

External evaluation

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Support to Mongolia's Quality Infrastructure with particular regard to the energy sector



Country Region:	Mongolia
Project number:	2018.2122.2
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Lead executing agency:	Ministry of Energy (MoE)
Executing agency(ies):	Mongolian Agency for Standardisation and Metrology (MASM)
PTB Section:	9.32 Asia
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This evaluation is an independent assessment. Its contents reflect the assessor's opinion which is not necessarily equivalent to PTB's view.

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List of abbreviations

APMP	Asia Pacific Metrology Programme
BMZ	Federal Ministry for Economic Cooperation and Development <i>Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung</i>
CMC	Calibration and Measurement Capabilities
DC	Development Cooperation
EE	Energy efficiency
ERC	Energy Regulatory Commission
IEC	International Electrotechnical Commission
iKZE	Intermediary short-term experts <i>Intermittierende Kurzzeitexperten</i>
ISO	International Organization for Standardization
MASM	Mongolian Agency for Standardisation and Metrology
MoE	Ministry of Energy
NEC	National Electrotechnical Commission
NPTGC	National Power Transmission Grid Company
OECD-DAC	Organization for Economic Cooperation and Development – Development Assistance Committee
PTB	Physikalisch-Technische Bundesanstalt
QI	Quality Infrastructure

1. Summary

Object of the evaluation was the project „Support to Mongolia’s Quality Infrastructure with particular regard to the Energy Sector”, with the objective “Quality infrastructure services needed to increase energy efficiency are improved”. A functioning energy sector is essential in Mongolia, both for the population and for economic development. At the same time, it is Mongolia’s largest contributor to greenhouse gas (GHG) emissions, accounting for about two thirds of the country’s GHG emissions. Increasing energy efficiency, which is currently extremely low in Mongolia, is therefore of central importance. To implement the ambitious political goals, a functioning QI is required, in particular demand-oriented services in the field of metrology, standardisation, technical regulations, and testing. However, at the start of the project, Mongolia's national quality infrastructure was not sufficiently capable of providing the necessary services.

The evaluation was carried out between April and June 2023 by the independent evaluator Fritz Kölling, based on the review of project documentation, online interviews with stakeholders, and self-evaluation of the project team. Additionally, the Capacity WORKS factors were assessed and provided input to the evaluation of project steering and project implementation under the effectiveness criterion. The results are summarized in the following tables:

Assessment according to the OECD DAC criteria

Criterion	Evaluation of the criterion
1. Relevance	1.3
2. Coherence	2.0
3. Effectiveness	1.5
4. Efficiency	2.0
5. Impact	2.0
6. Sustainability	2.3
Global assessment	1.9

- Since effectiveness, impact or sustainability were rated "4" or worse, the global assessment is downgraded to "4" although the mean would actually be better than "4".
- No downgrading of the global assessment.

Relevance	By targeting the energy sector and specifically focusing on energy efficiency, the project addresses the needs and demands of Mongolia's energy sector. It aligns with national and international strategies,
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	<p>supporting the country's sustainable development goals and fulfilling its international commitments.</p> <p>Mark: Very successful (1.3)</p>
Coherence	<p>The project aligns well with the national efforts and existing quality infrastructure bodies and regulations. It also contributes to the dissemination of international standards and participates actively in relevant international committees. However, the project falls short in fully capitalizing on potential synergies with other German projects and lacks systematic coordination with other donor programs.</p> <p>Mark: Successful (2.0)</p>
Effectiveness	<p>Despite the impairment caused by the COVID19 pandemic, the project has largely achieved its goals and even partially exceeded the indicators. Its activities, inputs and outputs have contributed significantly to the achievement of the objectives. The quality of the implementation was good. In addition, it has produced other positive effects such as growing awareness of the importance of QI in the energy sector.</p> <p>Mark: Very successful (1.5)</p>
Efficiency	<p>The project shows good production and allocation efficiency. The Modes of Delivery were suitable for achieving the objective. There were few inefficient activities. However, the procurement of important equipment was delayed due to internal PTB processes. The partners participated in an appropriate manner. However, little use was made of potential synergies with other German projects and international donors.</p> <p>Mark: Successful (2.0)</p>
Impact	<p>There is a high probability that the project will contribute to the achievement of higher-level development results such as improved energy efficiency and reduction of CO₂ emissions. However, a direct contribution can only be proven in individual cases and has not been significant to date (e. g. cost reduction through better QI services in laboratories and companies). There is no evidence that private consumers benefited directly from the project, but it also did not cause negative impacts.</p> <p>Mark: Successful (2.0)</p>
Sustainability	<p>The project has effectively strengthened the capacity of stakeholders to continue the positive results. The durability of the results is reasonably ensured. The main risks are the lack of financial capacity and the fluctuation of human resources of MASM. By leveraging opportunities and addressing challenges, the project has a potential for the long-term continuation of its positive outcomes.</p> <p>Mark: Successful (2.3)</p>

The main recommendations are to continue with the adoption of standards in the field of energy efficiency and maintain the presence in international organisations and networks. The partners should also maintain the Working Groups as instrument for coordination which has been an important benefit of the project. As the need for better QI services in the energy sector is still pending and new topics will arise in the transformation process towards a climate neutral economy. While maintaining the relationship with the academic sector, it is recommended to involve the private sector stronger (industry and business associations). In addition, it is crucial to create awareness for the importance of QI on higher political levels. To get further financial support, it is necessary to link the ongoing activities with the “Standard and Development Program”, so that new relevant topics, such as Renewable Energies, can be targeted. For these technologies, new standards will be needed to secure their quality.

2. Introduction

Object of the evaluation was the project „Support to Mongolia’s Quality Infrastructure with particular regard to the Energy Sector”, which is part of the program “Energy Efficiency in Mongolia” of the German development cooperation. For now, it is the last bilateral project of PTB in Mongolia. The geographic scope is the whole country of Mongolia. After a modification offer, the implementation period was extended until 08/2023 and the budget was increased from 1,000,000 EUR to 1,250,000 EUR. The reason were the delays in implementation due to the COVID pandemic.

Project	Support to Mongolia’s Quality Infrastructure with particular regard to the Energy Sector
Objective	Quality infrastructure services needed to increase energy efficiency are improved.
Term	01.09.2019 – 31.08.2023
Volume	1.250.000 EUR
Political partner	Ministry of Energy (MoE)
Main implementing partner	Mongolian Agency for Standardisation and Metrology (MASM)
Evaluation period	04 – 06/2023

For the International Cooperation Group of the German National Metrology Institute, the *Physikalisch-Technische Bundesanstalt* (PTB), project evaluations are an important instrument for the quality assurance of its cooperation and advisory services. They serve as a means of accountability vis-à-vis the partners and the Federal Ministry for Economic Cooperation and Development (BMZ), which finances the German contribution to the present project. The recommendations of this evaluation are also expected to serve the project partners, as well as other quality infrastructure (QI) institutions and stakeholders in Mongolia (such as regulators, laboratories, companies, and universities). The evaluation was carried out between April and June 2023 by the independent evaluator Fritz Kölling, based on the review of project documentation, online interviews with stakeholders, and self-evaluation of the project team. Specific topics of the evaluation were: sustainability of results; effectiveness of online training activities and practicability of online evaluations.

3. Framework conditions and strategic approach of the project

3.1. Framework conditions

In view of the enormous differences between minimum and maximum temperatures, a functioning energy sector is essential in Mongolia, both for the population and for economic development. Mongolia is one of the most coal-intensive countries in the world, with coal accounting for 91% of electricity generation and 97% of heat production (IRENA, Mongolia

Energy Profile 2020). This results in a very high CO₂ intensity of the energy sector and a heavy burden of air pollutants. The energy sector is Mongolia's largest contributor to greenhouse gas (GHG) emissions, accounting for about two thirds of the country's GHG emissions. According to Mongolia's nationally determined contributions, GHG emissions will increase to 51.5 million tons of carbon dioxide (mtCO₂) by 2030 in the business-as-usual scenario, with energy's share of total emissions increasing to 81.5%. The country targets reducing GHG emissions by 7.3 mtCO₂ by 2030 through emission reductions from power generation (4.9 mtCO₂), industry (0.7 mtCO₂), and transportation (1.7 mtCO₂) (ADB, 2023).

The negative environmental impacts are exacerbated by rising energy consumption, due to increasing demand in private households, the economic growth of recent years and the losses within the heat distribution network. This will not change significantly in the coming years, as it can be assumed that the energy sector will remain dependent on coal, at least in the medium term. To reduce the environmental impacts and the costs of the energy supply, increasing energy efficiency, which is currently extremely low in Mongolia, is therefore of central importance. Against this background, political goals were included in the long-term strategy (Mongolia Sustainable Development Vision 2030), the energy strategy (Government Policy on Energy) as well as the National Energy Efficiency Action Programme (2018 - 2022), and with the Energy Conservation Law (2015), the legal framework was established to promote energy efficiency.

To implement the above-mentioned political goals, a functioning QI is required, in particular demand-oriented services in the field of metrology, standardisation, technical regulations, and testing. Metrological services form the basis for the correct determination of energy consumption. Testing laboratories provide reliable analysis results on the energy efficiency of products and processes. The standards system defines efficiency criteria and creates the basis for internationally standardised processes and systems to increase energy efficiency. Technical regulations can refer to this when legally binding requirements are necessary. The Metrology Act, which was drafted as part of the predecessor module, was adopted by parliament in May 2019 after many years of political delays. It allows the development of metrological capacities, which are not yet available in MASM, in laboratories of electricity transmission companies. In addition, MASM regional centres became officially responsible for providing calibration services.

Despite the progress made in the previous module, at the start of the project Mongolia's national quality infrastructure was not sufficiently capable of providing the services required for the implementation of the policy objectives. As a result, the quality infrastructure could not contribute sufficiently to increasing EE (core problem). This resulted in the module objective of the evaluated project: Quality infrastructure services which are needed to increase energy efficiency are improved.

MASM plays a central role within the national quality infrastructure. In metrology, it offers services in the areas of voltage, resistance and resistance decades, electrical energy and power but it lacks the human and technical capacity to provide important services needed to improve energy efficiency. Various laboratories in Mongolia offer services in the field of testing which can contribute to increasing energy efficiency, for example for the analysis of thermal insulation properties. However, the test procedures are often not accredited, there is a lack of

trained personnel and quality management measures, so that the reliability of the test results is not guaranteed. In the field of standardization, there is still little coordinated practice in the adoption of international standards. These include, for example, the standards of the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the Russian standards (Gossudarstwenny Standart, GOST) as well as relevant Chinese and Korean standards. In the previous module, the creation of a standardization strategy was supported, which defined priorities, specifies a work plan and includes the involvement of interested parties. The National Electrotechnical Committee (NEC) was reorganized with greater participation from the academic and private sectors. In addition, 19 relevant IEC standards were identified and translated so that they can now be adopted in the Mongolian set of standards.

The demand for quality infrastructure services to promote energy efficiency is still relatively low. The most important reason for this can be seen that so far very few private homes have heat meters. Although electricity meters are installed in many households, their reliability could not be guaranteed as the necessary quality infrastructure did not exist before the project. As a result, there is no monetary incentive for consumers to save electricity and heat energy. Electricity and heat meters are - if at all - only gradually retrofitted in existing apartments and installed in new buildings. Although a tariff system has been adopted, it has not yet been applied.

3.2. Strategic approach of the intervention

The project strategy is visualized in a simple results model, which reflects the relation between module objective, the three outputs, and the program objective. However, it doesn't provide more detailed information about additional results and the underlying hypothesis. Only for one of the outputs a more differentiated chain of results is elaborated. The module objective is: "Quality infrastructure services needed to increase energy efficiency are improved." The three main indicators are formulated in an adequate way and reflect the module objective:

1. 2 additional services of metrological laboratories comply with the standard for quality management in calibration and testing laboratories ISO/IEC 17025:2017 for an international recognition.
2. 10 strategic, normative, or regulatory documents are prepared for adoption, taking into account international good practice (with the modification offer from 2021 the value was increased to 12).
3. The use of metrological services for electrical measuring instruments and for testing services in the energy sector has increased by 20 % in selected laboratories.

The project follows a multi-level approach with a focus on strengthening the technical capacity and institutional competencies of QI organizations (meso level). The macro level is primarily achieved through information events for political decision-makers and improving the normative and regulatory framework. The project aims at achieving **three main outputs**:

The module supports the improvement of the services of selected metrology and testing laboratories (**Output 1**). In addition to the National Metrology Institute in Ulaanbaatar, the module aims to support the development of a designated institute (the laboratory of the

National Power Transmission Grid Company NPTGC), and to strengthening three regional centres and possibly other testing laboratories. By internationally recognizing the Calibration and Measurement Capabilities (CMCs) or accreditation according to ISO/IEC 17025:2017, the technical competence of the laboratories is demonstrated to the customers. This can increase confidence in the services provided in the medium and long term. In addition, the development of organizational structures and processes of relevant bodies is supported, considering good international practice (**Output 2**). In particular, the project aims to enable the integration of international standards in the Mongolian standards system and, at the same time, meet the requirements of the stakeholders in the energy sector to increase energy efficiency (EE). Furthermore, the formation of new working groups for the preparation of technical regulations is supported, for example in the field of heat meters. To increase the knowledge about the relevance of QI services for increasing EE (**Output 3**), QI training materials have been developed in cooperation with training providers and teachers have been trained. With information measures, the project aims to raise awareness amongst decision makers in the energy sector. The project has provided one coordinator with the support of a project assistant (both based in Braunschweig), an intermittent short-term expert (iKZE) to advice on energy efficiency issues and a national consultant to assist the project team on site. Other short-term experts are deployed to provide specific thematic consulting services. For the procurement of laboratory equipment and consumables, 125.000 EUR were earmarked.

4. Evaluation methodology

4.1. Evaluation design

The evaluator has assessed the results achieved in the project from the point of view of the OECD-DAC criteria: relevance, coherence, effectiveness, impact, efficiency, and sustainability. As it is the last bilateral project of PTB in Mongolia, a specific focus was on the sustainability of the achieved results. Additionally, the Capacity WORKS factors were assessed and provided input to the evaluation of project steering and project implementation under the effectiveness criterion. The following specific evaluation questions (developed by the project team) were assessed:

- How important was PTB's support in the energy sector in Mongolia in terms of added value for other German implementing organisations and their projects?
- How can the sustainability of the project interventions be ensured by the regional project (MEDEA) of PTB and other implementing organisations and projects?
- How important was this project for Mongolia's energy-efficient orientation and how sustainable are the developments initiated by it?
- What lessons could be learned from the COVID-driven transition towards online/virtual formats of project coordination and implementation?

The evaluation paid particular attention to the following aspects from the point of view of cross-project learning: lessons learned in the field of energy efficiency, effectiveness of training measures, steering structure, and sustainability of the PTB contribution to a long-term project which phases out.

The evaluation was conducted remote (online). A sufficient quality of data was guaranteed by applying different methods of data collection and analysis:

- Review of project documentation such as the project proposal, the logical framework, operational plans including monitoring, information on counterparts, progress reports, joint reports, sectoral information related to renewable energy and energy efficiency, among others.
- Semi-structured interviews, based on an interview guide. The questions were geared towards the evaluation criteria and the specific questions. The data collected in this way were categorised and interpreted by means of qualitative content analysis. The interviews served to check and compare the results of the reports and literature data with the perceptions of the actors. Most of the interviews were conducted using a translator.
- An important source of information was the self-evaluation of the project by the PTB project team (project coordinators and short-term experts, permanent iKZE and national consultant). The team filled in the self-assessment questionnaire prepared by PTB, based on the five success factors according to Capacity WORKS.

4.2. Data sources; data quality

The main sources of the data upon which the analysis and measurement of the results are based were the project offer, annual reports to BMZ, documentation of steering group meetings, reports of consultants and the documentation of Capacity WORKS instruments such as a Capacity Development Strategy. They were of sufficient quality.

Interviews were held with all main stakeholders in an open and frank atmosphere (see the list of interviews in the annex). The statements of the Mongolian partners were triangulated with the statements of the project team. Overall, no major contradictions could be observed between the statements of the different interview partners. The results coincided with the data extracted from the project documentation.

The preliminary results were discussed and validated at the end of the interview phase through a virtual meeting (26 of June 2023) with the most important counterparts in Mongolia (MoE, MASM, ERC). Besides some minor clarifications, the participating partners agreed with the results presented by the evaluator.

5. Evaluation results

5.1 Status of the transformation process (OECD/DAC)

Marking scale for the evaluation of the OECD/DAC criteria

Evaluation	Grade	Description
very successful	1	very good result, far above expectations
successful	2	good result, entirely meets expectations
successful to a limited extent	3	satisfactory; results are below expectations, but mainly positive
rather unsuccessful	4	unsatisfactory result; below expectations; negative results prevail despite several positive results
mainly unsuccessful	5	negative results clearly prevail despite several positive partial results
entirely unsuccessful	6	the project has failed completely; situation has rather deteriorated

5.1.1 Relevance

The intervention's design is geared to country-specific, regional, and global policies and priorities of the partners and the BMZ.

Overall, the objectives of the intervention are geared to the partners' policies and priorities. Mongolia's energy sector is undergoing significant transformation processes, including the

renovation of the grid by substituting old Russian equipment, increasing energy efficiency to reduce air pollution and CO₂ emissions, and transitioning to consumption-based payments of energy services through the implementation of smart meters.

In the project design, all relevant documents of the political and institutional framework have been considered. The project is in line with Mongolia's relevant national strategic framework, which includes the National Green Development Policy (2014) and the Energy Savings Law (2015). These policies emphasize the importance of sustainable development and energy efficiency, which are directly addressed by the project. By implementing energy efficiency measures, the project contributes to achieving the objectives outlined in these strategic documents. Furthermore, the strong involvement of the Ministry of Energy (MoE) as the project's political counterpart highlights the importance of the topic "Quality Infrastructure in the Energy Sector." This indicates the recognition of the significance of establishing a reliable and efficient energy infrastructure to support Mongolia's energy transition goals.

The intervention's design is geared to the German DC programme, the BMZ's country strategy and the BMZ's sectoral concepts. It contributes to the achievement of the programme objective:

Make an effective contribution to the economically and ecologically more sustainable provision and use of energy and to security of supply.

In terms of international relevance, the project aligns with various agreements and strategies, including the Sustainable Development Goals (SDGs) and the Paris Agreement (2015). The SDGs emphasize the importance of affordable and clean energy, while the Paris Agreement aims to combat climate change and reduce greenhouse gas emissions. By promoting energy efficiency and reducing emissions, the project contributes to both international commitments.

The intervention's design is geared to the needs and capacities of the target groups.

The project addresses the demands of the target groups. These are (according to the project proposal) the users of QI services in the energy sector (generation, transmission, and distribution companies and laboratories), who require clarity on quality requirements and a QI that offers adequate services to meet these requirements. The project also addresses the demands of private consumers of electricity. There are currently 800,000 electricity meters in Mongolia. Their reliability depends on these services. The project aims to fulfil these demands and improve the quality and reliability of the energy sector. Although it does not directly address the energy efficiency of electric appliances, which would be a direct benefit for the consumers, it has supported the establishment of technical committees in this field.

Due to the subject, there is no specific focus of the project to the needs and capacities of particularly disadvantaged and vulnerable beneficiaries and stakeholders. All consumers of electricity in Mongolia benefit from the QI services which have been improved by the project.

The intervention's design is appropriately, realistically and plausibly geared towards achieving the intervention's objective.

The intervention’s design is appropriate and realistic (in terms of technical, organisational, and financial aspects). The modes of delivery (instruments) have proved to be adequate. The goals are realistic but ambitious enough, and the budget has been sufficient to carry out the activities.

The intervention’s design is precise and plausible. The results can sufficiently be linked to the interventions of the project. The three indicators have been formulated according to the SMART criteria and reflect the module objective.

The design focussed primarily on the improvement of QI services. Social aspects did not play a role. Economic aspects in so far, as the costs of measurements / calibration and the financial situation of MASM was considered. Indirectly, on the level of higher development goals, improved QI services (as a precondition for energy efficiency) contribute to economic development and environment protection. However, in the design the direct benefits for increase in energy efficiency were not explicitly described. The outputs and activities were not directly related to significant energy savings and, consequently, the monitoring system also was not designed to monitor the effects on this level. (This makes it later difficult to evaluate the impact of the project, see chapter 5.1.5).

The intervention’s design has responded to changes in the environment and adapted to the needs.

The intervention’s design has responded appropriately to changes in the environment, in particular to the COVID19 pandemic, which hit the project shortly after the beginning of the implementation. Because of the delays caused by the pandemic, PTB submitted a change offer to BMZ. As consequence, the project was prolonged, and the budget increased from 1,000,000 to 1,250,000 Euro.

Summarized evaluation

Considering all these factors, the relevance of the energy efficiency project of PTB in Mongolia is valued as "very successful." By targeting the energy sector and specifically focusing on energy efficiency, the project addresses the needs and demands of Mongolia's energy sector. It aligns with national and international strategies, supporting the country's sustainable development goals and fulfilling its international commitments.

Criterion	Evaluation dimension	Weighting	Appraisal
Relevance	The intervention’s design is geared to country-specific, regional and global policies and priorities of the partners and the BMZ.	25 %	1

	The intervention's design is geared towards the needs and capacities of the target groups	25 %	2
	The intervention's design is realistically and plausibly geared towards achieving the intervention's objective	25 %	1
	The intervention's design has responded to changes in the environment and adapted to the needs.	25 %	1
Global assessment of the relevance			Very successful (1,3)

5.1.2 Coherence

Internal coherence: Within German development cooperation, the intervention was designed and implemented in a complementary manner, based on the division of tasks.

On a general level, the project is designed in a complementary manner within German development cooperation. The planned outputs correspond to the objectives of the programme and there are potential areas where synergies between the German implementing agencies could be generated. There is coordination and ongoing communication with a PTB project that works with the regional metrology networks Asia-Pacific Metrology Program (APMP) and Asia-Pacific Legal Metrology Forum (APLMF) - in short: the MEDEA project, as well as with German Technical Cooperation *Deutsche Gesellschaft für internationale Zusammenarbeit* (GIZ) and the German Development Bank *Kreditanstalt für Wiederaufbau* (KfW). During the visits of the project coordinators in Mongolia, regular meetings with GIZ and KfW have been held. However, it is noted that there is no common strategy among these programs, despite the potential for synergies. For example, KfW is financing the renovation of the transmission grid, for which the establishment of measurement facilities for high voltage and current in NPTGC means an important contribution. There has been no coordination with KfW with regards to this activity. With the GIZ energy programme, some joint activities have been carried out. In the field of energy manager and auditors training, synergies have been leveraged. In other areas there would have been more opportunities, but GIZ is focussing its activities mainly in the building sector, while PTB targets the power sector. GIZ addresses the thermo-technical rehabilitation and improve energy efficiency in prefabricated concrete residential buildings. Another project aims to enhance the quality of vocational training in the installation, operation, and maintenance of energy-efficient heating solutions. Generally, it must be added that the planned exit of development cooperation with Mongolia did not help to stimulate long-term cooperation between the implementing organisations.

The project actively contributes to the dissemination and application of international standards, such as those developed by ISO and IEC. By promoting the use of these standards, the project

enhances the compatibility and interoperability of the country's quality infrastructure with international systems. This is crucial for facilitating trade, promoting competitiveness, and ensuring the acceptance of the country's products and services in the global market.

External coherence: The intervention’s design and implementation complement the partner's own efforts and are coordinated with other donors’ activities.

Generally, the project complements and supports the partner’s own efforts to improve the QI system for energy efficiency and strengthen the existing QI bodies.

While the project demonstrates strong engagement in international networks like APMP and IEC (where MASM provides an affiliated leader since 2021) and facilitates the accreditation of internationally recognized laboratories, there is no systematic coordination with the activities of other donors or programs, such as the ADB and the new USAID project. This represents a missed opportunity for enhanced coordination and collaboration to achieve greater impact and avoid duplication of efforts.

Overall, the intervention’s design has been geared to the use of existing systems and structures. It demonstrates a strong alignment with existing QI bodies and regulations in the country. It complements and supports the efforts of the main local QI actors, such as MASM. This indicates that the project is well-integrated into the existing national framework for quality infrastructure. By leveraging the resources and expertise of these local actors, the project can effectively contribute to the development of the sector and avoid duplication of efforts.

Summarized evaluation

Overall, the project achieves a successful level of coherence. It aligns well with the national efforts and existing quality infrastructure bodies and regulations. It also contributes to the dissemination of international standards and participates actively in relevant international committees. However, the project falls short in fully capitalizing on potential synergies with other German projects and lacks systematic coordination with other donor programs. By improving coordination and collaboration with other stakeholders, the project could enhance its effectiveness and amplify its impact.

Criterion	Evaluation dimension	Weighting	Appraisal
Coherence	Internal coherence: Within German development cooperation, the intervention was designed and implemented in a complementary manner, based on the division of tasks.	50 %	2

	External coherence: The intervention's design and implementation complement the partner's own efforts and are coordinated with other donors' activities.	50 %	2
Global assessment of the coherence			Successful (2.0)

5.1.3 Effectiveness

The intervention has achieved its objective (at outcome level) according to the indicators agreed upon.

Overall, the project has achieved its objective according to the agreed indicators, even though the COVID19 pandemic has hit the implementation heavily. The following table shows a high degree of fulfilment. Indicator 1 has not been achieved so far but it is probable that it will be achieved until the end of the project. In case of indicator 2, the agreed number of documents prepared for adoption, could not be reached. But 4 documents were not only prepared for adoption but already adopted during implementation. Indicator 3 shows an over-achievement, as the number of calibration services has exceeded the agreed 20 % by far.

Outcome indicator	Degree of fulfilment (in %)	Appraisal (A-C)*	Justification
1. 2 additional services of metrological laboratories comply with the standard for quality management in calibration and testing laboratories ISO/IEC 17025:2017 for an international recognition	90 %	A	<p>So far, one new service complies with the respective ISO/IEC standard: <i>AC/DC meter & AC power, DC resistance calibration (at MASM electricity laboratory)</i></p> <p>Another important service which is in the process of being accredited is: <i>High voltage / high current calibration (at NPTGC laboratory)</i></p> <p>The equipment has been recently delivered, advisory and training of NPTGC staff is on the way and NPTGC will become Designated Institute.</p>
2. 12 strategic, normative or regulatory documents are prepared for adoption, taking into account international	80 %	B	To date, only 8 documents have been prepared for adoption, 4 others are in process. The indicator has not been fully

good practice” (with the modification offer from 2021 the value was increased from 10 to 12).			achieved. But 4 documents have even been adopted.
3. The use of metrological services for electrical measuring instruments and for testing services in the energy sector has increased by 20 % in selected laboratories.	100 %	B	The Project Advocacy Working Group shows that the number of measuring transformers calibrated and certified by NPTGC and MASM has increased from 525 (2019) to 1069 in (October 2022) – far more than the target value of 605. The planned number of calibration services for 2023 is 1125. However, it was not possible to verify the current state of calibration services in this year. The strong increase of the demand shows, that the services are demanded and that the clients expect services of good quality.

*: Appraisal: A = adequate indicator; B = slight objections; C = poor indicator, to be revised if applicable

The intervention’s activities, inputs and outputs have considerably contributed to achieving the intervention’s objective (at outcome level).

The results measured with the indicators would not have been achieved without the contribution of the project. Overall, most of the defined inputs have been delivered even though the COVID-19 pandemic has led to certain delays, mainly due to the travel constraints for international experts. An important bottleneck has been the procurement of equipment through PTB. This caused the (most significant) delay in the establishment of the high voltage / current measurement facilities in the NPTGC laboratory. Indicator 3 shows that the results of the project are increasingly used by beneficiaries (in this case: laboratories). There is no information yet about the application of the new (and already approved) standards (indicator 2). Generally, the assumptions and risks mentioned in the project design have been addressed appropriately. The political backing was guaranteed by a strong involvement of MoE. At the same time, the cooperation between QI and energy sector was fostered by systematic and frequent working group meetings. The risk of fluctuating staff in the QI bodies (in particular at MASM), on the other hand, could not be eliminated (see chapter 5.1.6). However, the main constraint – the COVID 19 pandemic – was not foreseeable at the stage of project planning but was addressed by switching activities (e. g. trainings) and coordination mechanisms to virtual formats.

In addition to the results measured with the three indicators, the project has produced important other results:

- Capacity building of laboratories: the number of trained stakeholders has increased from 200 per year before to 520 in 2022 (mainly calibration officers)
- Support international recognition: Publishing of CMC on Electricity
- Preparation of ISO 50001 certification process (training of energy managers and auditors)
- Awareness raising in the academic sector: the project introduced QI topics in the curricula of engineering studies and elaborated a textbook which can serve as an important basic source of knowledge in the field of QI in the future.

There is a great potential for additional benefits arising from these results: the participation in international QI bodies will strengthen the standing of Mongolia in these bodies and create opportunities for further capacity building and support. The ISO 50001 standard can lead to significant energy savings (and other environmental improvements) in large enterprises in Mongolia. It fits to the national programme on energy efficiency. There are already first positive examples (see 5.1.5 “Higher level development results”). The introduction of QI issues at university level can lead to more awareness on QI amongst engineering students and have a positive effect on the provision of qualified local staff in this field.

The quality of the intervention’s implementation has considerably contributed to achieving the intervention’s objective (at outcome level).

CW – Strategy factor

The project strategy (results model and module proposal chapter 5.1) has been developed in a joint process with the project partners. An important step was the Inception Workshop at the beginning: mapping and involvement of stakeholders and definition of clear objectives. Generally, the evaluator observed a common understanding of the intended objectives (outputs, outcomes, impacts) and the theory of change.

Although the project did not use an explicit capacity development (CD) strategy, it addressed all levels of capacity development (person, organization, society). The main focus was the training of staff and awareness building of stakeholders, but important activities were also organisational development (of MASM) and the development of standards as framework for QI in the field of energy efficiency.

The main partners know the project strategy and the objectives and could relate to it in the interviews. An important success factor was the continuity of key persons in the MoE and MASM, who participated in the appraisal mission and Inception Workshop.

CW – Cooperation factor

Based on stakeholder mapping, the project has identified the relevant stakeholders – both from the energy sector as well from QI. The most important stakeholders have been involved in the project (besides MoE and MASM, other QI institutions and laboratories, power and transmission companies and the Mongolian University of Science and Technology (MUST)).

However, the involvement of the private sector was rather low. For example, in the Technical Committee for energy standardization, there are only two participants from industry, in comparison to 6 from public institutions and 3 from science.

There was a clear division of roles between MoE (as political partner, who also led the Advocacy Working Group), MASM as main implementing partner with its competence in metrology, the ERC with the competence in energy efficiency issues and the PTB with international expertise. The intervention of the MoE to include QI topics in the curricula of MUST (letter to the Ministry of Education to include) is an indicator for the strong ownership.

Partners and project team reported a good flow of communication between the main partners. A crucial instrument has been the working groups established with the steering structure, which met frequently, and the results of the meetings were documented by PTB.

CW - Steering structure factor

The steering structure was one of the main success factors of the project. It made sure that there was a continuing flow of information and decisions could be taken on time. Due to COVID19, the frequent and documented online-meetings of the Working Groups guaranteed a close coordination with and between the main project partners PTB, MASM and MoE. The three working groups were chaired by local partners and the protocols show the strong ownership and engagement of the partners. They confirmed that they will keep this structure, which is a precondition for future joint efforts to further improve the QI in the energy sector. The participation of the MoE guaranteed the political backing for the project.

CW – Processes factor

The project has elaborated a process map. A more differentiated analyses of the key processes – elaboration and approval of new standards, - would have helped to identify weaknesses and focus even more on streamlining these processes in the partner system. However, within MASM, some of the core processes could be improved. One example is the process of establishing calibration procedures. In another important process - adopting international standards by MASM – there is still need for improvement. Additionally, an organizational change process was started with MASM, but no major changes were put in place by the decision makers.

Within the project, cooperation, learning, supporting, and steering processes worked well. One success factor was the long experience of cooperation between PTB and MASM.

CW – Learning and Innovation Factor

The project has not defined specific learning objectives, but elaborated at the beginning a Capacity Development Strategy which identifies strengths and weaknesses on the three levels (individual, organizational and society level). The analyses could have been more specific (directed at the main actors) and the derived measures addressing more clearly the challenges. Example: as a thread, fluctuation of staff was identified, but no specific counter measure developed to avoid this. On the other side, at MASM a much better understanding of project management has been achieved.

Learning experiences were discussed in the working groups, but there is no systematic documentation and dissemination of lessons learned (knowledge management).

The intervention has leveraged potentials of unintended positive results and reacted to risks and/or the occurrence of (unintended) negative results.

The evaluator did not observe any unintended negative direct results of the intervention.

The project had set up a monitoring system and monitored the key indicators. However, the monitoring of unintended results, impacts and sustainability is rather weak.

Summarized evaluation

Despite the impairment caused by the COVID19 pandemic, the project has largely achieved its goals and even partially exceeded the indicators. Its activities, inputs and outputs have contributed significantly to the achievement of the objectives. The quality of the implementation was good. In addition, it has produced other positive effects such as growing awareness of the importance of QI in the energy sector.

Criterion	Evaluation dimension	Weighting	Appraisal
Effectiveness	The intervention has achieved its objective (at outcome level) according to the indicators agreed upon.	25 %	1
	The intervention's activities, inputs and outputs have considerably contributed to achieving the project's objective (at outcome level).	25 %	2
	The quality of the intervention's implementation has considerably contributed to achieving the intervention's objective (at outcome level).	25 %	1
	The intervention has leveraged potentials of unintended positive results and reacted to risks and/or the occurrence of (unintended) negative results.	25 %	2
Global assessment of the effectiveness			Successful (1.5)

5.1.4 Efficiency

Description of inputs

The following table describes the distribution of the budget according to the outputs at the moment of the evaluation (a number of open positions were not yet reflected in the data, for example a study trip and the related costs of the consultants):

Outputs	Percent of total costs
1. New QI services	52 %
2. New standards	31 %
3. Awareness raising on QI	17 %

The project spent significantly less than planned in the first few years of implementation. The reason for this was the Covid-19 pandemic. At the moment of the evaluation, there were still a number of open contracts and participant-related costs for trainings and study tours which were not yet reflected in the data, which make it difficult to analyse the real share of different expenditures in the overall budget. This shows that there is a significant time lag for the appearance of costs in the financial monitoring which reduces their informative value. Generally, the project had a lean project management structure without own office infrastructure and mainly based on virtual formats. The biggest part of the project budget (70 %) was spent for project staff and experts including national and international experts for trainings and consulting as well as their travel costs. As part of these costs, services were provided in the area of project management and joint steering with the partners. The expenses for international experts, on the other hand, are well below the planned value. This is because during the pandemic, travelling to Mongolia was not possible, so that the planned onsite consultancies could not be carried out or had to be realised remote (using virtual formats). The training measures were carried out with virtual formats during this time, which significantly reduced costs. However, there was no alternative to carrying out the expert assignments and training sessions virtually. Project steering was also virtually effective. With 19 % of the total budget, material costs are slightly higher than originally estimated. This is primarily laboratory equipment, especially for high voltage in current messages in the NPTGC laboratory. The evaluation was not able to determine whether delays in the procurement of material goods led to an increase in costs. It can be assumed that a significant part of the increase was caused by increasing transportation and material costs (due to the war in Ukraine).

The use of resources by the intervention is deemed reasonable with regard to the outputs achieved (production efficiency).¹

¹ The evaluation dimension "production efficiency" refers to the appropriateness of the relationship between inputs and outputs. The evaluation dimension "allocation efficiency" refers to the appropriateness of the relationship between the inputs and the results achieved by the intervention. The "efficiency" criterion relates both to the intervention's design and implementation and to the results it achieves.

The achieved outputs demonstrate a reasonable level of production efficiency, indicating that the resources allocated to the project were utilized effectively. By reviewing the individual budget items under "3. Summary of actual costs," it can be observed that project management costs are relatively low, with most of the resources dedicated to knowledge transfer and a smaller portion allocated to equipment procurement. This distribution suggests a focused and efficient use of financial resources. Of course, some results at the output level could have been further enhanced by reallocating financial resources. Activities with a good cost-benefit ratio, such as trainings, have proven to be effective in achieving desired outcomes. Here, in particular the onsite trainings have been highlighted by the beneficiaries. While working online saved resources, it was not always as effective as on-site interventions. Other spendings, such as financing the participation of MASM in IEC meetings (in San Francisco), were at the end not very effective, as 2 of the 3 staff members of MASM were dismissed later. This cannot be foreseen beforehand, but it reduces the cost-effectiveness.

As described before, there have been delays in the achievement of the outputs – mainly due to the Covid19 pandemic, but also due to delays in the procurement of equipment by PTB. Regarding the first, the project reacted in an adequate way (see chapter 5.1.1). The second has structural reasons within PTB which cannot be influenced by the project management.

The use of resources by the intervention is deemed reasonable regarding the achievement of the intervention's objective/outcome (allocation efficiency).

Considering the achieved results in relation to the financial resources used, it is determined that the intervention demonstrates a reasonable level of allocation efficiency. The objective has been widely achieved even with less budget than expected. However, there is potential for achieving similar results with fewer financial resources, for example by optimizing procurement procedures in PTB.

Potential for maximizing results at the outcome level using the same amount of financial resources, can be addressed by better using synergies with other German programmes or other donors. Other opportunities could have been the leverage of resources in the partner system, for example mobilizing funds from the energy sector (such as generation or transmission companies). However, the evaluator did not meet with these institutions, so that there is no evidence about this potential.

Summarized evaluation

The project shows good production and allocation efficiency. The Modes of Delivery were suitable for achieving the objective. There were few inefficient activities. However, the procurement of important equipment was delayed due to internal PTB processes. The partners participated in an appropriate manner. However, little use was made of potential synergies with other German projects and international donors.

Criterion	Evaluation dimension	Weighting	Appraisal
Efficiency	The use of resources by the intervention is deemed reasonable with regard to the outputs achieved (production efficiency).	50 %	2
	The use of resources by the intervention is deemed reasonable with regard to the achievement of the objective/outcome (allocation efficiency).	50 %	2
Global assessment of the efficiency			Successful (2)

5.1.5 Higher-level development results

The intended higher-level development changes have taken place or are expected to take place in the near future.

The higher-level development changes (impacts) have been described in the project proposal as contribution to superior programs such as the National Green Development Policy or the German-Mongolian Energy Efficiency Program. The latter has a defined objective and 4 indicators:

1. Reduction of the specific CO₂ emissions
2. Improvement of the efficiency of the power plants
3. Increase in the level of economic cost recovery in the energy sector
4. Additionally adopted laws, regulations, and standards to improve the framework conditions for energy efficiency

While the CO₂ emissions of Mongolia are still increasing (mainly because the energy consumption is increasing significantly), the efficiency of the power plants and the cost recovery in the energy sector have remained at the same level during the implementation of the project.

The results achieved by the intervention (at outcome level) have contributed to the intended or implemented higher-level changes.

As shown in chapter 5.1.3, the project has directly contributed to indicator 4 of the German programme (4 standards/ strategies approved, 4 standards prepared for approval). In addition, it indirectly contributed to the other indicators:

- The improvement of NPTGC laboratory as Designated Institute (DI) for high voltage / current is a precondition to reduce transmission losses and increase energy efficiency of the power grid.
- An increased awareness about the importance of QI and trained and competent human resources might lead to better quality, improved energy efficiency and cost-benefit ratio of products.
- Certification with ISO 50001 will lead to energy savings in industry. The project already contributed to the certification of one company, but there is no information about the results.

The examples show that there is a high potential and a certain probability but no evidence for increased energy efficiency and reduction of CO₂ emissions.

With regards to the laboratories, the project has already led to increased demand for calibration services with several positive implications (see module indicator 3, chapter 5.1.3). For the users of the services the costs of calibration are reduced (before the equipment had to be send to China). Moreover, the laboratories have gained a better reputation and started to generate additional income, and NPTGC laboratory has even hired a new staff for these services. At the level of private consumers of electricity, there is still no evidence that higher-level development changes have occurred, e. g. in contributing to reduced energy costs or reduced emissions.

It is probable that the project induced positive synergies between social, economic, and environmental changes. New standards and QI services are not only a precondition for economic growth but contribute to increased energy efficiency and reduction of CO₂ emissions. They are precondition for reliable electricity meters and consumption-based payment. In other countries it has been observed that consumption-based payments lead to significant reduction in the energy consumption of households and companies, and therefore to a reduction in emissions (International Energy Agency, 2021: The Potential of Behavioural Interventions for Optimising Energy Use at Home). At the same time, they are a precondition for increasing the efficiency of electric appliances of the consumers. However, there is no evidence that the intervention contributed or will contribute to higher-level development results at the level of disadvantaged or vulnerable groups.

The intervention has contributed to positive and not to negative unintended higher-level development changes.

The evaluation did not observe any indication for negative unintended impacts or negative trade-offs between the economic, social and environmental dimensions.

Summarized evaluation

With regards to higher-level development results, the project is rated “successful”. There is a high probability that the project will contribute to the achievement of higher-level development results such as improved energy efficiency and reduction of CO₂ emissions. However, a direct contribution can only be proven in individual cases and has not been significant to date (e. g.

cost reduction through better QI services in laboratories and companies). The intervention has contributed to positive and not to negative unintended higher-level development changes.

Criterion	Evaluation dimension	Weighting	Appraisal
Higher-level development results	The intended higher-level development results have taken place or are expected to take place.	25 %	2
	The results achieved by the intervention (at outcome level) have contributed to the intended or implemented higher-level results.	50 %	2
	The intervention has contributed to positive and not to negative unintended higher-level development changes.	25 %	2
Total assessment of the higher-level development results			Successful (2)

5.1.6 Sustainability

The partners, target groups and organizations involved have the capacities required to ensure that positive results are continued.

Overall, the beneficiaries and stakeholders involved in the intervention demonstrate a reasonable level of capacity to ensure the continuation of positive results after the assistance has ended. The MoE is aware of the importance of QI in the field of energy efficiency and will continue promoting the development and implementation of standards.

MASM possess the institutional structures and human resources to continue with this task and establish the necessary QI services. The NPTGC has hired a new staff member to take over responsibilities for the new service in high voltage and current measurements. Additionally, there is a noticeable level of ownership and willingness among the partners, target groups, and organizations to actively maintain and further develop the positive results beyond the intervention period. The main constraint is the financial situation of MASM (which does not allow the expansion of the new services) and the fluctuation of qualified staff.

The partners, target groups, and organizations involved exhibit a reasonable level of capacity to successfully address existing or foreseeable risks and maintain the sustainability of the positive results. They possess the necessary mandates, access to information, resources, power, influence, and organizational structures to effectively mitigate risks and ensure the

durability of the intervention's outcomes. This resilience is crucial for the long-term continuation of the positive changes achieved.

The intervention has considerably contributed to the capacity of partners, target groups and other organizations involved to continue the positive results.

The intervention has made a considerable contribution to building the capacity of the stakeholders to sustain the positive results even after the assistance has ended. It has facilitated the development of institutional structures, enhanced human resources through training and capacity building initiatives, and provided financial support where necessary. Additionally, the intervention has fostered a sense of ownership and willingness among the stakeholders, reinforcing their commitment to continuing the positive changes achieved.

The intervention has successfully contributed to strengthening the resilience of the partners, target groups, and organizations involved. It has equipped them with the necessary tools, knowledge, and skills to effectively address challenges and risks that may arise.

The project has made efforts to strengthen the institutional structure of MASM and improved processes and capacities which will not only serve to further improve the QI services in energy efficiency but can be applied in other subjects.

The results of the intervention are durable.

Overall, most of the results of the project are deemed reasonably durable under the prevailing conditions. The new standards approved will be valid in the future and those standards which have been prepared for approval have good chances to be approved soon. The established QI services are expected to continue, but efforts are needed to generate a growing demand, particularly through stronger private sector involvement. The maintenance of knowledge and new equipment in MASM depends on the availability of sufficient human and financial resources. The delays in the procurement of the equipment and training of staff for the NPTGC laboratory have created a certain risk that the measurement services will not be offered in the necessary quality, but the project has still the chance for countermeasures. The stakeholders are willing to continue with the successfully established working groups. However, this relies on individuals taking on functions such as invitation, moderation, and documentation (which was organised by GIZ before). The awareness building measures in the academic sector (inclusion of QI in curricula, elaboration of a workbook) most probable will continue generating results, but regular updates are necessary, and it is not sure who feels responsible for this task.

The durability of the project's benefits is influenced by several risks and potentials. Risks include fluctuation and/or reduction of staff in MASM, insufficient time for training local staff on new equipment (NPTGC laboratory), and financial constraints limiting MASM's participation in international organizations. However, there are opportunities for securing the intervention's benefits in the long term, such as further support and follow-up through international programs like USAID or PTB funded MEDEA, or through the participation in regional technical networks like APMP. Another option is the alignment of the started activities within the national "Standard

and Development Program." The project addresses most of these factors and has proposed to the partners measures to mitigate risks and leverage opportunities.

Summarized evaluation

The project demonstrates a successful level of sustainability. The beneficiaries and stakeholders possess the necessary capacities to ensure the continuation of positive results beyond the intervention period. The project has significantly contributed to building the capacity of partners and target groups to sustain the positive results and enhance their resilience. While risks exist, such as staff fluctuations and financial constraints at MASM, the project has addressed these factors and identified some opportunities for securing the project's benefits in the long term.

Criterion	Evaluation dimension	Weighting	Appraisal
Sustainability	The partners, target groups and organizations involved have the capacities required to ensure that positive results are continued.	33.33 %	3
	The intervention has considerably contributed to the capacity of partners, target groups and other organizations involved to continue the positive results.	33.33 %	2
	The results of the intervention are durable.	33.33 %	2
Total assessment of the sustainability			Successful (2.3)

5.1.7 Summary of the intervention's contributions to the 2030 Agenda for Sustainable Development

Universality, shared responsibility and accountability

The project supports the Mongolian strategy for implementing the sustainability goals, particularly with regard to energy and industry, innovation and infrastructure (SDG 7 and 9). Additionally, it has the potential to contribute to SDG 12 (sustainable consumption and production) and 13 (climate action). The project used the existing institutions and processes in the partner system and did not build up parallel structures. It supported the partners in their

efforts to apply international standards. As pointed out in the chapter on “coherence”, the cooperation with other donors was limited. The project did not apply a joint system monitoring, learning and accountability used by partners and other donors.

Interplay of economic, environmental and social development

As the design of the project focussed primarily on the improvement of QI services, social aspects did not play an explicit role. Economic aspects in so far, as the costs of measurements / calibration and the financial situation of MASM was considered. Indirectly, on the level of higher development goals, improved QI services (as a precondition for energy efficiency) contribute to economic development, consumer and environment protection.

Inclusiveness/Leave no one behind

There has been no specific emphasis on the participation, promotion or building resilience of disadvantaged groups. But also, no unintended negative effects could be observed on these groups. The needs of the population with regards to QI services were not directly addressed, as the project focussed on improving the services for laboratories and companies. As a result, it can be assumed that all people connected to electricity services will indirectly benefit from the results of the project. In 2018, this were 98.1 % of the population (World bank data).

6. Assessment of specific evaluation questions

In the frame of the evaluation, several specific evaluation questions were assessed (see chapter 1).

How important was PTB's support in the energy sector in Mongolia in terms of added value for other German implementing organisations and their projects?

In comparison to other German and international projects, PTB's projects are small in terms of volume. The evaluated project had to focus on a few topics in the energy sector, which were selected together with the national partners MoE and MASM. For the other German projects, the added value was limited, apart from two areas of cooperation with GIZ:

- GIZ has trained energy auditors and managers in the field of energy management systems. The activities of PTB for additional trainings in ISO 50001 supported these efforts (which was not a core topic of the PTB approach).
- GIZ works in the field of energy efficiency in buildings, where also new QI services are needed (e. g. heat meters, heat transmission characteristics of different materials etc.). The project supported the ISO standard on “Thermal performance of buildings and materials”
- KfW is financing transmission infrastructure in Mongolia. However, the cooperation was not focussed on specific QI needs in the frame of these projects. Nevertheless, the establishment of the high voltage / current measurement capacities in the NPTGC laboratory might contribute to these efforts (but so far there is no evidence).

Therefore, it is important to embed PTB's activities within joint strategies with other donors and, in particular, with the German development organisations to focus on those topics which are addressed also by the other projects.

How can the sustainability of the project interventions be ensured by the regional project (MEDEA) of PTB and other implementing organisations and projects?

MEDEA acts on a different, less sector-specific level than the bilateral projects. Its thematic focus is not on energy but on health, water, and industrial development. Participating countries are free to participate in training courses and other events funded by MEDEA, which MASM has often used up to now (without any special funding). As a regional project, MEDEA cannot make any tailor-made offers here, but could, in consultation with its partners, particularly support topics that are relevant for MASM. A vote on this can take place internally at the PTB. So far, however, there has been no strategic planning for linking bilateral and regional projects.

In addition, MASM has the option of addressing the need for support to the secretariats of the regional organizations APMP and APLMF. The organisation of the annual meeting of APMP in Mongolia helped to improve the standing of Mongolia in the international QI scene. Their *Developing Economies' Committee* has a budget to support members from developing countries, but this only makes up about a third of MEDEA's budget. Nevertheless, MASM can receive financial support for participation in training courses or submit concrete projects in this way. In addition, exchanges with other countries can be promoted. For example, MASM could learn from the "best practice" example of Thailand with its national metrology institute, NIMT, which has developed very quickly in recent years.

In the Asian region, Japan and Australia are possible international development partners who promote QI projects. However, the PTB is unique with its own department for international cooperation.

How important was this project for Mongolia's energy-efficient orientation and how sustainable are the developments initiated by it?

No sufficient evidence could be found for this (see chapter 5.1.5). It is unclear to what extent aspects of QI are integrated into energy policy strategies and action plans or even boosted the topic. Nevertheless, as pointed out in the above-mentioned chapter, it had contributed to create preconditions for making the generation and transmission of power more efficient.

On the institutional level, it has been proven that the institutions involved have become more aware of material and energy flows and energy management systems. The in-depth training courses for energy managers and auditors, who have been trained by ERC since 2016 (without the participation of PTB), have contributed to this. However, the activities of the project enabled the deeper understanding of ISO 50001 and the knowledge of how it is applied in companies.

What lessons could be learned from the COVID-driven transition towards online/virtual formats of project coordination and implementation?

With regards to the steering routine of the project, virtual formats (like the working group meetings) were effective, as they allowed a more frequent coordination (sometimes up to twice a week) with and between the stakeholders. When evaluating the virtual steering, it must also be taken into account that the project can look back on a long history with the partners and that the control processes are very routine. The important role that, for example, the inception workshop had for the set-up of the evaluated project and the ownership of the partners, shows that it is still useful and necessary for PTB to be physically present in the appraisal and start of projects.

With regards to the implementation of the project, most of the interview partners confessed that the virtual trainings were good, but not as effective as in presence. The lack of practical elements in the virtual trainings were seen as risk.

7. Learning processes and experiences

Learning processes:

Within the Mongolian QI institutions, the project facilitated a capacity building in systematic project management. Based on deficits in time management, it became clear to the Mongolian QI institutions that improved planning and management of the resources used was crucial, e. g. when planning standardization projects. There is still a need for training here. The quality of this training and the learning curve was highlighted by many interview partners. However, the training opportunities on site were severely restricted by COVID19.

An important learning process for MASM was the transition from the (old) Soviet system with fixed measurement ranges to a modern system with individual measurement uncertainties and calibration deadlines. Existing knowledge was deepened through expert assignments and training. Together with experienced experts, MASM staff developed calibration instructions themselves.

Another important learning process for MASM was the participation in international comparisons. Within the framework of the entire project, this was possible in six cases, accompanied by international experts from PTB.

Experiences:

As reaction to the COVID19 pandemic, both – the Mongolian partners and PTB – gained experiences in virtual steering of projects, communication, and capacity building. When the pandemic started, this was a new topic. Most MASM employees had neither experience in conducting video conferences nor the appropriate equipment (e.g. cameras). However, these difficulties were gradually resolved. Since local assignments by the German project team were no longer possible, the project intensified virtual communication, e.g. through regular virtual meetings of the working groups. At the same time, the planned on-site training events had to be replaced by virtual measures. Here, too, both sides were able to gain new experience that

can be used in the future (e.g. participation by MASM in international online training courses, but also by the PTB in the efficient implementation of projects).

For MASM, the cooperation with the academic sector was a new experience. Through the project, MASM staff encountered academic personal, for example, participated in the development of QI modules in the curricula of the MUST, but also participated in awareness building events (like giving lectures to students at the “Metrology Day”).

8. Recommendations

Recommendations to partners

- Continue with the translation and adoption of documents / standards. But get involved earlier in the adaptation of international standards.
- Maintain the presence in international organisations and networks and ensure regular budget for continued membership. Make use of other existing support programs, such as APMP / MEDEA, for training activities. The participation in regional networks can open opportunities for capacity building, organisational learning and even access to financial support.
- Maintain the Working Groups as instrument for coordination between the partners (MoE, MASM, ERC). As pointed out in chapter 5.1.3, it has been an important benefit of the project to establish an excellent working relationship and joint efforts of the energy and QI sector. As the need for better QI services in the energy sector is still pending and new topics will arise in the transformation process towards a climate neutral economy, this cooperation is important for future developments.
- Maintain the relationship with the academic sector but involve the private sector stronger (industry and business associations). While the awareness of the academy is crucial for the application of standards, the participation of the private sector is crucial to know the needs of the potential clients.
- Go on with the efforts to create awareness for the importance of QI on higher political levels (PM and Dep. PMs office). For this purpose, it can be helpful to carry out a plan for monitoring impacts: define indicators (e. g. monitoring the increasing demand for QI services) or document concrete examples that show how QI services are used and what the benefits are. This might help to convince political decision-makers to strengthen the QI system by providing the necessary financial support and political backing. QI is not a system for itself but must prove its benefit for the society. To get further financial support, it is necessary to link the ongoing activities with the “Standard and Development Program”.
- In the energy sector, target new relevant topics, such as Renewable Energies. Mongolia has a large potential for wind and solar energy, which will be exploited in the future to reduce the share of coal in power generation. For these technologies (which must be imported), new standards will be needed to secure their quality.

Recommendations to the project team

Recommendations for the last months of the project:

- Finish the activities started, in particular the training of NPTGC staff on the new measurement and calibration equipment. This is of high relevance for the sustainability of the results, as here the biggest contribution to higher-level development goals can be expected (contribution efficiency of the power grid). Without a proper training, there is a risk that the equipment will not be used in an adequate manner.
- Together with MASM and MoE, develop an exit strategy, answering the following questions:
 - How can the results of the projects be anchored in the partner system?
 - Which services previously provided by GIZ must be continued to secure sustainability of the results? Which of the stakeholders can provide them?
 - Which partner capacities must be strengthened by the end of the project so that the processes can continue afterwards?
- Support MASM in the accreditation process to certify ISO 50001. There is a high interest on partner side to advance in this field, and, at the same time, a high potential for improving the energy efficiency in larger industrial companies, if they apply this standard.
- Seek synergies with other development partners for further support: GIZ, for example, also supports the establishment of ISO 50001 services. Their main scope is, however, in the field of energy efficiency in buildings. There is a need for QI in this field. With KfW, there could be agreements about the further support of the NPTGC laboratory, as they generally work with power and transmission companies. The USAID Energy Governance program runs a project development fund for energy efficiency and renewable energy. Here could also be opportunities for support of QI projects.

Recommendations to the International Cooperation Department (Group 9.3)

- Improve the procurement procedures to avoid significant delays of equipment which is crucial for achieving the project objectives. The delay was one of the main bottlenecks in this project and caused a high risk of non-sustainable intervention. It undermines the reliability of PTB as project partner and causes critical situations for the project coordinator, who must explain the delays to the partners. An alternative could be the financing of partner organisations if they have the possibility of faster and unbureaucratic procurement procedures.
- Make sure that in the project design clear hypothesis and indicators are formulated which relate outputs and outcome with higher development goals. If it is not possible to find suitable indicators (which can be measured with reasonable effort), case studies can help to proof the contribution of the project to higher development goals.
- It is important to maintain frequent coordination with and between the main partners. In case of the evaluated project, due to COVID19, frequent and documented online-

meetings of the Working Groups guaranteed a close coordination. In addition to PC's and iKZE travelling to the partner countries, this should be applied in all projects.

- Establish regular (online) meetings within the PTB project team to embed the work of specialized experts within the project strategy. A better horizontal communication between project coordinator, iKZE and short-term experts can create synergies.
- An early coordination with the other German development institutions (GIZ, KfW) is recommended to link the QI interventions with the needs of larger investment projects (financial cooperation) or capacity development processes.

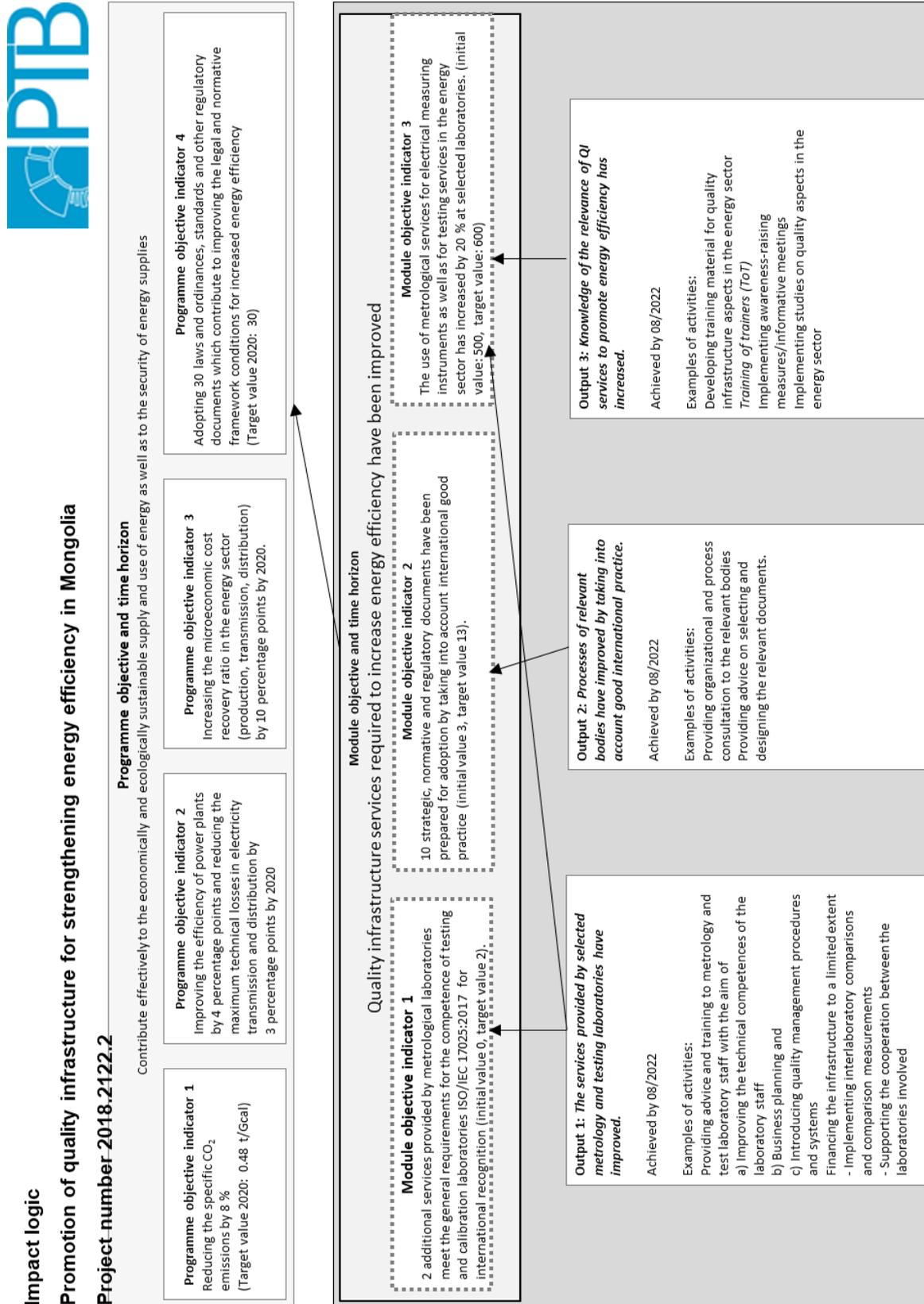
Recommendations to the evaluation unit of Working Group 9.01.

- For smaller projects such as the evaluated project, remote evaluations are a cost-effective suitable option. The online interviews and focal group discussions with partner organisations and other stakeholders are sufficient to validate the results. In countries as Mongolia, the interviews with individuals lead even to more openness. Virtual formats give more flexibility for the timing of the meetings, as the data collection phase can be adjusted of a longer time period.
- As a prior step, a short (one day) workshop with participation of PC and iKZE (including the Capacity WORKS self-assessment) could be helpful to discuss the project outputs and the monitoring of the indicators.
- For the criteria which are described with an even number of dimensions, the result may end up unclear: in case of coherence, for example, a “2” and a “3” in the dimensions will result in a “2.5” (which is something in the middle between “successful” and “rather successful”). This can happen as well for “relevance”, “effectiveness” and “efficiency”.

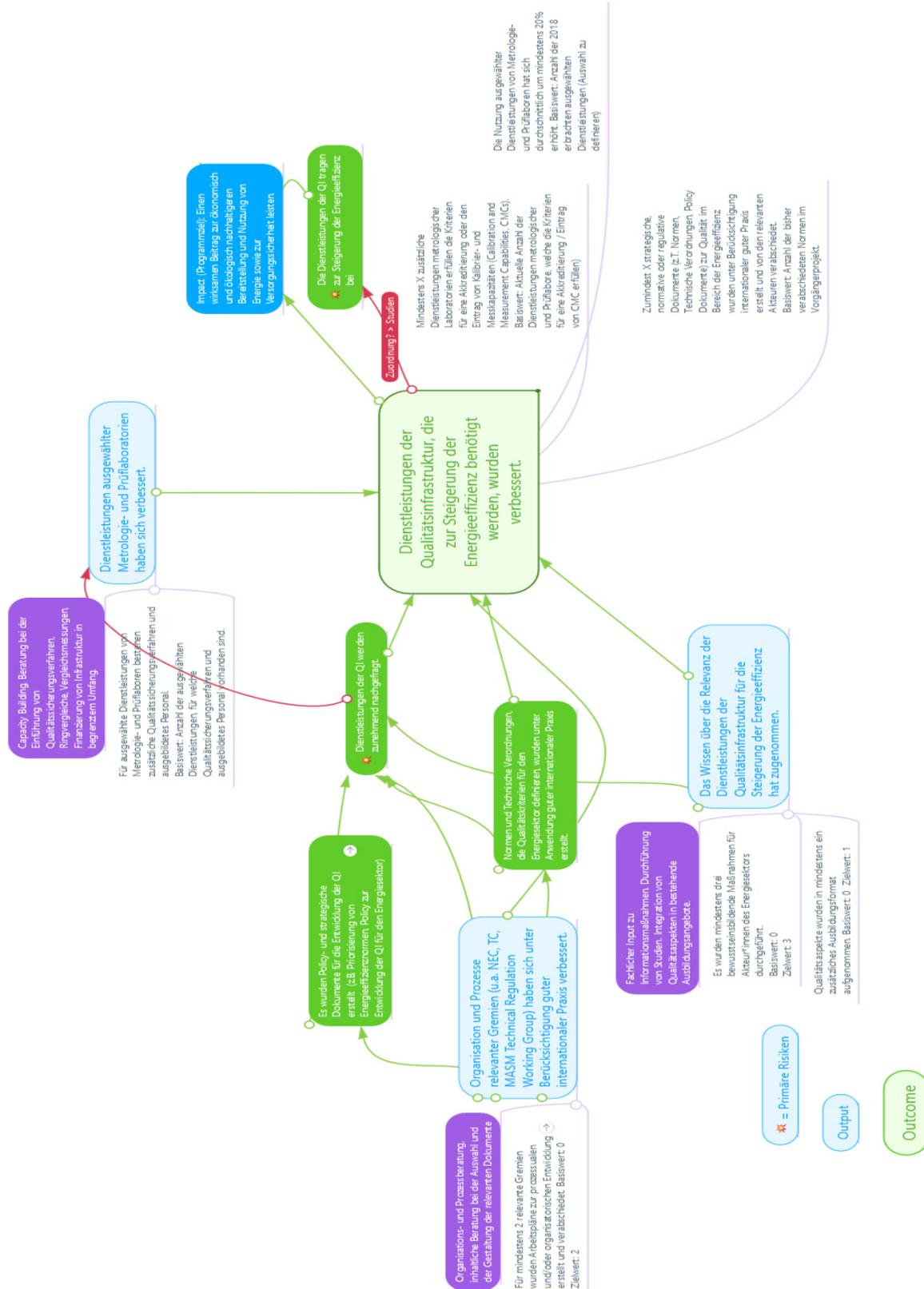
9. Annexes to the evaluation report

1. Intervention logic (from the module proposal)
2. “Results Model” Capacity WORKS tool 7 (if available)
3. Evaluation schedule
4. Schedule of the field phase/data acquisition, and list of contact persons
5. Questionnaires and/or interview guidelines

Annex 1: Impact logic (from the module proposal)



Annex 2: "Results Model" Capacity WORKS tool 7



Annex 3: Evaluation scheduleInception Report

	Deadline
Inception Report / 1. Draft	10.03.2023
Comments by PTB	16.03.2023
Elaboration 2. Draft	20.03.2023
Comments by partners	27.03.2023
Comments by PTB	30.03.2023
Elaboration of final version	03.04.2023

Evaluation report

	Deadline
Data collection / Interviews	April / May 2023
Validation Workshop with partners	26.05.2023
Evaluation report / 1. Draft	16.08.2023
Comments by PTB	31.08.2023
Evaluation report / 2. Draft	07.10.2023
Comments by partners	20.10.2023
Elaboration of final version	27.10.2023
Presentation of results and final workshop with PTB	02.11.2023
Elaboration of Summary Report and One-Pager	02.11.2023

Annex 4: Schedule of the field phase/data acquisition, and list of contact persons

Date / time	Interview partners	Institution / function
17.04.2023, 1 pm	Ms Gerel	Expert in charge of energy standard and normatives policy, Policy and Planning Department of the Ministry of Energy (MoE)
17.04.2023, 2.30 pm	Ms Ariuntungalag	Head of Senior specialist of Electricity Standard Laboratory of Metrology Institute, MASM
17.04.2023, 4 pm	Mr Khosbayar	Electricity metering laboratory engineer (NPTGC)
19.04.2023, 10.30 am	Ms Kaiser	expert in standardization
19.04.2023, 2 pm	Mr Roeschlein	expert in project management
19.04.2023, 4 pm	Ms Mayer	former project coordinator, PTB
20.04.2023, 8 am	Ms Undraa	Senior officer of Standardization and conformity assessment policy department, MASM)
20.04.2023, 9.30 am	Mr Khiimorisain	Specialist for Energy Efficiency and Conservation Department" in the Energy Regulatory Commission of Mongolia (ERC)
20.04.2023, 11 am	Ms Bolortuya	Specialist of training for energy auditors and managers" in the Energy efficiency and conservation department of ERC
20.04.2023, 2 pm	Mr Prem	Intermittent consultant / coordinator
20.04.2023, 4 pm	Mr Bachmair	Expert in voltage, resistances and laboratories
21.04.2023, 1 pm	Mr Bilguun	Chairman MASM
21.04.2023, 2:30 pm	Fr. Narangerel	Director of Metrology Policy Department
21.04.2023, 4 pm	Mr Dambasuren	Head of Metrology Department, MASM
25.04.2023, 9 am	Ms Kalkuhl	Project coordinator MEDEA project, PTB
25.04.2023, 3 pm	Mr Saleth	Project manager, KfW
11.05.2023, 7 am	Ms Hoffmann	Project manager, GIZ
27.04.2023, 9 am	Ms Bolormaa	Local project coordinator
Various meetings	Ms Santourian	Project coordinator PTB

Annex 5: Questionnaires and/or interview guidelines

Relevance

- To what extent is the project concept in line with the relevant strategic reference frameworks (for example, national strategies, including the national implementation strategy for the 2030 agenda, regional and international strategies, sectoral and intersectoral strategies)?
- Is it clear who the target group is? Does the project address the demand of the target group?
- How realistic is the project objective from the current perspective and the resources allocated (time, finances, partner capacities)?
- What changes have occurred during the implementation of the project? How did PTB react to these changes?

Coherence

- To what extent is the project complementary to the programs of German development cooperation and international conventions?
- Does the project support the efforts of the partner organisations? In how far could it use existing structures and mechanisms?
- How was the coordination with other entities involved (partners and international programs)?

Effectiveness

- So far, what have been the three most important successes of the project?
- To what extent were the project objectives achieved? What is still missing?
- Were the objectives clear to everyone? Was there a common strategy which was developed together with the partners?
- What were positive experiences in the cooperation system? Were all relevant partners included? What have been the main success factors?
- How were decisions made, on strategic and operative level? Which mechanisms have been established and how useful were they?
- Which processes in the partner system have been addressed? Which processes in the energy sector and quality infrastructure have been strengthened?
- What were the learnings? What were the innovations? Was the learning adequately documented?
- What would have happened without the project?

Impact

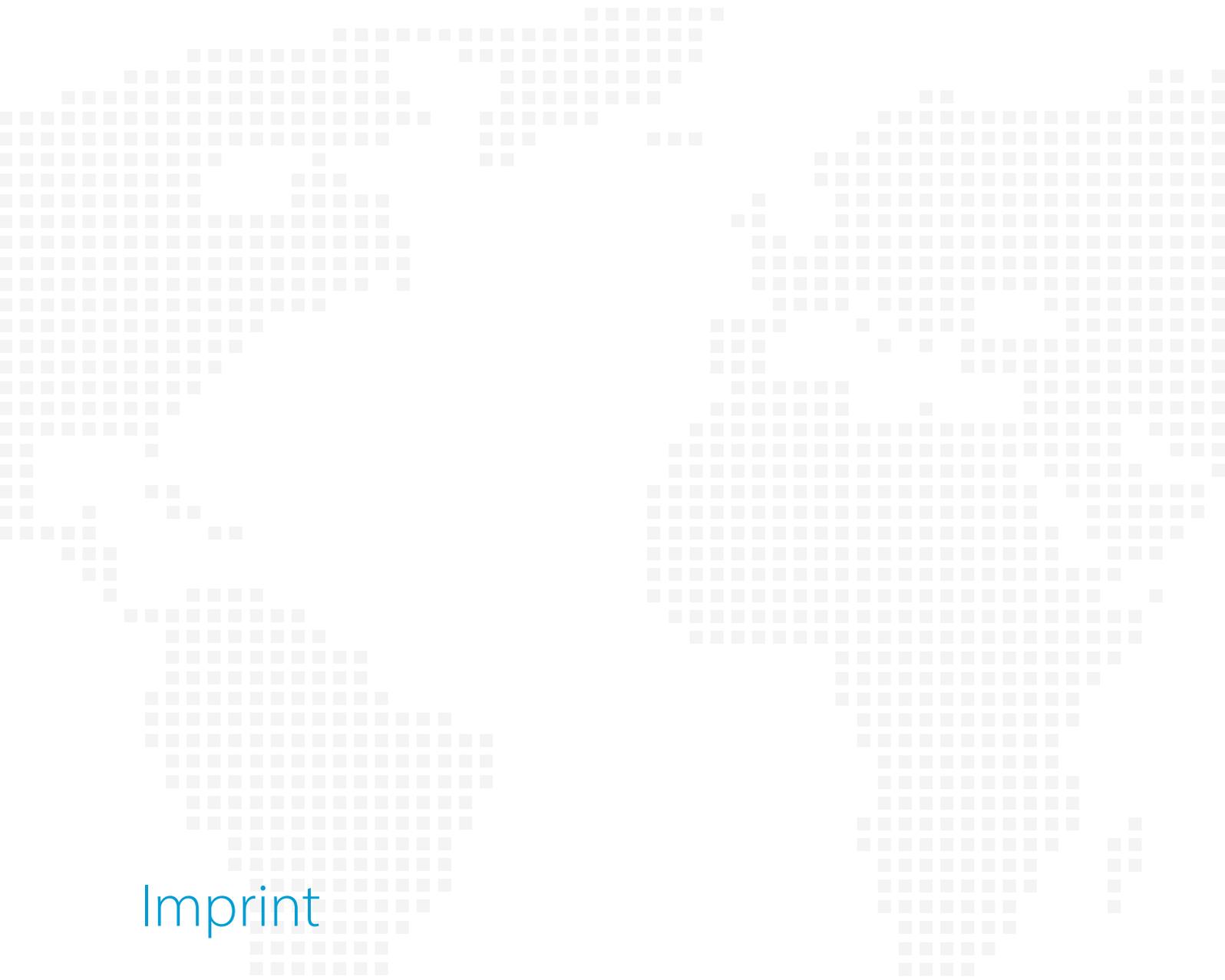
- What were the main impacts of the project?
- How do the results contribute to achieving the higher objectives of the policy and strategies of the partner countries? How do the achievements of the project contribute to the development of EE in Mongolia?
- To what extent have structural changes been achieved: at the level of institutions, capacities or the regulatory framework?
- Are there concrete examples of positive changes caused by the project (eg in the application of new standards or testing methods)?
- Were there any unexpected (positive) or unwanted (negative) impacts?

Efficiency

- Do you think that the contribution of the PTB was pertinent, timely and efficient (cost-benefit)? Could the same results be achieved with less investment?
- What have been the activities with the greatest cost-benefit ratio? Where have you spent resources without many effects?
- Was coordination and synergies achieved with other projects in a complementary manner, specifically from German cooperation?

Sustainability

- What are the biggest risks to the durability of the results?
- To what extent have changes in the framework conditions (COVID, war in Ukraine) influenced the results of the project? What is the current political situation like with respect to the objectives of the project?
- Was the project oriented towards the capacities of the actors in the sector (organizations, individuals and groups)?
- What will happen to the activities and results of the project once it is finished? How have the products / results of the project been integrated in the partner organizations?
- Do the project beneficiaries continue to apply the learnings (for example, laboratories) and is there a demand (and funds) for quality services in the long term? To what extent the costs of QI services can be covered by clients?
- What strategy exists for up-scaling, self-financing of services and better efficiency of services?
- What is the exit strategy of the project or program?



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