ENERGY PROFILING AND EFFICIENCY ENHANCEMENT OF SELECTED MICRO-SMALL-MEDIUM ENTERPRISES IN ILOCOS NORTE, PHILIPPINES

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ABSTRACT

This study looked at the daily operations' energy consumption patterns, assessed corporate operators' energy awareness, and suggested doable plans for cutting use and improving efficiency of MSMEs in Ilocos Norte. By not only identifying areas in need of improvement but also arming MSMEs with the required knowledge to adopt sustainable practices inside their operations. The study demonstrates that with the right knowledge and tools, MSMEs can significantly reduce operational costs and enhance sustainability. Findings support the formulation of localized energy interventions and policies that empower MSMEs to contribute to broader renewable energy and climate goals.

OBJECTIVES

Specifically, the study aims to:

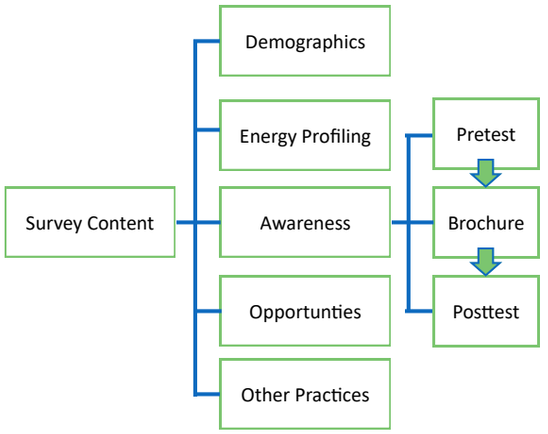
1. Determine the current electricity consumption of selected MSMEs in Ilocos Norte by collecting equipment-level energy estimates
2. Analyze daily and monthly energy usage patterns, identifying energy intensive processes
3. Assess MSME awareness and adoption of energy-efficiency practices
4. Identify opportunities to improve energy efficiency based on energy efficiency enhancement practices applicable to the MSMEs
5. Recommend solar PV setup as an energy-efficient alternative best practice to increase their competitiveness and sustainability.

BACKGROUND

The Philippines has set targets to increase the renewable energy share to 35% by 2030 and 50% by 2050 (*Philippines - Energy*, 2024). MSMEs comprise 99.6% of all businesses in the Philippines and are vital to the country's economic development (Ibarra & Velasco, 2015). Micro, small, and medium-sized enterprises (MSMEs) play a significant role in the Philippine economy because of their impact on employment, income, and overall economic development

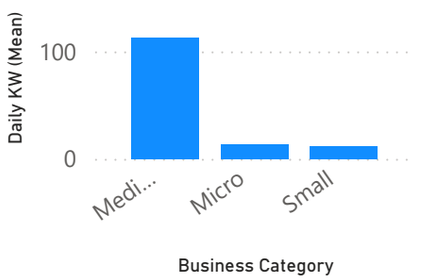
Size	By Employment	By Asset Size
Micro	1-9 employees	Up to Php 3M
Small	10-99 employees	Php 3,000,001.00-Php 15M
Medium	100-199 employees	Php 15,000,001.00-Php 100M

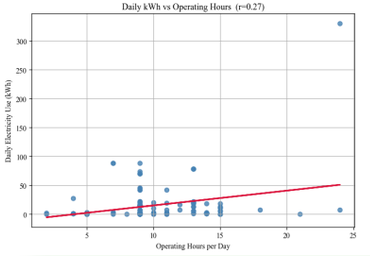
METHODS

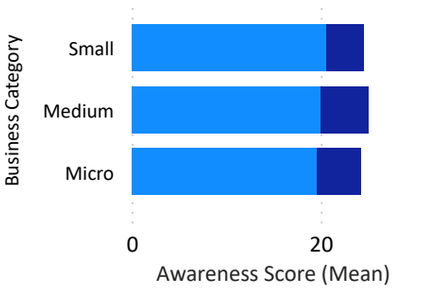


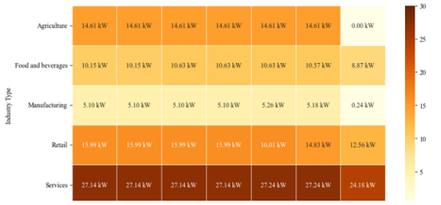
RESULTS

Overall mean is 15.43 KW. Refrigeration, lightning and ventilation are top energy consuming categories. Most MSMEs operate within a low energy intensity range, however, there are some few outliers from different sectors or business category that needs further enhancement. Sunday has the le usage and Fridays has the most. Operating hours are not a good indicator of energy consumption. Through a structured awareness intervention, the study also revealed improved understanding and adoption of energy-efficient practices, particularly in relation to renewable energy. The assessment energy efficiency practices highlighted strong applicability in areas such as LED lighting, behavioral changes, and energy-efficient appliances, presentir immediate opportunities for improvement. Based on their calculated daily energy consumption, tailored solar PV setups were recommended, with m businesses falling within the 1 to 6 kW system range. Higher-capacity systems (above 20 kW) were not encouraged to pursue standalone setups due t cost and storage limitations. Battery storage remains essential for off-grid reliability but is economically viable primarily for small to mid-sized installations. Single line diagram grid tie setup is provided as recommendation









CONCLUSION

Current energy usage, is anticipated to change with increased awareness. Distinct consumption patterns were observed; however, certain patterns require enhancement through energy-efficient practices. An educational brochure effectively improved the awareness of context-specific practices among MSMEs. The applicability of each recommendation is dependent on the equipment portfolio of individual MSMEs .The foremost best practice involves the implementation of solar photovoltaic systems, preferably under net-metering agreements to enhance surplus generation and reduce costs

REFERENCES

Ibarra, V. C., & Velasco, R. M. (2015). *Accounting Knowledge, Practices, and Controls of Micro, Sr and Medium Enterprises: Evidence from the Philippines*. https://api.semanticscholar.org/CorpusID:155224265

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Mean Daily Energy Usage (KWh)

15.43

Micro (kWh) 13.22

Small (kWh) 12.07

Medium (kWh) 113.25

Cooling & Ventilation 2.19 (0.00 – 15.43)

Entertainment & Audio 0.87 (0.00 – 15.43)

Lightning and Electrical 2.21 (0.00 – 15.43)

Office & IT Equipment Daily Usage 1.46 (0.00 – 15.43)

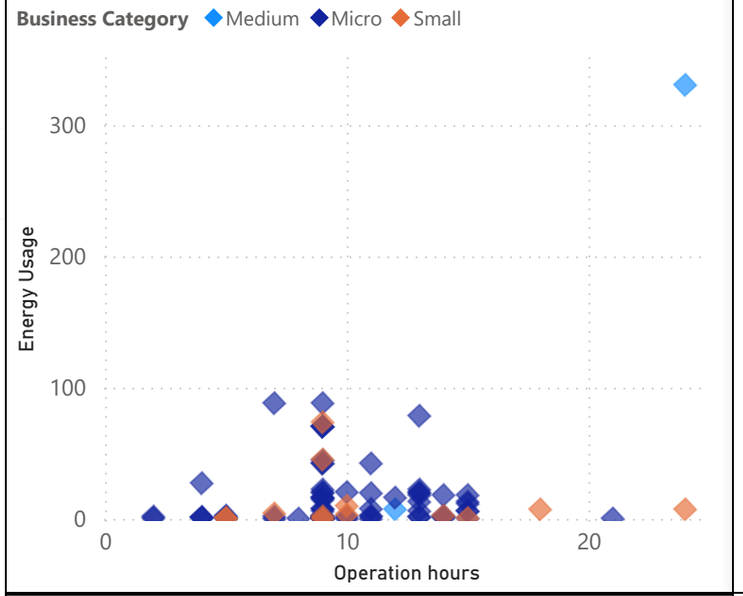
Kitchen Equipment 1.04 (0.00 – 15.43)

Refrigerator and Storage 4.26 (0.00 – 15.43)

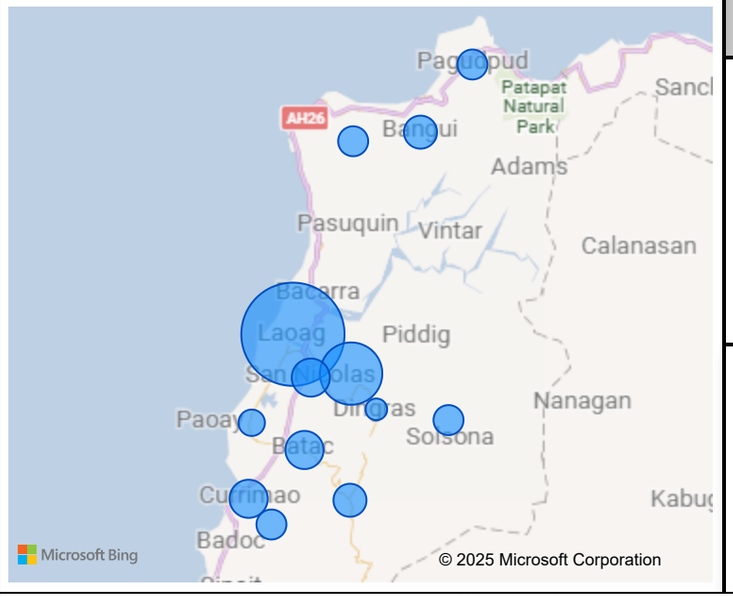
Industrial & Manufacturing 1.76 (0.00 – 15.43)

Others 1.63 (0.00 – 15.43)

Correlation Between Energy Usage and Number of Hours

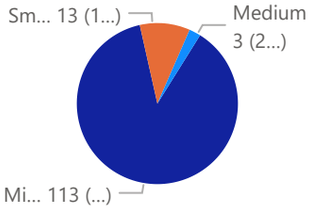


Municipality

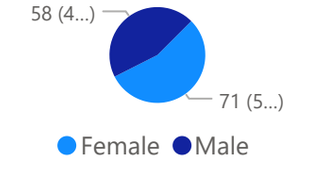


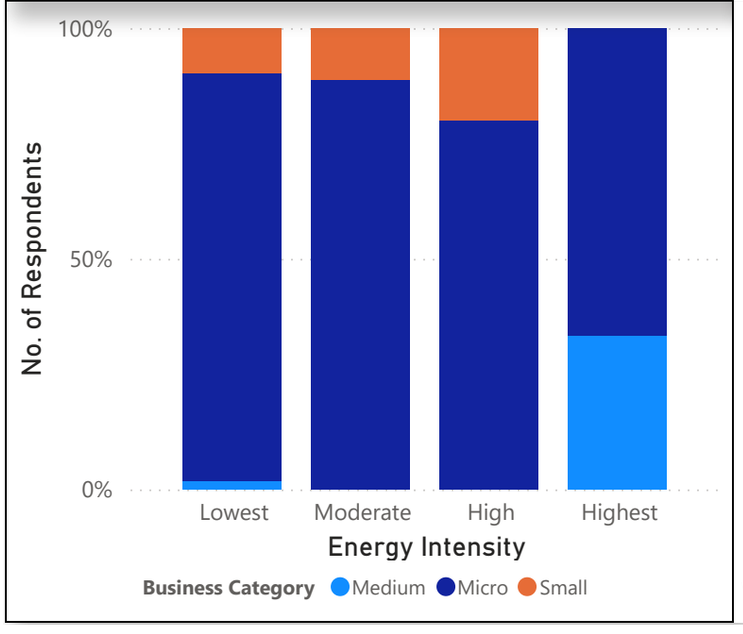
Industry Type: All

No. of Respondents by Business Category

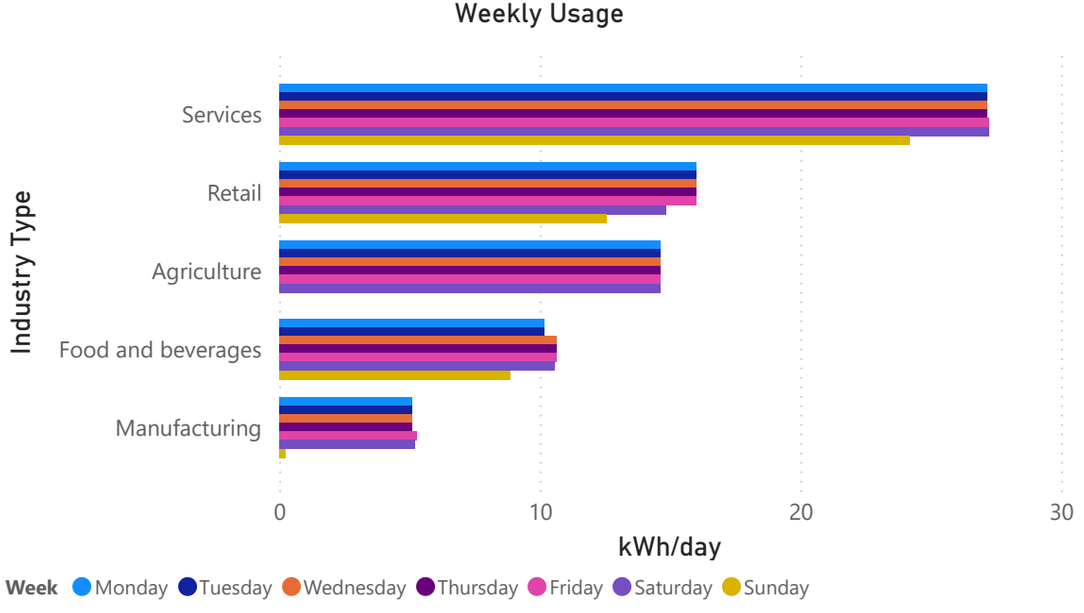


Number of Respondents by Sex Aggregation





Weekly Usage



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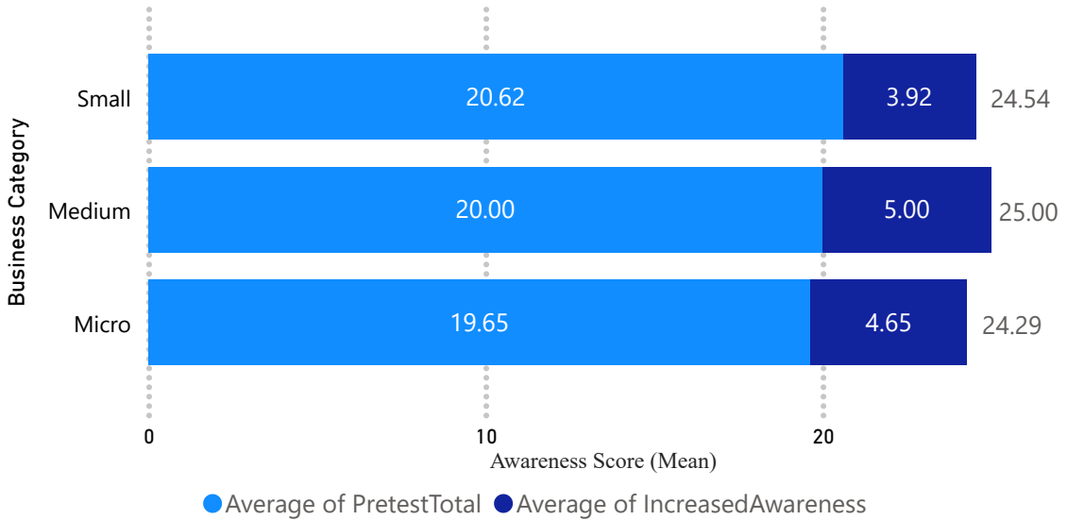
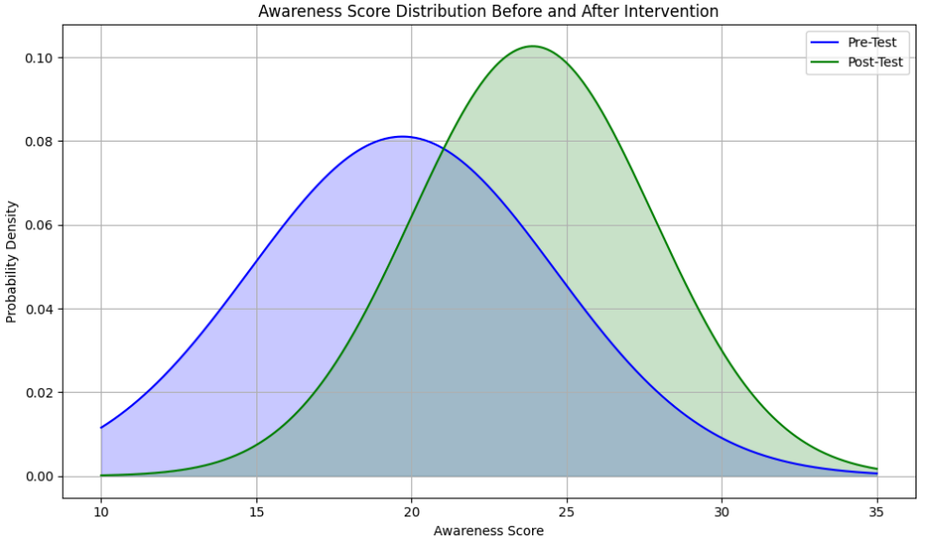
4.58

Average of IncreasedAwareness

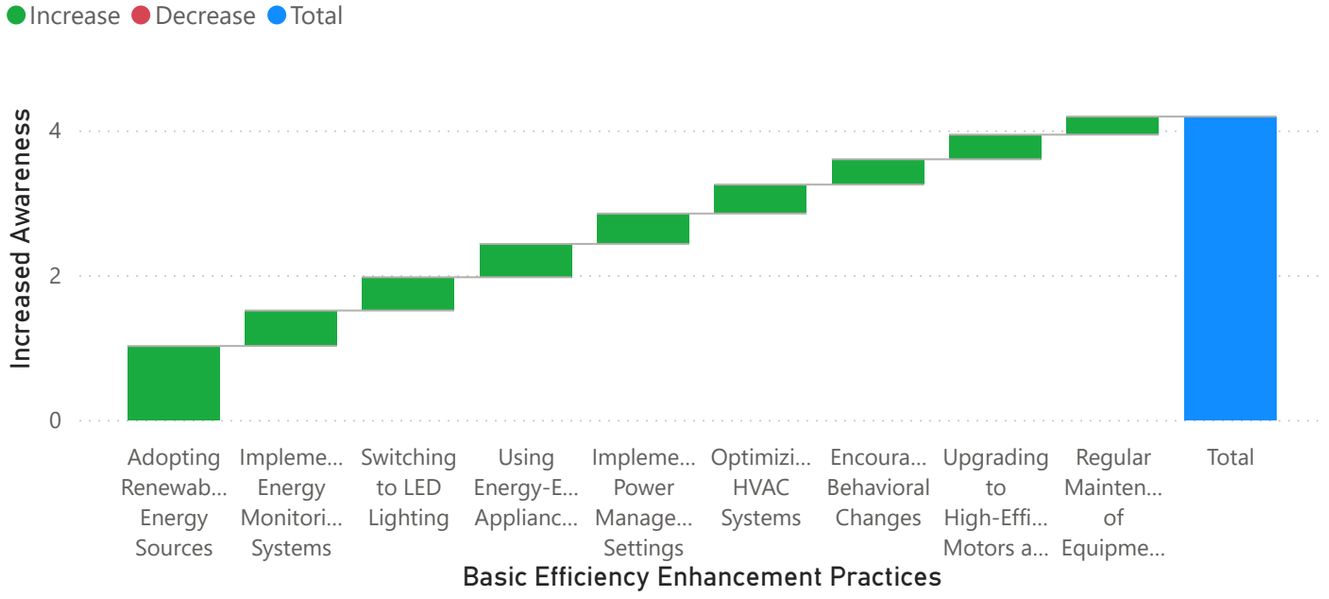
Mean Awareness Score per Business Category



Awareness Score Distribution Before and After Intervention



Increased Awareness by Basic Efficiency Enhancement Practices



Opportunies to apply basic energy efficiency practices