency of the net-zero challenge means that the process of energy innovation needs to be accelerated, without cutting any corners on safety or reliability of the energy system.

Policy evaluation is a critical element for improving citizens' trust in governments' decision making processes, and enabling sound public governance that ensures that public funds directed to clean energy solutions are used in the most efficient and responsible ways. However, while it is clear that well-grounded evidence will help governments adopt best practice in innovation policy design to meet decarbonization targets, scholars have emphasized that knowledge about which support mechanisms most effectively drive clean energy innovations, and under which conditions, is ominously scarce.

The topic has not always received adequate attention among energy policy-makers, but the current level of engagement indicates an opportunity to share experiences and latest knowledge with decision-makers that are designing and refreshing clean energy innovation policies.

Highlights

Most countries face significant [challenges](#) in promoting policy evaluation, while the energy sector introduces some specific additional layers of complexity. In general, conducting a rigorous policy evaluation requires dedicated financial and personnel resources, the availability of which varies between countries and is often constrained. Some of the pressing challenges specific to energy innovation policy that a good evaluation needs to address are:

- **The energy sector has a wide array of policies that can directly or indirectly contribute to energy innovation**, and a given innovation outcome will be affected by several positive and negative spillovers, not even tagged as innovation.

- **Energy innovation is characterised by long development cycles**, as the time lag to have an outcome of a societal interest often extends beyond the political cycle in which an energy innovation policy or programme is implemented.
- **Attributing cause and effect to a specific policy process is complex**, as the energy innovation system is highly interrelated with a mix of different policies. It is important to remember that correlation does not imply causation. Policy evaluation will aim to understand what works, why, for whom, and under what circumstances, and this requires identifying whether the desired impact or outcome would have happened and how quickly it would have happened in the absence of this policy or if it would have been carried out differently.
- **Data availability is scattered** across different institutions beyond those responsible for energy policy design and implementation.

Recommendations

Enhancing evaluation design

- Integrate evaluation plans into policy design from the outset, selecting impacts worthy of measurement and enabling the identification of causal effects.
- Integrate a procedure for data identification, collection and mapping into the upfront design of the policy measure including, where possible, alignment with metrics used in any *ex ante* impact assessments. Develop an inter-institutional coordination framework to support data exchange and consistency among datasets, taking any relevant pre-existing data architecture into account .
- Maintain the evaluation process over many years, taking into account the long development cycles of energy innovation, while providing intermediate findings that fit into shorter policy cycles and could be used by decision-makers.
- Map policies beyond energy R&D support, including non-R&D policies and regulations, and their interactions, even if they were not developed primarily to enhance energy innovation.
- Design evaluation indicators that seek to understand failure, and not only positive achievements. Innovation is risky and learning from failure brings valuable insights.

Creating evaluation ownership

- Secure the buy-in from policy-makers to enshrine the use of innovation evaluation in energy policy design. Promote the view of evaluation as a means to increase accountability, learning and improve future public interventions, rather than as a threat.

Further research on energy innovation evaluation

- Develop and share strategies to isolate the impact of specific interventions to identify causal effects, such as embedding quasi-experiments or randomized control trials (RCT), although the latter are often difficult to apply in the context of innovation.
- Develop quantitative and/or qualitative indicators to capture more outcomes and impacts, including social ones, that may stem from energy innovation globally.
- Conduct and support meta-evaluations ("evaluations of evaluations") nationally and internationally to assess the quality of evaluation processes and their results to improve evaluation design, and enhance methodological rigour and trustworthiness of evaluation.

Insights from speakers

The urgency of the climate challenge demands the most effective and evidence-based innovation policies

Araceli Fernández, Head of the IEA Technology Innovation Unit, set the scene by highlighting IEA's interest in learning more about best practices for the evaluation of R&D programmes and innovation policies.¹ **Birte Holst Jørgensen**, the EGRD Chair stressed as governments' investments in energy are increasing the investments in public energy R&D, they are accountable for maximizing the efficiency for the use of public funds and resources. **Fernando Galindo Rueda** (Senior Economist, Head of science and technology indicators at the Science and Technology Policy Division of the OECD Directorate for Science, Technology and Innovation) emphasized that improving standards for those who are responsible for managing public funds is required, but it is also necessary to go beyond the legitimization of the intervention, proving the impact of policies and initiatives implemented and the consecution of the intended changes, facilitating learning to identify what could be done better and informing decision-making to improve energy policy design.

The challenges of conducting energy innovation policy evaluation and how to improve it

Speakers from different countries shared their experiences on how they are addressing some of the challenges associated to energy innovation policy evaluation. For example, **Shumpei Miyajima** shared that due to the long development cycles of energy innovation, Japan's New Energy and Industrial Technology Development Organization (NEDO) measures its impacts through an extended survey more than 10 years after project implementation, and **Harris Berton** explained that Natural Resources Canada recently conducted multi-decade evaluations (looking 30-40 years back) to understand the impact of past research programmes.

Ann-Sofie Rönnlund (European Commission) shared that the indicators to evaluate the impact of the European innovation programme, Horizon Europe, are chosen from the beginning and with a focus on the policy priorities. **Andreas Türk** (Austrian Platform for Research and Technology Policy Evaluation [FTEval]) and **Lars Guldbrand** (Swedish Energy Agency) also stressed the importance of developing indicators that can measure social innovation. Lastly, **Jennifer Gerbi** ([ARPA-E](#)) emphasized that it is important to measure fail, i.e. it is relevant to find that a certain pathway is not worth pursuing, especially in high-risk high-reward research.

¹ Countries might refer to different types of public interventions when using the term "policy". Evaluations of public interventions could be aimed at policies (defined course of action to guide or achieve a goal, expressed in guidelines, strategic aims and actions on a specific topic), programmes (set of programmes to achieve specific objectives and goals in the short, medium and long term), portfolios (set of projects with specific and common objectives) or projects (set of activities to achieve a specific objective with a given budget and time limitation). Here we use the term "policy measure" to represent any of these four types of public interventions.

As some data will already be available at different institutions, **Aliki Georgakaki** (European Commission Joint Research Centre in the Netherlands) advises careful mapping of what is already available and by whom, and coordinating across institutions. **Carmen Sanches** (Brazilian Electricity Regulatory Agency [ANEEL]) stressed that the establishment of a governance framework that ensures an adequate coordination between institutions will be a critical task towards the implementation of a successful evaluation system.

Fernando Galindo Rueda, Jacquelyn Pless (MIT Assistant Professor), and other international experts shared some recommendations on how to improve energy innovation evaluation

Enhancing evaluation design

- A generic evaluation plan must be embedded in the policy design from the outset, before starting the implementation of the policy measure, and connecting to the intervention logic model, including when outcomes are expected to materialise, which impacts of interest are worth measuring, and enabling the evaluation of causal effects. Upfront design of an evaluation framework can ensure a methodologically rigorous and systematic use of evaluations throughout the policy cycle.
- Design a procedure for data collection as well as data mapping already when planning the design of the policy measure. Identify what data is already available and who generates it, and develop an effective coordination framework between institutions to favour data exchange and coherence among datasets. Data collection should consider tracking all applicant information, inputs, outputs, outcomes, and impacts, including data already generated by other institutions. The evaluation process should facilitate the convenient merging of multiple datasets and make these resources available to researchers at universities, think tanks, labs, etc.
- Energy innovation is characterised by long development cycles from idea generation to commercialization; therefore, data collection on outcomes and impacts will span long time periods after interventions, and the reporting process will need to be maintained over many years. However, evaluation should also fit the policy cycle to increase learnings and use of findings by decision-makers, so it is recommended to identify some additional intermediary outputs that might be correlated to the desired outcome.
- Energy innovation evaluation should not limit to those policies designed with the explicit goal of affecting innovation, but also take into account other policies that might have a significant impact on innovation even if they were primarily developed for other purposes. The design of the evaluation process should consider the energy innovation implications of policies beyond energy R&D support, including non-R&D policies and regulations, and their interactions; for example, carbon pricing, risk reduction policies, etc.
- Innovation, and especially energy innovation, is inherently risky and governments need to be tolerant of failure and understand that if something does not achieve all of its

objectives, it does not mean that it does not bring any value. Evaluation indicators should not focus only on positive achievements, as learning from failure should be an important part of innovation evaluation and should be adequately measured.

Creating evaluation ownership

- Secure the buy in from policy-makers, as they should not regard the evaluation process as a threat, but as an opportunity to increase accountability, learn and improve future public policies and programmes.
- Evaluations are not audits, and should be embraced as an opportunity to improve policy in the interest of the public. Public managers should have the right incentives to be continuously challenged and contribute to long-term improvements within government.

Advancing on further research on energy innovation policy evaluation

- Identify strategies to isolate the impact of specific interventions, which will enable the evaluation of causal effects. While randomized control trials² (RCT) are the gold standard, they are typically difficult to implement in the innovation context; however, it is possible to embed quasi-experiments into, for example, when assessing an incentive design, setting cut-offs in the ratings of applications that determine funding status or funding rates, likely to be very similar on each side of the threshold, and comparing outcomes just under and over the threshold. This might also imply measuring those that were not awarded the fund.
- Consider indicators that could be used to measure social and other impacts beyond energy due to energy innovation and its cross-border effects. Develop quantitative and/or qualitative indicators to capture more outcomes and impacts that may stem from energy innovation, especially those with a social interest.
- Conduct meta-evaluations, i.e. an evaluation of the evaluation, which will assess the quality of processes and results of the evaluations to improve the evaluation design, enhancing the methodological rigor and the trustworthiness of energy innovation evaluations.

Next steps

The EGRD and the IEA CERT Committee found this meeting to be very helpful and timely. They will consider appropriate follow-up activities to expand the still limited available knowledge on the topic of energy innovation policy evaluation and the lack of comparative analysis.

² Carefully designed experiments that test a hypothesis by randomising treatment.



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