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Strengthening Equity and Transparency in Electricity Billing in Panama Through Metrological Verification

CENAMEP AIP has reduced maximum permissible measurement errors for the verification of thousands of electricity meters, resulting in a 5-10 % reduction in billing errors

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The Challenge

In the late 1990s, Panama's electricity distribution service was privatized. In this context, the government established the National Public Services Authority (ASEP) to regulate and oversee the quality and fairness of the service provided by private distribution companies. Over time, ASEP faced a significant increase in user complaints, primarily related to incorrect billing and reports of high energy consumption. This situation posed a challenge to public trust and transparency in the electricity sector.

In response to this issue, ASEP requested the support of the National Metrology Center of Panama AIP (CENAMEP AIP) with two main objectives: 1) to establish a reliable metrological process to validate electricity consumption measurements and 2) to reduce billing inconsistencies and, consequently, user complaints.

The Solution

In response to this need, CENAMEP AIP designed and implemented, in coordination with ASEP, a national program for the metrological verification of in-service electric energy meters, based on the ANSI C12.1 standard. This program consisted of periodic evaluations (approximately every 4 years) of a representative sample of meters installed in residences nationwide (about 1 200 units per campaign). The verifications were conducted through controlled laboratory tests, enabling the determination of the meters' compliance with their accuracy class (see **Figure 1**).

A key element of the program was ensuring the international acceptance and metrological traceability of measurements. To this end, CENAMEP AIP strengthened its technical capabilities by acquiring higher-accuracy electrical energy standards, providing specialized training for its technical staff, and obtaining international recognition of its calibration and measurement capabilities (CMCs) from the International Bureau of Weights and Measures (BIPM). This approach ensured that the results were reliable, internationally comparable, and suitable to support regulatory decisions.

A Quantifiable Impact

The metrological verification campaigns—covering approximately 1 200 meters per campaign—carried out through a collaboration between the National Public Services Authority and the National Metrology Center of Panama (AIP) have yielded measurable results directly linked to key indicators in Panama's electricity sector.

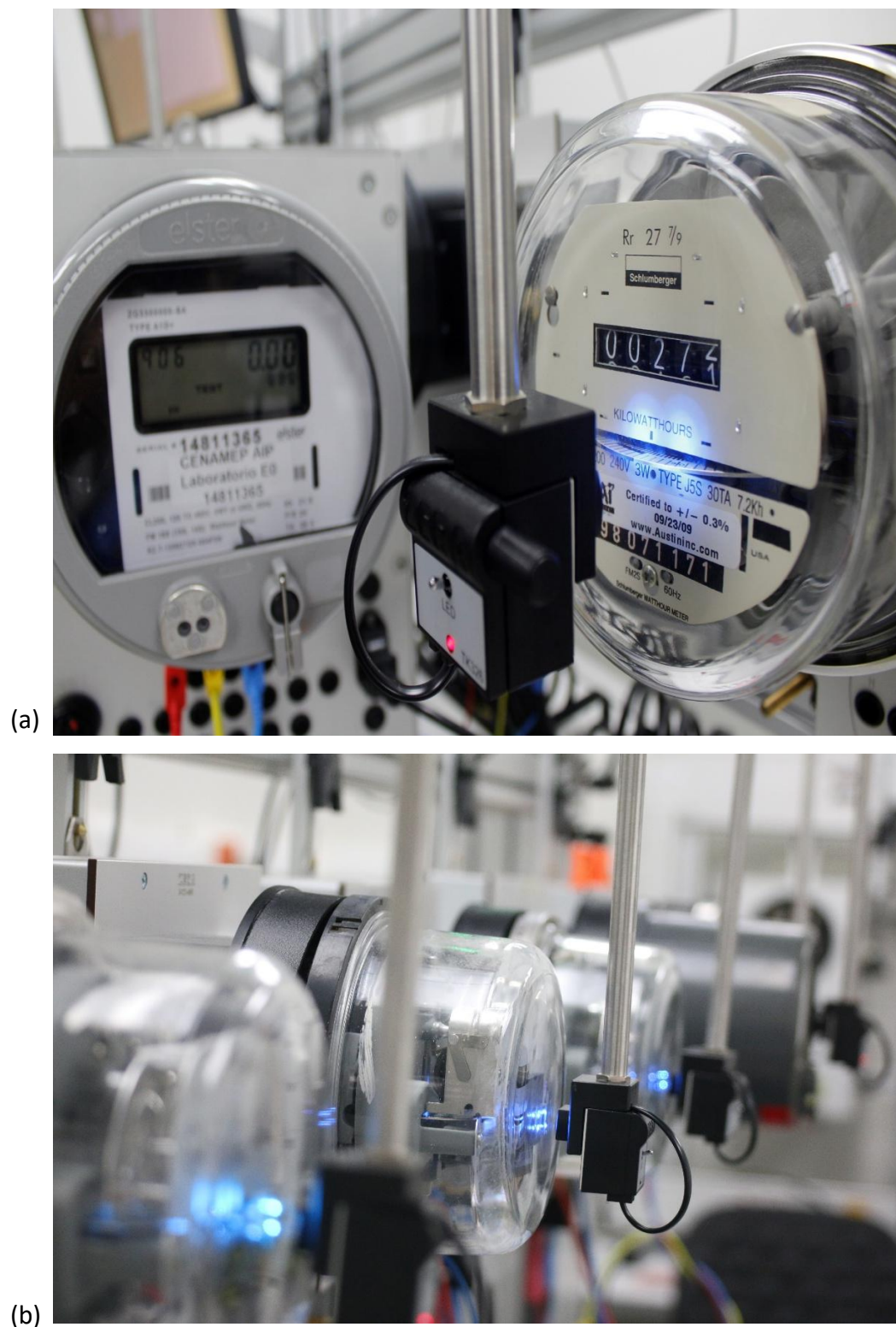


Figure 1. (a) A representative CENAMEP AIP test bench for electric energy meters. (b) A close-up showing the optical head of the test bench detecting the rotational speed of the rotor (or disc) of an electromechanical meter.

According to ASEP, complaints regarding high energy consumption have historically accounted for nearly 90 % of complaints in the electricity sector. Through metrological verification campaigns, it was found that approximately 94 % of the meters evaluated comply with their accuracy class, ruling out systematic equipment failures. Also, the problem of high consumption was primarily associated with errors in manual consumption readings. In 2016, about 67 % of installed meters were electromechanical meters with an accuracy class of ± 2 % (conforming to ANSI C12.1-2014¹). These findings formed the technical basis for ASEP's regulatory decisions to replace electromechanical meters with electronic meters of ± 0.5 % accuracy class (conforming to ANSI C12.20-2015²) and to implement remote consumption reading systems. After the metrological intervention, an estimated 15 % to 25 % reduction in administrative costs associated with claims management (ASEP and distribution companies).

This metrological intervention has resulted in a quantifiable impact, reducing the maximum permissible measurement error by up to 75 % (from ± 2 % to ± 0.5 %). As a result, there was a significant improvement in the accuracy, fairness, and reliability of the national electricity billing system. It is estimated that a 5 % to 10 % reduction in billing errors can be achieved by using ± 0.5 % class meters and remote reading systems. This has a direct impact on businesses and the general population's economic activities.

Further, the development of these capabilities and the strengthening of the country's metrological infrastructure have had a positive national impact through the transition to more accurate meters. For example, the laboratories of distribution companies acquired measurement standards at a higher metrological level. AIP, as the National Metrology Center of Panama, also strengthened its technical measurement and calibration capabilities, in line with its CMCs that have been accepted and published in the KCDB. As a result, a national metrological system was created and is now capable of supporting regulatory decisions based on internationally accepted, metrological traceable and comparable measurements.

Improvements in measurement reliability and in identifying the actual causes of complaints enabled the sector to optimize its operational management. As was the case prior to the campaigns, a significant proportion of complaints about high consumption resulted in unnecessary meter replacements because the cause was incorrectly attributed to the equipment. After technically demonstrating that the meter was not the primary source of error, this type of intervention (and the unnecessary cost) was reduced. This has promoted greater operational efficiency of the electricity system, improved service equity for end users, and strengthened the sector's economic sustainability.

Furthermore, this initiative promoted consumer and marketplace equity by ensuring fairer, more accurate electricity billing for all residential customers, regardless of socioeconomic status or location, through the implementation of more precise meters and remote reading systems. These measures were based on the findings and recommendations from the metrological verification programs conducted by CENAMEP AIP and are being gradually

¹ ANSI Standard C12.1-2014, American National Standard for Electric Meters—Code for Electricity Metering, 2014

² ANSI Standard C12.20-2015, American National Standard for 0.1, 0.2, and 0.5 Accuracy Class Revenue Meters, 2015

mandated by ASEP, the service regulator. As highlighted by ASEP in a public communication regarding the ongoing national meter verification campaign:

“This preventive action seeks to ensure that electricity billing accurately reflects the real consumption of households, strengthening transparency, public trust, and the protection of electricity users’ rights.” — ASEP, 2026

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