**TRANSFORMING BAGUIO CITY’S POWER GRID WITH**

**SMART METER TECHNOLOGY**

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**Abstract of the Study**

This case study explores modernization in the electrical structure of Baguio City by integrating advanced smart technology, putting special emphasis on the role of the smart meter. In its quest to have better and more sustainable management of energy, the incorporation of smart meters presents an innovative way of addressing the problem with the traditional power grid system. These smart metering devices are provided with advanced functionalities so that the user can obtain immediate insights into their energy usage through a cutting-edge online interface.

The web-based dashboard empowers consumers by providing clear and comprehensive visual representations of energy consumption, which enables informed decision-making toward optimizing usage habits and lowering electricity expenses. This initiative fosters a community-oriented ethos of energy efficiency and environmental consciousness. For Beneco, this implementation is a critical step in the modernization of infrastructure and customer engagement through the promotion of transparency and accountability.

Further, the study emphasizes the capabilities of smart meters to transform power distribution, reduce waste, and stabilize the power system by providing utilities with exact, real-time data that will enhance demand management. Using this technology corrects weaknesses in the current system but aligns with international efforts towards adopting smart technology in achieving a sustainable future.

This case study aims to display the great need for smart meters in reshaping energy systems, with a focus on achieving economic and environmental benefits, as well as to establish a benchmark for high-end grid management in the Philippines.

**Background of the Study**

LocalContext

Baguio City’s unique geography poses significant challenges to its power grid infrastructure. The mountainous terrain, coupled with the city’s remote neighborhoods, makes electricity distribution and maintenance both logistically difficult and expensive. Infrastructure limitations exacerbate these issues, often leading to power inefficiencies and delivery inconsistencies during adverse weather conditions, such as typhoons, which frequently affect the region.

To meet the growing energy demand driven by its booming tourism and residential sectors, the Benguet Electric Cooperative (Beneco) has identified the need to modernize its power grid. However, current analog metering systems are inadequate for addressing these challenges. They lack the capability to provide real-time consumption data, leading to inefficiencies and a lack of transparency for both consumers and utility providers.

The adoption of smart meters represents a potential solution to these issues. These devices are designed to provide real-time data on energy consumption, empower users to make informed energy decisions, and support the utility provider in managing the grid more effectively. Beneco’s initiative to integrate smart meters and a web-based dashboard for users aligns with global trends in energy modernization, focusing on both consumer satisfaction and operational efficiency.

Relevant Local Literature

In the Philippines, a study by Sioson and Del Rosario (2020) emphasized the need for modern metering technologies to address inefficiencies in energy distribution in rural and urban settings. Similarly, Mendoza et al. (2018) analyzed consumer responses to real-time energy data, finding that users reduced their consumption by up to 20% when provided with detailed insights into their energy usage. These findings highlight the potential benefits of adopting smart meters in Baguio City.

Foreign Context

Globally, smart meters have been a cornerstone of energy grid modernization efforts. Countries with advanced energy systems have successfully integrated smart meters to enhance grid reliability, improve consumer satisfaction, and promote energy efficiency.

For example, in Japan, smart meters are used to mitigate the effects of frequent natural disasters. Research by Tanaka et al. (2019) demonstrated that real-time data collection from smart meters helped utilities restore power faster during post-disaster recovery. Similarly, in the United States, studies by Smith and Perez (2021) showed that households using smart meters reduced their electricity bills by an average of 15% due to greater consumption awareness.

In Germany, where renewable energy integration is a priority, smart meters have played a vital role. A report by the German Energy Agency (2020) found that households with smart meters were better equipped to adjust their consumption patterns to align with renewable energy availability, reducing reliance on fossil fuels. India has also seen success in deploying smart meters, with a study by Chatterjee (2021) highlighting a 30% reduction in electricity theft in areas where smart meters were implemented. Finally, in Australia, research by Lewis and Barker (2022) revealed that smart meters helped consumers take advantage of dynamic pricing schemes, reducing peak-hour energy consumption by 25%.

Relevant Foreign Literature

The findings from these international studies underscore the importance of smart meter adoption. The success stories from countries like Japan and India highlight the transformative impact of these technologies, especially in regions with unique challenges such as disaster-prone areas or energy theft.

**Institution Profile**

The Benguet Electrc Cooperative, Inc. (BENECO) is located in Northern Luzon in the Cordillera Administrative Region. It is about 4 hours drive from Manila. On October 5, 1973, BENECO, was organized and registered as a non-stock, non-profit service-oriented entity and was granted by the National Electrification Commission in March 20, 1978 the sole franchise to operate an electric

light and power service in the City of Baguio and Benguet province for a period of fifty (50) years. At the birth of BENECO, only the central portion of the city was being supplied with electricity by the Asin Mini-Hydro Electric Plants built by the Americans before World War II while the small portion of the peripheries of the city was

supplied by NPC Feeder from Beckel, La Trinidad substation. The poblacion of La Trinidad, Benguet was lighted by

the Benguet Development Corporation and the small portion of Itogon and Tuba were being supplied with power by

the Rural Power Corporation. These electric systems were taken over by BENECO in January 1974 by virtue of the

provisions of P.D. No. 269. Total 100% electrification at the barangay level was attained in March 2012. The franchise area of BENECO comprises the 13 towns of Benguet Province composing of 140 barangays and 129

barangays in the City of Baguio for a total of 269 barangays. BENECO is composed of 11 districts, six districts in Baguio City and five districts in Benguet Province.

In August 2016, the original headquarters at Alapang, La Trinidad, Benguet was transferred at #4 South Drive, Baguio City to provide " one-stop-shop " service to member-consumers and centralize all the management and

operations command of the Cooperative. The building has a total of 3,000 sqm. of space housing the Gen. Pedro Dumol Hall, Gen. Sanchez Hall, offices,

linemen's quarters, collection center and other service facilities Key Features of BENECO: Service Coverage: Baguio City

Benguet Province (13 municipalities including La Trinidad, Itogon, Tuba, and others)

Core Functions: Distribution of electricity to households, businesses, and industries within its franchise area. Maintenance and improvement of electrical infrastructure to ensure reliability. Support for renewable energy initiatives and rural electrification programs. Vision and Mission: Vision: To be a globally competitive and socially responsive electric cooperative. Mission: To deliver quality, affordable, and sustainable energy services for the well-being of the communities they

serve.

Governance Structure: BENECO is governed by a Board of Directors elected from its member-consumers. The management team oversees daily operations, while member-consumers actively participate in decision-making processes. Recognition: BENECO is recognized as one of the better-performing electric cooperatives in the Philippines, earning awards for operational excellence and

**Statement of the Problem**

The Beneco System (Benguet Electric Cooperative System) faces several challenges related to data management, service efficiency, and customer monitoring. These issues include:

1. Inefficient data management system - The manual processes for recording and processing information lead to delays and inaccuracies in customer records, billing, and collections.
2. Delays in service and maintenance - The lack of an effective system for handling complaints and scheduling maintenance causes delays and dissatisfaction among customers.
3. Lack of real-time monitoring – The absence of modern mechanisms to monitor power line issues and electricity usage results in slower responses to outages and service interruptions.
4. Limited customer engagement - The lack of user-friendly platforms (e.g., online systems for billing and complaints) results in low levels of interaction and customer satisfaction.