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EXAMINING THE VIABILITY OF ADOPTING SOLAR ENERGY INTEGRATION AS POWER COST REDUCTION INITIATIVE OF MANUFACTURING COMPANY A

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ABSTRACT

Industrial companies in the Philippines face mounting pressure to adopt renewable energy to counter volatile electricity costs; however, leadership at Manufacturing Company A hesitated due to perceived capital constraints, viewing the project as a simple, high-cost power reduction initiative rather than a strategic necessity. To address this research problem, this study employed a qualitative, single case study methodology utilizing environmental scanning and in-depth, semi-structured interviews with 11 key managers and supervisors. The major findings revealed that the primary drivers for adoption are mitigating the high operational cost of an unstable grid and upholding the brand integrity of a green-tech company, rather than simple utility savings. Furthermore, the firm's key internal strength is world-class engineering expertise, contrasted by a critical weakness of limited internal capital. Consequently, the study concludes that solar integration is a core strategic imperative essential for the company's operational stability and ESG credibility, not merely a cost-saving measure. Based on these conclusions, it is recommended that the company reframe the initiative as a living Showcase and R&D testbed, and leverage a Zero-Capex Power Purchase Agreement (PPA) model to bypass internal financial hurdles.

Keywords: *renewable energy, solar energy integration, PESTEL analysis, SWOT analysis, TOWS analysis.*

INTRODUCTION

Industrial companies in the Philippines are facing significant operational and strategic challenges, driven by both unpredictable increases in electricity costs and mounting pressure for corporate sustainability. As major energy consumers, reliance on fossil fuels exposes the industrial sector to market volatility and positions them as key contributors to national carbon emissions (Alam et al., 2020). While the country's high solar irradiance makes photovoltaic (PV) systems a geographically and economically viable solution—as demonstrated by leading local manufacturers like Uratex, which now powers multiple factories with clean energy (Catubay et al., 2024; Uratex, 2024) the transition is rarely a simple purchasing decision. It is a complex strategic choice influenced by dynamic external threats, such as grid instability and regulatory permit delays (Bunda et al., 2023; Enerdata, 2024), alongside internal weaknesses, such as limited specialized financial resources (Gutierrez & Ermita, 2023; Tone et al., 2024).

For Manufacturing Company A, adopting solar energy is critical to counter these volatile costs and maintain the brand integrity expected of a green-tech firm. However, leadership often hesitates due to the overwhelming number of external factors and perceived high capital costs. The rationale of this study stems from a critical research gap observed from an insider's perspective: while existing literature extensively describes the external barriers to solar adoption, there is a lack of research applying a structured strategic framework to guide a specific firm through this complex decision-making process. Most studies focus on describing problems rather than providing a prescriptive, customized roadmap. Therefore, conducting a structured viability assessment is imperative to shift the organizational perspective, proving that solar integration is not merely a financial decision, but a holistic, strategic imperative for operational survival.

Research Questions

The study aimed to assess the readiness of Company A for solar integration. Specifically, it sought to:

1. What is the current state of Manufacturing Company A for solar energy integration environmentally scanned through Political, Economic, Social, Technological, Environmental, and Legal (PESTEL)?
2. What are the key challenges and opportunities for Manufacturing Company A in adopting solar energy, identified through a SWOT analysis of its internal Strengths and Weaknesses and external Opportunities and Threats?
3. What strategies can be proposed to guide Manufacturing Company A in effectively integrating solar energy?

METHODOLOGY

Research Design

A qualitative research methodology using a single case study design was employed to gain a holistic understanding of the organizational context. The study utilized two analytical frameworks: PESTEL for external environmental scanning and SWOT for internal assessment.

Research Locale and Population

The study was conducted at Manufacturing Company A, located in Light Industrial Park III, Sto. Tomas, Batangas. The company was selected for its strategic alignment as a green-tech leader. Participants included 11 key personnel (Managers and Supervisors) from Engineering, QA, Production, Facilities, and Finance, selected via purposive sampling.

Research Instrumention

Two primary instruments were utilized to collect data. First, an environmental scanning matrix was used to systematically categorize secondary data from government reports, industry publications, and news media according to PESTEL factors. Second, a validated, semi-structured interview guide was deployed, utilizing open-ended questions strictly mapped to the PESTEL and SWOT frameworks.

Data Gathering Procedure

Data collection was guided by an interpretivist approach and conducted with an emic perspective, leveraging an insider's view of the organization's culture and operations. Following the acquisition of informed consent, environmental scanning was performed concurrently with the interview process. Interviews were facilitated to gather detailed insights, focusing on documenting verbatim quotes and the core substance of the management's perceptions. Member-checking was utilized post-interview to ensure the credibility and accuracy of the qualitative data.

Management and Treatment of Data

Data Analysis Plan: The qualitative data were rigorously processed using Braun & Clarke’s (2006) six-phase Thematic Analysis. The plan executed the following phases: (1) Familiarization with the interview notes and scanning data; (2) Generating initial codes line-by-line; (3) Searching for potential themes; (4) Reviewing themes for coherence; (5) Defining and naming themes strictly categorized under the PESTEL and SWOT headers; and (6) Producing the final analytic narrative synthesized via a TOWS matrix to generate strategic proposals.

RESULTS

This section presents the synthesis of the environmental scan and interview data, structured by the research objectives.

PESTEL Analysis: The External Environment

Table 1. Summary of Emerged Themes from the Study

Category	Themes
POLITICAL & LEGAL	**Theme 1:** National policy provides both foundational support and key gaps.
	Theme 2: Legal-administrative barriers threaten project implementation.
ECONOMIC	**Theme 1:** High and unpredictable energy prices are a primary driver.
	Theme 2: The project is a strategic investment in stability, not a simple cost.
SOCIAL	**Theme 1:** Brand integrity and Walking the Talk are non-negotiable.
	Theme 2: Meeting external stakeholder demands
TECHNOLOGICAL	**Theme 1:** External technology presents reliability challenges.
	Theme 2: Internal and advanced technology is the key opportunity.
ENVIRONMENTAL	**Theme 1:** High solar irradiance is a key geographical asset.
	Theme 2: Climate and national goals drive urgency for resilience.
STRENGTHS (Internal)	**Theme 1:** In-House Engineering and Technical Expertise
	Theme 2: Availability of Suitable Physical Assets
WEAKNESSES (Internal)	**Theme 1:** Financial and Human Resource Constraints
	Theme 2: Gaps in Operational and Organizational Planning
OPPORTUNITIES (External)	**Theme 1:** The Living Showcase for Sales and Branding.
	Theme 2: Achieving Operational and Process Stability.
	Theme 3: An R&D and Troubleshooting Testbed.
THREATS (External)	**Theme 1:** Systemic and Policy Instability.
	Theme 2: Physical and Component-Level Risks.

Strategic Analysis

The synthesis of these factors led to the following strategic propositions:

Table 2. TOWS Analysis

Internal Factors / External Factors	**Strengths:** **S1:** In-House Engineering & Technical Expertise **S2:** Availability of Physical Assets **S3:** Proprietary Core Technology	**Weakness:** **W1:** Financial & Human Resource Constraints **W2:** Gaps in Operational & Organizational Planning
Opportunities: **O1:** Living Showcase for Sales **O2:** Operational & Process Stability **O3:** R&D / Troubleshooting Testbed **O4:** Zero-Capex (PPA) Model	**Strengths + Opportunities** **S1 + O2:** Position the project as a strategic R&D and Marketing asset, not a simple cost-saving measure, by leveraging in-house expertise to build the ultimate Living Showcase and R&D Testbed. **S2 + O2:** Use the ample roof and land space to design a system (ground-mount or rooftop) that maximizes operational stability and resilience, not just energy output. **S3+O2:** Use the company's own flywheel technology to solve solar intermittency and guarantee the operational stability that production managers require.	**Weakness + Opportunities** **W1+O4:** Overcome internal capital and human resource constraints by utilizing the mature zero-capex PPA market, achieving cost stability without an upfront budget battle **W1+O3:** Justify a dedicated project team by framing the project as an R&D testbed, thereby avoiding the side project trap.
Threats: • Systemic & Policy Instability • Physical & Component-Level Risks	**Strengths + Threats** **S1+T2:** Use in-house engineering expertise to aggressively mitigate component and physical risks by writing all technical	**Weakness + Threats.** **W1+T1:** Use the PPA model as a financial shield against policy instability, transferring the long-term

	specs, vetting all vendors, and supervising the installation to typhoon-grade standards. **S1+T1:** Mitigate delays by leveraging in-house experts to prepare a 100% compliant design and permitting package before submission.	asset risk from Company A to the PPA provider. **W2+T2:** Solve the internal no O&M plan weakness by mandating that any vendor contract includes a comprehensive, long-term Operations & Maintenance (O&M) and service-level agreement (SLA) to mitigate component failure risks

DISCUSSION

Political/Legal: The Renewable Energy Act of 2008 provides essential fiscal incentives. However, managers identified legal-administrative barriers, specifically LGU and ERC permitting delays, as a critical financial risk.

Economic: High and unpredictable energy prices were the primary economic driver. Participants framed the project not as a cost, but as an insurance policy against the high operational costs of grid instability. While leadership initially viewed the project as a high-cost capital expense, financial viability is achievable through specific strategic benchmarks. Based on internal financial assessments, a self-funded solar integration project for Company A is considered viable if the payback period is within a 5–7-year window. This timeframe allows the company to transition from a large upfront investment to long-term power cost reduction and financial stability, effectively turning a volatile energy bill into a predictable operational cost.

Social: For a company manufacturing energy storage, brand integrity is non-negotiable. Walking the talk regarding renewable energy is essential for determining credibility with investors and employees. This internal drive is supported by literature showing that 60% of industrial firms in the Asia-Pacific link renewable energy transition to brand reputation and investor confidence (EY Global, 2023)

Technological: The external grid is viewed as a threat due to frequent fluctuations. Conversely, the company's internal proprietary technology is a major opportunity to stabilize solar intermittency. This finding aligns with broader ASEAN trends where aging infrastructure makes grid independence a strategic necessity for manufacturing continuity (Alam et al., 2020; Enerdata, 2024).

Environmental: High solar irradiance in Batangas is a key asset. However, typhoon risks necessitate high wind-load engineering standards to prevent catastrophic damage.

SWOT Analysis: Internal Strengths and Weaknesses

Strengths: The most significant strength is In-House Engineering Expertise. Unlike typical manufacturers, Company A can design, vet, and validate the system internally, reducing reliance on external vendors. By leveraging in-house engineers, Company A bypasses the skilled labor shortages cited by 67% of Southeast Asian manufacturers as a primary barrier to green tech adoption (Deloitte, 2024)

Weaknesses: The primary weaknesses are Financial/Human Resource Constraints. Budget is tight, and engineering teams are allocated to revenue-generating R&D, leaving no man-hours for internal projects. There is also a lack of a clear Operations & Maintenance (O&M) ownership plan.

Opportunities: The project offers a living showcase for sales, turning the factory into a marketing tool. It also serves as an R&D Testbed for product data.

Threats: Policy instability (changes in net metering) and physical risks (component failure/typhoons) remain the top external threats.

Flagship Project Strategy (S1+O2): Re-frame the project from a cost-saving measure to a strategic living showcase and R&D testbed. This justifies the investment by linking it to sales growth rather than just utility savings.

Zero-Capex Strategy (W1+O4): To overcome critical internal capital and human resource constraints, Company A should utilize the mature Zero-Capex Power Purchase Agreement (PPA) market. In this model, a third-party provider bears the 100% upfront financial cost and the long-term asset risk, while Company A secures stable, discounted electricity rates. This strategy serves as a strategic shield against policy instability, as the vendor (as the asset owner) bears any long-term policy or regulatory risk, protecting Company A's investment reserves while achieving immediate ESG compliance and grid independence

Technical Evaluation Strategy (S1+T2): Leverage in-house engineering strengths to vet all specifications and monitor installation, effectively shielding the company from the threat of low-quality components and typhoon damage.

Conclusions

Based on the summary of findings, it is concluded that solar energy integration is a highly viable and necessary strategic imperative for Manufacturing Company A. The initial leadership hesitation regarding high capital costs can be resolved by shifting the perspective from a simple cost-reduction initiative to a strategic marketing and R&D asset. By leveraging a Zero-Capex PPA model, the company can successfully bypass its internal financial constraints, neutralize external threats using its inherent engineering strengths, and secure critical operational stability.

Recommendations

Conduct Quantitative Financial Analysis: Run a full model comparing self-funded vs. PPA options to finalize the business case.

Formalize the R&D Testbed: Officially designate the project as an R&D initiative to allocate specific engineering man-hours.

Mandate O&M in Contracts: Ensure any vendor agreement includes a comprehensive O&M Service Level Agreement to mitigate the no ownership risk.

For Future Research:

Methodological Improvements: Future studies should prioritize face-to-face interviews and audio recording to capture non-verbal cues and allow for a more detailed micro-analysis of participant responses, which was a limitation in this study due to logistical constraints.

Expanding Scope: While this study provided deep insider insights from a single firm, future research should conduct a broader quantitative survey across multiple manufacturing firms in the Calabarzon region. This would determine if the strategic drivers identified—such as brand integrity and grid instability are statistically generalizable across the industrial sector

Compliance with Ethical Standards

Written consents from the selected participants of the study were obtained. The researcher provided the participants with clear and understandable information regarding the study's purpose, procedures, and their right to voluntary participation. The researcher ensured the confidentiality and anonymity of the participants' data. The researcher respected each participant's privacy, and the collected data were stored securely and made accessible only to me. The researcher used the data solely for the academic purposes of this research and reported them in a collective form to maintain participant confidentiality.

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