Using evaluation findings to support the energy transition – Germany's Energy Research Programme as a learning programme

This paper examines the evaluation of Germany's 7th Energy Research Programme (ERP) "Innovations for the Energy Transition" (2018–2023), which aimed to accelerate the energy transition by fostering technology transfer, innovation, and cross-sectoral collaboration. The evaluation, commissioned by the Federal Ministry for Economic Affairs and Climate Action, utilized a theory-based, multi-level approach combining programme theory, innovation system thinking, and transformative outcomes. Employing mixed methods, the evaluation was structured around iterative learning cycles with participatory events, regular stakeholder engagement, and in-depth topic studies. These cycles enabled continuous programme learning, informed steering, and the integration of evaluation results into decision-making. The findings and recommendations from the evaluation directly influenced the design of the subsequent 8th Energy Research Programme. The paper highlights how structured, participatory evaluation processes can enhance organizational learning and programme effectiveness in the context of national energy policy and research funding.

Introduction

The 7th Energy Research Programme (ERP) 'Innovations for the Energy Transition' (2018-2023), is pursuing a strategic approach for energy research, focussing on the transfer of technology and innovation. The Federal Ministry for Economic Affairs and Climate Action funds Collaborative Projects (TRL 3-7), Living Labs (TRL 7-9), Micro Projects and accompanying measures (energy research networks and research communication at programme level). The programme strengthens research into cross-system issues and strives for close networking at international and European level. A total of 6,499 projects have been funded with an amount of € 3,318 bn. Open calls for participation offer continuous application possibilities.

The evaluation of the Energy Research Programme started in 2021 and is a five-year accompanying evaluation of the measures of the 7th Energy Research Programme (ERP) on behalf of the German Federal Ministry for Economic Affairs and Climate Action[1]. The evaluation is theory-based combining a programme theory approach with multi-level perspective innovation system thinking and the concept of transformative outcomes. (to learn more about this approach see Dinges et al., 2022; Dinges et al., 2025). It uses a mixed-methods approach to develop ongoing analyses, reflections and recommendations as a basis for steering and continuous improvement of the programme ("programme learning"), while also contributing to an assessment of its effectiveness and impact of the programme. It fed into the design of the 8th Energy Research Programme, which was launched as a mission-oriented research programme in 2023, with funding starting in 2024.

This paper focuses on how a cycle of events and activities were built into the evaluation process to maximise the opportunities for learning. Academic literature shows that learning processes in evaluations are particularly supported when evaluations are participatory, results are communicated transparently, and actively used for reflection and further development. Success factors include stakeholder involvement, a learning-friendly organizational culture, and the integration of evaluation results into decision-making processes (Thum et al., 2019; Faßhauer, 2016; Preskill and Torres, 2017; Christie and Alkin, 2020).

[1] After the formation of the government, in May 2025 the name of the ministry has changed.to Federal Ministry of Economic Affairs and Energy (‚BMWE').

Key objectives of the programme

With the Climate Action Plan 2050 and the Climate Action Programme 2030, the German government has set ambitious targets for reducing energy consumption and CO_2 emissions and for increasing the share of renewable energies. With the amendment of the Climate Protection Act in 2021, the Federal Government has further tightened the climate protection targets and enshrined the goal of greenhouse gas neutrality by 2045. CO_2 emissions are to be reduced by 65% by 2030 and by 88% by 2040. The energy transition - a secure and efficient energy supply with a high share of renewable energies - is one of the key social, political and economic challenges of our time.

The 7th Energy Research Programme (BMWK 2017) has a key role to play in this context by establishing a link between the long-term goals of the Federal Government as strategic objectives and the time horizons of applied technology research. In this way, government support for technology development and innovation is intended to make a significant contribution to accelerating the transformation, strengthening Germany as an industrial location and preventing risks for society as a whole. The ERP follows the basic principles of technology-open funding, extends project funding to include system integration and cross-system topics, and strengthens international and European cooperation. The focus is on innovation and technology transfer.

The overarching target system is shown in figure 1.

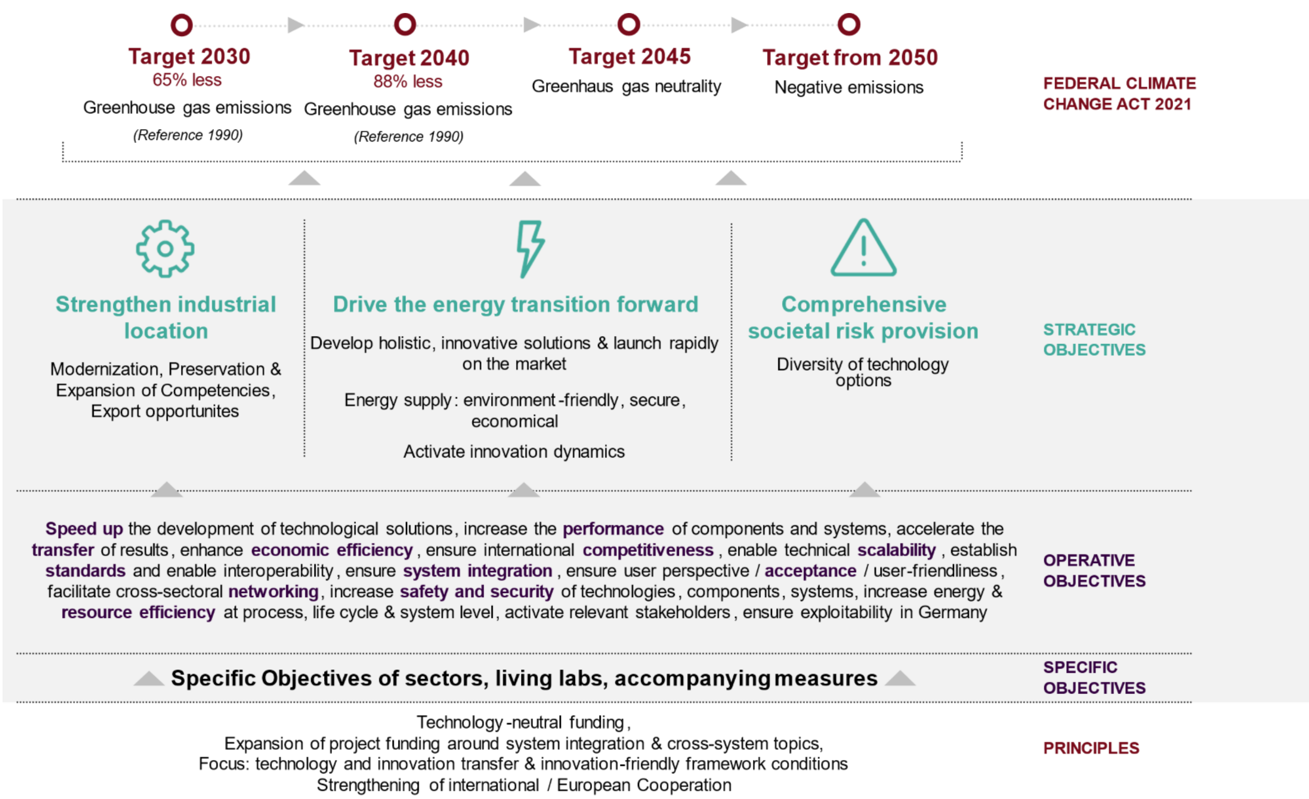

Figure 1: Objectives of the 7th Energy Research Programme. *Source: Dinges et al., 2022, p. 59*

There are fourteen operational objectives that apply equally to all sectors, the living labs and the accompanying measures and are pursued across the board. The overall target system of the ERP - and therefore the scope of the evaluation - is much broader. In addition to the operational objectives, there are specific objectives for each of the 18 sectors (i.e., various consumption and energy supply sectors as well as system integration and cross-system sectors), for the living labs and the accompanying measures, which were derived from the needs of the sector when the programme was developed.

The initial evaluation approach

The evaluation was planned to consist of three fixed evaluation rounds. This approach was proposed by the evaluation team and agreed upon with the ministry. In these rounds, primary data collection, consisting of online surveys and interviews, as well as secondary data analyses were to be carried out at intervals of about 1.5 years in order to assess the progress of the programme. In addition, in-depth topical investigations were planned to be selected in each of these three rounds in order to focus on issues of particular interest to clients at that time. These in-depth topics were not pre-defined and had to be explicitly selected developing an individual research approach.

To ensure regular communication with clients, every four weeks, a regular meeting was held with the project management of the Federal Ministry for Economic Affairs and Climate Action, the evaluation team and the evaluation experts of the funding agency to discuss the evaluation activities. In addition, a quarterly meeting was held every three months, which was also attended by the responsible heads of the two commissioning departments, as well as representatives of the Ministry involved in the programme and of the funding agency. The main purpose of these quarterly meetings was to receive feedback on the evaluation results, but in some cases to plan further evaluation steps. A number of expert workshops, whose content and participants were also not defined in advance, were additional flexible elements, in which, for example, presentations or workshops could be held.

The evaluation’s learning cycle

According to the agreed evaluation approach, the evaluation of the ERP is intended to facilitate the optimisation of programme implementation and management during the programme period, thereby enabling 'programme learning'. To this end, a structured cycle had been designed (see Figure 2), which included three 'learning events' (shown in the inner circle of the following figure):

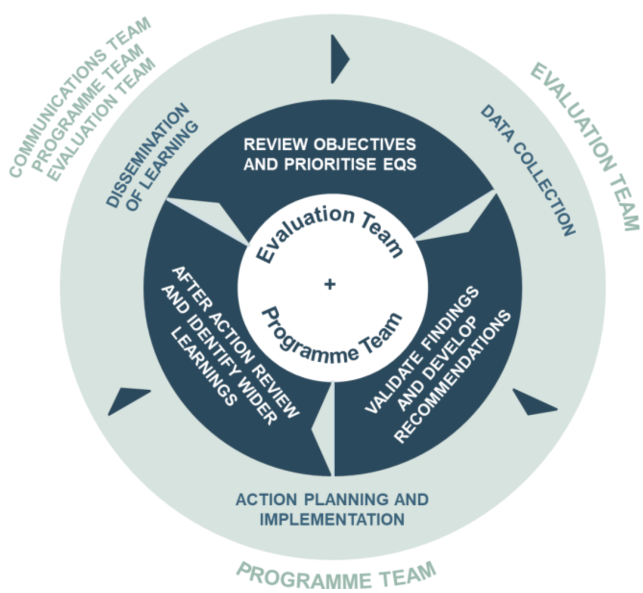

Figure 2: Learning cycle for programme learning. *Source: Own illustration*

A similar learning cycle had been used successfully in another multi-year evaluation. It ensures stakeholder involvement for reflections on changes in programme's objectives and environment, uses participatory elements for sense making, validation and action planning and also actively seeks reflection for further development. Thus considering research findings on learning processes during the evaluation.

Review objectives and prioritise evaluation questions

In light of the complex target system it seemed to be necessary to ensure that at the beginning of each evaluation phase, the programme objectives would be reviewed for any changes and updated if necessary. Changes can relate to the different levels of the target system and therefore have different effects:

- Changes to the strategic targets (e.g., climate protection legislation): These targets are set by the federal government and have a long-term, overarching character. The fundamental assumption is that the ERP is not fundamentally jeopardised by a change in the overarching goals. Changes are adopted as necessary and apply to all activities of the ERP over its entire term (i.e., also retroactively for projects already underway).
- Amendments to the strategic objectives can occur for several reasons. Changes may be needed to align with newly established overarching goals or due to significant adjustments to existing strategic objectives. Each amendment must be evaluated on a case-by-case basis to determine if the changes apply to all ongoing and future activities or only to particular parts of the programme.
- Changes to operational objectives: It is important to note that operational objectives are linked to specific indicators for evaluation purposes. This allows for the establishment of future target values for these objectives. Because of their impact on project direction, changes to operational objectives will apply to all projects that submit an application after the change.
- Changes to the specific objectives of the sectors, living labs, accompanying measures: Changes at this level of the target system are made in addition to the existing targets and apply to all projects that submit an application after the change.

In addition, the evaluation questions were also to be reviewed at the beginning of each round of a new evaluation phase and, if necessary, adapted in consultation with the client. It was assumed that all evaluation criteria would be retained, as the purpose of the evaluation will not change fundamentally. The focus is to identify the questions that are of particular interest to the programme owners in the specific context. These questions were given special attention in the next round of the evaluation. The choice of in-depth topics is a particular manifestation of this prioritisation. The in-depth investigations allow particularly relevant issues to be analysed in detail as part of the accompanying evaluation. The aim of these studies on in-depth topics is to obtain detailed findings on selected aspects of the programme regarding the impact in certain sectors or target groups. For each of these studies on in-depth topics, a separate concept was developed and agreed with the client, in which the focused questions and their relation to the overarching evaluation questions, the methodological approach, specific data collection instruments, as well as timetables and necessary resources for the studies were defined.

Validating the results and deriving recommendations for action

After the completion of an evaluation round (results of the basic analysis and the in-depth analysis), observations, conclusions and options for action are presented by the evaluation team in a joint reflection meeting and discussed and validated together with the responsible persons at the BMWE and the funding agency. The aim of the reflection meetings is to gain insights into the following questions:

- Which intended and unintended mechanisms of action and (preliminary) effects of the programme were observed during the evaluation period?
- Were the instruments and accompanying measures adequate in view of the observed and expected developments of the programme and its environment? Are there gaps? In which areas are changes necessary?
- What measures can be taken to make improvements during the programme period? What principles should be followed in designing the measures?

During the reflection meeting, recommendations for action are collaboratively developed, the individuals responsible for implementing these recommendations are identified, and a timeline for execution is established. The progress on these recommendations is reviewed in the subsequent evaluation cycle.

Conclusion of the evaluation round and identification of wider learnings

Feedback on the completed evaluation round gathers what went well in this process and should be maintained, and what can be improved in the next evaluation round. These conclusions were also to be used to adapt the evaluation concept. In addition, the key findings of the evaluation round were identified which are of general interest and should therefore be disseminated. This includes the identification of audiences for dissemination and the selection of appropriate formats. In principle, the results can be of interest to the ministry, the funding agency, the general public, the ERP 7 research community or the evaluation community.

Roles and responsibilities within the learning cycle

These three "learning events" (review of objectives and evaluation questions, validation of the results and conclusion of the evaluation round) are primarily aimed at the responsible programme designers at the BMWE and the responsible stakeholders at the funding agency. This means that representatives of the BMWE key departments are the main participants in the group. It made sense to use the quarterly meetings for this purpose.

The activities that take place between these meetings are shown in the outer circle of Figure 2. For example, data collection for the evaluation is primarily the responsibility of the evaluation team, implementation of the recommendations for action is primarily the responsibility of the funding agency and the ministry. The dissemination of the results is the responsibility of the specialized departments at BMWE responsible for ERP 7 or responsible for public relations and communication at the BMWE and the funding agency, or the evaluation team, depending on the target group (e.g. conferences to reflect on the approach).

Conducting the evaluation

As a first step in the evaluation, after an exploratory phase with first interviews and data analysis in 2021, the evaluation approach was further developed in 2022. The first baseline analysis started in summer 2022, during which the first in-depth studies were carried out. For instance, the heat transition study highlighted key topics for the 7th ERP in that technology. A first interim report of the evaluation was published in 2023 (Dinges et al., 2023). It provided first insights on the the progress of the energy transition in Germany and the programmes’ contribution to it, the significance of the ERP to the target groups and the achievement of its objectives so far.

Significant changes at the end of 2022 impacted the evaluation and learning design unexpectedly. ERP 7 was originally intended to run until 2027 or longer but was then terminated at the end of 2024 because the Ministry for Economic Affairs and Climate Action wanted a refocused energy research programme with a clear connection between energy research and energy policy. This meant that preparatory work for the planning and implementation of the 8th Energy Research Programme had to be carried out in parallel with the accompanying evaluation of the 7th Energy Research Programme. Additional resources of the evaluation were requested and used in this process. In 2023, three topics were examined closely to inform the design of the new programme. These included:

(a) A stakeholder analysis: Target groups of the programmes were investigated in detail at an organisational level to assess the potential size of the target groups and identify groups of stakeholders that need to be addressed and included in the programme activities.
(b) A second in-depth study focused on related funding measures and interventions that go beyond the funding of energy research, highlighting the different funding mechanisms that exist and where improved coupling with energy research is seen.
(c) The third topic was dedicated to mission orientation. The 8th Energy Research Programme was designed as a mission-oriented programme. The evaluation team advised on the 8th Energy Research Programme by analysing current mission-oriented research and discussing its implications in workshops with BMWE.

In addition, several workshops and feedback sessions were held on the formulation of objectives for the 8th ERP to ensure evaluability. Of course, all these changes also meant that the planned learning cycle had to be adopted according to upcoming needs.

Results: Changes to the evaluation’s learning cycle

The following consequences could be observed:

- **Review of the objectives:** This review was no longer necessary. With the start of the 8th ERP in the beginning of 2024 all changes deemed necessary had been incorporated into the new research programme. Therefore, the target system of ERP 7 did not change significantly and could be maintained as it was defined at the beginning of the evaluation. The scope of the evaluation was widened to include an ex-post assessment of ERP. The system of objectives will now be used to assess the overall effectiveness of the programme.
- **Prioritising evaluation questions**: Focused data collection and analyses for the evaluation rounds were achieved by prioritising evaluation questions, as interim reports needed to be brief and clear. The in-depth studies proved to be an essential instrument for ensuring the flexibility of the evaluation, as did the workshops, which were not pre-determined and could be used to develop and deepen specific themes. The in-depth studies provided the opportunity to work on the three themes mentioned above, which were highly relevant to the 8th ERP. However, in addition to using the evaluation, the responsible unit also used a broad consultation process to prepare the 8th ERP. Comments were sought from various stakeholders and interest groups and used in the preparation of the 8th ERP. They also collaborated with a research project on innovation issues, which they used to plan the governance structures for the new programme. In this way, the Ministry obtained a broad base of external perspectives and used them to shape the 8th ERP (BMWK 2023).

- **Validating the results and deriving recommendations for action**: After each evaluation round a presentation took place in which findings were discussed with the programme owners. Suggested recommendations by the evaluation team were discussed and challenged which led to more useful and practice-orientated recommendations. However, no clear action plans were discussed with the evaluation team. Since the first interim report fed into the stakeholder consultation, all activities at this point in time were directed towards developing the 8th ERP.
- **Conclusion of the evaluation round:** The planned reflection round did not take place in this form due to the changed evaluation approach. Due to time constraints preparing the new programme a reflection of the first phase of the evaluation did not take place. In retrospect, it is a weakness that this was not followed up consistently enough by the evaluators, as a more intensive reflection on what went well could certainly have improved the evaluation, both in terms of content and cooperation with the BMWE. Thus, it could have strengthened the process use of the evaluation even further.
- **Identification of wider learnings**: The evaluation team used a new conceptual approach for the evaluation combining a theory-based approach with multi-level perspective innovation system thinking and the concept of transformative outcomes. It shared learnings on a wide range of evaluation and innovation research conferences giving 2-3 presentations per year.

Conclusions

Based on the experience with the ongoing evaluation of the 7th ERP in a transitional process of two programme generations, whose orientation differs significantly, the following findings can be derived:

- It was very useful to include in-process learning in the evaluation approach. The learning cycle with the three learning occasions proved to be helpful, even if it could not be implemented consistently. If the review of the evaluation phase with the client does not occur, the evaluation team can only rely on its own reflections for the next phase. Important information to adapt to the client's needs will be unavailable.
- The in-depth studies with short-term adjustments to client interests allowed for a flexible evaluation responsive to external changes.
- Close and regular communication between the evaluation team and the client is useful for recognizing and responding to changing interests and needs promptly. It also helps to build trust between the client and the evaluation team so that political and administrative challenges are shared at an early stage.
- Evaluation in a challenging environment requires both consistency and flexibility within the evaluation team.
- Evaluations typically have fixed budgets and concepts. However, this tender included an option for additional funding. The evaluation concept was revised, allowing the team to provide extra services. Unforeseen challenges, especially in long-term evaluations, require flexibility. Optional services or flexible hourly budgets can help address these issues.

Again, there have been external events that have had an impact on the evaluation. The collapse of the German federal government and following general elections in 2025 were not foreseeable. Audiences for evaluation results and their interests shifted, impacting the evaluation. A recommendation for formative evaluations is that they should closely involve stakeholders, contain flexible elements to give adaptability and create room for reflection, sense-making and learning.

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