

# EXTERNAL EVALUATION – SHORT REPORT

Key evaluator: Dr.oec.habil. Karl-Christian Goethner  
Second evaluator: Jan-Marius Tillmanns

Strengthening Quality Infrastructure for Renewable Energies and Energy Efficiency in  
Brazil

Country | Region: Brazil

Project No.: PN: 2013.2085.2  
Period: August 2016 – January 2020

Executing Agency: Instituto Nacional de Metrologia, Qualidade e Tecnologia INMETRO  
Implementing Partner:

PTB | Working Group: 9.3  
PTB | Project Coordinator: Lieselotte Seehausen

Date: October 17, 2019

This is an independent evaluation. The contents represent the view of the evaluators and cannot be taken to reflect the views of PTB.

**List of abbreviations**

<b>ABC</b>	Agência Brasileira de Cooperação Brazilian Agency for International Cooperation
<b>ABEEólica</b>	Associação Brasileira de Energia Eólica Brazilian Wind Energy Association
<b>ABNT</b>	Associação Brasileira de Normas Técnicas Brazilian Association for Technical Standards
<b>ABSolar</b>	Associação Brasileira de Energia Solar Fotovoltáica Brazilian Association for Solar Energy
<b>ANDI</b>	Asociación Nacional de Empresarios de Colombia National Association of the Entrepreneurs of Colombia
<b>ANEEL</b>	Agência Nacional de Energia Elétrica National Electric Energy Agency
<b>ASOCEC</b>	Asociación Colombiana de Organismos de Evaluación de Conformidad Colombian Association for Conformity Assessment Bodies
<b>BIPM</b>	Bureau International des Poids et Mesures International Bureau for Weights and Measures
<b>BMZ</b>	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung Federal Ministry for Economic Cooperation and Development
<b>BNDES</b>	Banco Nacional de Desenvolvimento Econômico e Social
<b>CAB</b>	Conformity Assessment Body
<b>Caint</b>	Coordenação Geral de Articulação Internacional, INMETRO Coordination of International Affairs
<b>CEIP</b>	Centro de Excelência em Iluminação Pública do LABELO
<b>CEPEL</b>	Centro de Pesquisas de Energia Elétrica Center for Electrical Energy Research

<b>Cgcre</b>	Coordenação Geral de Acreditação, INMETRO Coordination for Accreditation
<b>DAC</b>	Development Assistance Committee from the Organization for Economic Cooperation and Development (OECD)
<b>Dconf</b>	Diretoria de Avaliação da Conformidade, INMETRO Directorate for Conformity Assessment
<b>DeGEval</b>	Deutsche Gesellschaft für Evaluation German Society for Evaluation
<b>Diavi</b>	Divisão de Metrologia em Acústica e Vibrações, Dimci, INMETRO Division for Metrology in Acoustics and Vibrations
<b>Diele</b>	Divisão de Metrologia Elétrica, Dimci, INMETRO Division for Electrical Metrology
<b>Dimci</b>	Diretoria de Metrologia Científica e Industrial, INMETRO Directorate of Scientific and Industrial Metrology
<b>Dinam</b>	Divisão de Metrologia em Dinâmica de Fluidos, Dimci, INMETRO Division for Metrology in Flow Dynamics
<b>Diopt</b>	Divisão de Metrologia Óptica, Dimci, INMETRO
<b>EE</b>	Energy efficiency
<b>Eletróbrás</b>	Centrais Elétricas Brasileiras S/A
<b>EPE</b>	Empresa de Pesquisa Energética
<b>GIZ</b>	Gesellschaft für internationale Zusammenarbeit mbH German Agency for Internationale Cooperation
<b>GNP</b>	Gross National Product
<b>IAAC</b>	Inter American Accreditation Cooperation
<b>IEE - USP</b>	Institute of Energy and Environment, University of São Paulo

<b>INMETRO</b>	Instituto Nacional de Metrologia, Qualidade e Tecnologia National Metrology Institute of Brazil
<b>IPT</b>	Instituto de Pesquisas Tecnológicas, São Paulo Institute for Technological Investigation
<b>KfW</b>	Kreditanstalt für Wiederaufbau Bank for Reconstruction, Germany
<b>LABELO</b>	Laboratórios Especializados em Eletroeletrônica, PUCRS, Porto Alegre
<b>LACR3E</b>	Quality Infrastructure Services for Renewable Energies and Energy Efficiency, PTB regional project
<b>LDA</b>	Laser Doppler Anemometry
<b>LED</b>	Light-emitting diodes
<b>ME</b>	Ministério de Economia Ministry of Economy
<b>MERCOSUL</b>	Mercado Comum da América do Sul Common Market of South America
<b>METAS</b>	Eidgenössisches Institut für Metrologie National Institute for Metrology, Switzerland
<b>MME</b>	Ministério de Minas e Energia Ministry of Mining and Energy
<b>NIST</b>	National Institute of Standards and Technology U.S. National Metrology Institute
<b>NMI</b>	National Metrology Institute
<b>ONS</b>	Operador Nacional do Sistema Elétrico
<b>PBE</b>	Programa Brasileiro de Etiquetagem Brazilian Labelling Program
<b>PMU</b>	Phasor Measurement Unit

<b>PMDB</b>	Partido do Movimento Democrático Brasileiro Party of the Brazilian Democratic Movement
<b>PROCEL</b>	Programa Nacional de Conservação de Energia Elétrica
<b>PSL</b>	Partido Social Liberal
<b>PT</b>	Partido dos Trabalhadores Worker Party
<b>PTB</b>	Physikalisch-Technisches Bundesanstalt National Metrology Institute of Germany
<b>PUCRS</b>	Pontifícia Universidade Católica do Rio Grande do Sul Katholic University of Rio Grande do Sul
<b>PV</b>	Photovoltaic
<b>QI</b>	Quality Infrastructure
<b>RCM</b>	Red Colombiana de Metrología Colombian Metrology Network
<b>RE</b>	Renewable Energies
<b>R3E</b>	Renewable Energy and Energy Efficiency (REEE)
<b>RELuz</b>	Programa Nacional de Iluminação Pública Eficiente
<b>SDG</b>	Sustainable Development Goal
<b>SI</b>	International System of Units
<b>SIM</b>	Sistema Interamericano de Metrología Interamerican Metrology System, Regional Organisation of the American NMIs
<b>TR</b>	Technical Regulation
<b>USP</b>	Universidade de São Paulo

## 1. Project Description

The PTB-Project “Strengthening Quality Infrastructure for Renewable Energies and Energy Efficiency (08/2016-01/2020)” is one of the modules of the German-Brazilian development program “Renewable Energies and Energy Efficiency”. It is implemented on behalf of the German Federal Ministry of Economic Cooperation and Development (Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung, in short: BMZ). Political project partner and main implementation partner is Brazil’s National Metrology Institute (Instituto Nacional de Metrologia, Qualidade e Tecnologia, in short INMETRO.).

The PTB module was planned to be implemented from 08/2016 till 07/2019. Due to difficulties connected with the deep crisis which Brazil was passing through in the middle of the decade it was prolonged till 01/2020. The German contribution was EUR 500,00.00.

As objective was formulated:

“The national quality infrastructure (QI) for the development of renewable energies and the improvement of energy efficiency is strengthened.”

The planning workshop in 2016 defined three lines of action:

1. QI for energy generation is strengthened (wind and photovoltaics)
2. QI for energy transmission and distribution is strengthened (phasor measurement units – PMU);
3. QI for energy consumption and efficiency is strengthened (public LED illumination)

For measuring the results of these three action lines the following outcome indicators were defined:

Outcome Indicator A: Until 07/2019 suppliers of photovoltaic and/or wind equipment use new services from INMETRO or INMETRO accredited conformity assessment bodies for quality assurance.

Outcome Indicator B: Until 07/2019 the new PMU traceability system (through INMETRO) is used by national bodies (CEPEL calibration laboratory or ONS).

Outcome Indicator C: Until 07/2019 at least 1 city hall buys and installs LED luminaires according to technical requirements based on recognized IQ services.

For reaching these indicators the project also intended to improve the cooperation between the relevant actors in QI for R3E. Thus, another indicator was formulated:

Outcome Indicator D: The exchange of information and the cooperation between the relevant actors in the Field “QI for Renewable Energies and Energy Efficiency” is improved.

## 2. Assessment of the project

The results and impacts of the project were evaluated according to the DAC/OECD-criteria, and the success factors developed by GIZ’s management model Capacity WORKS. Evaluations are an essential element of PTB’s quality assurance policy. PTB evaluations are in line with the standards set by the German Society for Evaluation (DeGEval, Deutsche Gesellschaft für

Evaluation). The evaluation method encompassed a thorough desk study of relevant project documents and a field mission to consult with main stakeholders and partners of the project.

## **2.1 Status of the change process**

### **Relevance**

Energy Efficiency (EE) and Renewable Energies (RE) were relevant themes throughout the planning process (2011-2013), implementation (since 2016) and at present. By supporting Quality Infrastructure (QI) services for the implementation of EE and RE the project developed solutions for the core problems defined in the project offer to the German Ministry of Economic Cooperation and Development (BMZ).

### **Effectiveness**

Indicators in general were formulated according to the SMART scheme. According to the results presented by the partners, the evaluation team estimates that approx. 70% of the indicators will be reached until the end of the project extension in January 2020. Only the services in photovoltaics need more time (estimation: 08/2020). Budget restrictions on INMETRO as well as staff movements had an adverse effect on the project implementation. The involved INMETRO staff, although highly involved and engaged, complained about high pressure to achieve the indicators.

### **Impact**

There has been significant positive impact especially in the pilot project on LED installation in municipalities. Support to the tendering processes with Eletrobrás not only improved energy efficiency in public lighting but also led to significant economic gains as well as improvement in public security. Inhabitants in Coronel Bicaco (Rio Grande do Sul state) and neighbouring towns are considering changing lighting in their households to LED, and neighbouring municipalities are requesting technical assistance from Coronel Bicaco staff to qualify for current and future public tendering with Eletrobrás's PROCEL Reluz Programme.

In solar and wind energy as far as in smart grids, the project was able to support the implementation of appropriate future Renewable Energies and Energy Efficiency (R3E) policies. In giving the traceability of measurements to the International System of Units (SI) through INMETRO is enabling Brazilian stakeholders to receive calibration and testing services according to international standards and best practices.

In the field of technical regulation, the project has given a significant contribution to approach good international practice (especially, the revision of Portaria 20/2017, an ordinance dedicated to public illumination). However, under the new government all revision and new development of technical regulations were stopped, because of an intended reformulation of the technical regulations.

Due to limited external communication, there is still too little demand for INMETRO's services developed under the project.

### **Efficiency**

The project has had partially good results: There has been good coordination between the PTB/INMETRO partnership and other (regional) programmes run by PTB. In addition, there has been coordination with U.S. National Institute of Standards and Technology (NIST) in the area of human capacity development. On the other side, staff changes and budget cuts within INMETRO lead to a temporary lack of ownership within INMETRO and made a closer coordination from PTB's side necessary. This led to an increase of backstopping trips (up to 8 trips per year) which resulted in significant increase in expenses for coordination work at the cost of other technical support activities.

Although INMETRO had limited resources, the partner achieved to make significant contributions to the project activities in order to complement PTB's support. The relationship between the financial contributions of PTB and the Brazilian counterparts (including other partners) achieved approx. 1:1.

### **Sustainability**

The sustainability of the project highly depends on the development of Brazil's political and economic stability. It is not clear enough what will be the impact of the strictly neoliberal policy on INMETRO and especially to scientific and industrial metrology, commonly seen as a public good, but also on the conformity assessment bodies. On the other side, the recently nominated INMETRO president has initiated substantial changes within the institution emphasizing a demand-driven development and strengthening internal coordination and communication.

## **2.2 Success factors for the observed results and change processes**

### **Strategy**

The project strategy was the result of a participatory approach considering the capabilities of INMETRO at the moment of project design. However, due to a three-year delay in starting, and major changes in the framework conditions in Brazil, the strategy had to be adjusted. Generally, the project strategy was correctly chosen and in large parts implemented. Although mentioned in the basic project documents, for different reasons accreditation (General Accreditation Coordination - Cgcre) and standardization (Brazilian Association of Technical Standards - ABNT) were not included in the project implementation.

### **Cooperation**

The present partnership PTB-INMETRO based on the cooperation between three different divisions of INMETRO with the aim of integrating services and facilitating communication: Coordenação Geral de Articulação Internacional (Caint), Diretoria de Avaliação da Conformidade (Dconf), and Diretoria de Metrologia Científica e Industrial (Dimci). On behalf of Dimci, four laboratories were involved: Divisão de Metrologia Elétrica Division for Electrical Metrology (Diele), Divisão de Metrologia Óptica Division for Optical Metrology (Diopt), Divisão de Metrologia em Dinâmica de Fluidos Division for Metrology in Flow Dynamics (Dinam), and Divisão de Metrologia em Acústica e Vibrações Division for Metrology in Acoustics and

Vibratons (Diavi). With exception of one year (changes of staff), cooperation was working well. A good example was the pilot project on public illumination. Dconf, Eletrobrás/Procel, the Electroelectronic Laboratories of the Catholic University of Rio Grande do Sul (LABELO), and the municipalities of Porto Alegre, Coronel Bicaco, Santo Augusto and Ajuricaba (all in Rio Grande do Sul state) cooperated efficiently. With some exceptions, the cooperation with the other regional PTB projects had also a positive effect.

### **Steering structure**

The project's final steering structure followed existing internal structures of INMETRO and was designed to improve dialogue and transparency between different departments by creating four thematic working groups in addition to the steering committee. In theory, the structure considers the ongoing changes on the Brazilian side, but after 2017, working group meetings did not take place as planned. This made project implementation more difficult and put more workload on the international intermittent expert and especially on the PTB coordinator. Only in the last months the steering structure is revived.

### **Processes**

A detailed operation plan was developed in a participatory way which contained the most important processes based on the impact matrix of the project. It was permanently monitored and redesigned several times, taking into consideration the various staff changes. Considering the difficulties and changes on the Brazilian side the processes could not be realized as foreseen. On the other side, with many efforts by the German team, the active support of Dconf and some professionals of Dimci and LABELO it was possible to adjust the processes.

The project was designed to improve the technical capacities within laboratories of INMETRO and to transfer this know-how to external clients. Internally, it managed to introduce cooperation and guided information exchange between several departments what is considered as one of the most important outcomes, according to the director of Dimci. It is in line with the strategic outlines presented by the new president of INMETRO, Angela Flôres Furtado.

### **Learning and innovation**

There were three learning processes and innovation planned initially. The project was designed (a) to improve the technical capacities within laboratories of INMETRO, (b) to transfer this know-how to external clients, and (c) to introduce cooperation and guided information exchange between several INMETRO departments. For this purpose, working groups were installed composed by the representatives of different INMETRO departments and laboratories. The results are documented in the reports made by the intermittent consultant, the PTB project coordinator, and the working groups' meetings. This internal learning processes is in line with the strategic outlines presented by INMETRO's new president.

The project was oriented to new strategic aspects of QI services and geared towards production, transmission and consumption of renewable energies and energy efficiency: photovoltaics, wind energy, smart grids, public illumination. The experiences and the obtained knowledge will be an important contribution to the elaboration of INMETRO's development strategy.

### 3. Learning processes and learning experience

The following concrete learning processes can be resumed:

- The introduction of working groups is a major achievement improving coordination and information flows within INMETRO.

As learning experiences can be summarized:

- Stability of the acting staff on the counterpart side and clear responsibility definition under the Presidency of INMETRO is very important for an effective and efficient implementation of international cooperation projects.
- Orientation to new strategic aspects of QI services (EE and RE) have produced experiences and knowledge (for instance inclusion of important stakeholders like EPE, ANEEL, ONS, Eletrobras; working division and cooperation between INMETRO and leading testing labs and research institutes; contact to relevant experts in Europe and U.S.A.) that will be an important contribution to the elaboration and future implementation of INMETRO's development strategy.
- In the case of EE in public illumination, the project managed to create an example of good cooperation between INMETRO, a calibration and testing laboratory (LAELO), and different municipalities in Rio Grande do Sul. This pilot activity led to a documented learning experience which can be exploited for future use. What is missing is an impact study which should be rapidly elaborated and disseminated to relevant stakeholders.
- INMETRO and its laboratories have developed a more intensive relationship with their clients (laboratories, industry, research institutes, and so on).
- Complex QI projects need the inclusion of INMETRO's accreditation department (Cgcre) and of the national standardization association ABNT.

Some of the activities are combining learning processes and experiences:

- The public illumination project has created an example of good cooperation and learning which not only created visible and significant impact but also led to a documented learning experience which can be exploited for future use.
- With the creation of a concise manual on tendering processes in public illumination projects, the illumination subproject also helped to develop a simplified language which is understandable by technicians in those municipalities where qualified staff is scarce.
- Calibration and testing laboratories are included in the technical committees of Cgcre which serves to foster the accreditation process. Technical assistance and dissemination of new calibration and testing methods and their appliances cannot be done by Cgcre, as there is a conflict of interest.

### 4. Recommendations

The following Recommendations are partially supporting the policy of the new INMETRO president which are already in implementation.

(a) Recommendations to the partners

- To intensify and systematize the exchange of information and cooperation between the different INMETRO divisions.
- It would be interesting to develop formats which allow to improve metrological competences in independent, industrial and research laboratories by INMETRO's reference laboratories. This would be also an important contribution to the accreditation process.
- To intensify the relationship with relevant calibration laboratories, industrial associations (ABSOLAR, CNI, FIESP, Chambers of Commerce, ABEEólica etc.). Especially INMETRO laboratories should actively approach industrial companies. Future projects should consider how to include important INMETRO clients into their implementation.
- To carry out innovation projects, together with industry and research institutes/laboratories for practical implementation in the country.
- To set up a special technological and innovation service in INMETRO
- Sometimes it seemed to the evaluators that in Brazil scientific and industrial metrology is only used by regulation, control, and market surveillance. But scientific and industrial metrology has another, perhaps more important task: to help industry to be successful in improving productivity and developing innovation of processes and products.
- To disseminate the information on the newly established facilities for transmitting traceability to calibration labs, industry, and industrial associations. A better demand analysis should be done (maybe "quick and dirty").
- To inform KfW on the new capabilities to measure wind speed, wind noise, and the PMU calibration facilities. KfW has relations with the operating companies.
- To systematize and disseminate the experiences of the successful illumination project (including impacts) for applying the experiences in other regions of Brazil, especially through PROCEL Reluz. A short impact study resuming and systematizing the direct and indirect impacts would be very helpful.
- To carry out research projects, together with CEPEL, on application and verification/re-calibration of PMU.
- To motivate ANEEL, ONS, and all the other interested parties in the field of smart grids to jointly develop a technical regulation including the necessity of verification/re-calibration of PMUs (if necessary).

(b) Recommendations to the project team (INMETRO/PTB 9.3)

- INMETRO needs to include the accreditation department (Cgcre) and the Brazilian standardization institution (ABNT) in future complex QI projects.
- In future projects, it should be actively considered how to include important clients (e.g. laboratories, industry, industrial associations) into their implementation.
- The long delays between initial planning (design workshop) and project start have made evident that in such cases a broader kick-off workshop is necessary to adjust to new situations and changes in conditions.

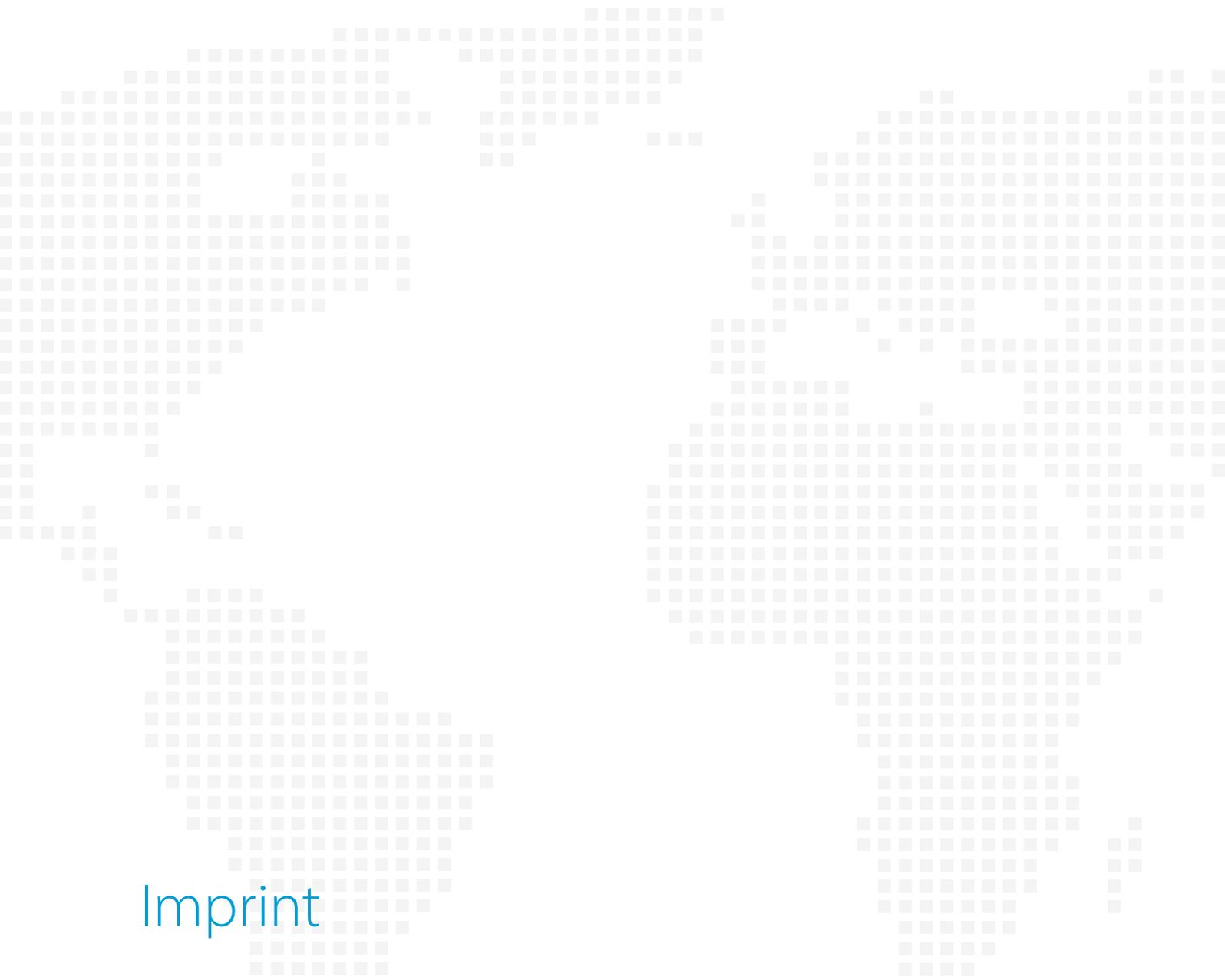
(c) Recommendations to PTB's Department 9.3

- The increased complexity of German development cooperation programs calls for improving the information exchange between KfW, GIZ and PTB and for producing synergies between the different modules.
- The coordination and information process within the bilateral and regional projects of department 9.3 was not seen in all the cases as efficient enough although the country manager for Brazil has reclaimed it various times. It has to be improved because these processes within our partners very often are not yet as systematic as desirable and has a more casual character. The results of activities are overlapping on the one hand, but there are also missed chances for creation of synergies between the PTB projects.

(d) Recommendations and observations directed to the Evaluation Working Group

- The inception report is a worthwhile instrument but primarily for the preparation of the evaluation team. Not all the counterparts are reading it before the evaluators' arrival. The guidelines in the inception report should be reduced to 6 or 8 central questions related to the main results and impacts, and the positive and negative aspects of the management and implementation process. The evaluators should also develop specific questions for the different actors of the project but not include them in the inception report.
- The sequence of the evaluation process in the Brazil was excellent: (1.) a meeting with the Brazilian management team reviewing the inception report and the main issues of the project implementation; (2.) visits of the main actors and beneficiaries of the project; (3.) workshop with the project management team (Brazilians and German coordinator) presenting the preliminary results; (4.) Presentation and discussion of the results with INMETRO's president.
- The experience to work with a leading (experienced) consultant and a new one was successful. In particular, the division of work – framework and QI treated by the leading consultant, assessment done primarily by the new consultant – assured a distant view from outside. The preparation of the new consultant could be improved, for instance by a longer stay in Braunschweig including visits of laboratories and a general introduction into QI.
- In an excellent way, the debriefing discussion in PTB served to analyse the evaluation methodology and to elaborate lessons learnt for future evaluations.
- The evaluators have some difficulties with the impact assessment. The evaluation at the end of a project can review the results of the project. Only in few cases it is possible already define some impacts (for instance the public LED illumination pilot project in South Brazil). A real impact evaluation can only be realized after 3 or 5 years.
- The evaluation of the sustainability represents another problem. It is possible to assess the project strategy in this field and to overview the activities of the project management team for assuring the continuity of the obtained results. If the sustainability in reality is guaranteed depends essentially from political conditions and personal engagement, especially in emerging and developing countries.

- The qualitative assessment seems more important than the notes and percentages. The team is not convinced that the notes make more comparable the results of the project implementation because of the different national and implementation conditions.



# Imprint

**Published by**

Physikalisch-Technische Bundesanstalt  
Bundesallee 100  
38116 Braunschweig  
Germany

**Responsible**

9.01 Processes of International Cooperation  
[evaluierung-9.3@ptb.de](mailto:evaluierung-9.3@ptb.de)  
[www.evaluierung.ptb.de](http://www.evaluierung.ptb.de)