Feasibility Study Report

ImoleDe: Smart Solar Energy Device and Management System

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1. INTRODUCTION

Nigeria faces a severe energy deficit, marked by unreliable grid supply, widespread dependence on fossil fuel generators, and limited access to affordable renewable energy. Less than 55 percent of the population has grid access, with most urban centers receiving under 12 hours of electricity daily. For decades, households, businesses, and hospitals have relied on fossil fuel generators, driving up operational costs, worsening environmental pollution, and placing heavy financial burdens on citizens. Although solar adoption is growing, many solutions remain basic, focusing only on energy generation and storage without addressing system optimization, predictive maintenance, or intelligent management. Existing deployments lack the scalability and smart features needed to transform Nigeria's energy landscape. This proposal introduces a Smart Solar Energy Device and Management System designed to optimize generation, distribution, and storage. The solution integrates solar photovoltaic hardware with Internet of Things (IoT) sensors, AI-driven predictive analytics, mobile and cloud-enabled dashboards. This enables real-time monitoring, intelligent control, predictive fault detection, and efficient energy utilization. Users can track consumption, anticipate component failures, and maximize system performance, ensuring long-term reliability and cost savings. The innovation is both timely and scalable. It supports individual households as well as community-level microgrids, aligning with Nigeria's renewable energy objectives and the global green transition. Beyond providing clean and reliable power, the system advances NASENI's mandate by fostering local industrial growth, technology transfer, and job creation, thereby contributing to a sustainable future under the Renewed Hope Agenda.

2. RESEARCH OBJECTIVES

The primary objective of this research is to commercialize ImoleDe, a Smart Solar Energy Device and Management System that enhances energy access, efficiency, and sustainability in Nigeria while supporting local industrial development. Specifically, the research seeks to:

a. develop and deploy a modular solar device with seamless integration into existing systems, reducing adoption barriers for households, SMEs, and communities;
b. incorporate IoT-enabled monitoring, AI-driven predictive maintenance, and smart load prioritization to improve reliability, reduce downtime, and lower the total cost of ownership;

c. provide real-time data visualization and remote control through mobile and web dashboards, enabling end-users to track consumption, efficiency, and savings;
d. ensure durability and low maintenance, with designs adapted to Nigeria's environmental conditions to guarantee long-term affordability; and
e. scale the solution across households, small and medium scale enterprises (SMEs), and community-level microgrids, contributing to Nigeria's energy transition by displacing fossil fuel generators and promoting sustainable, locally manufactured technologies.

3. INNOVATIVENESS AND NOVELTY

The uniqueness of this system lies in its ability to transform solar energy generation into a smart, managed process through digital intelligence. Unlike most solar installations in Nigeria that function as passive systems, this solution employs AI to analyze historical energy use patterns, predict maintenance needs before failures occur, and optimize overall performance. IoT sensors continuously track parameters such as voltage, battery health, and inverter efficiency, triggering alerts when anomalies are detected. The system incorporates smart load prioritization and balancing, ensuring that high-priority appliances receive power first, reducing wastage, and extending battery life. A further innovation is its remote control capability, which allows users to manage appliances even while away from their homes or offices. This is particularly valuable during peak sunshine hours, when users can activate energy-intensive devices to maximize solar utilization and reduce reliance on stored power. Hybrid compatibility enables seamless integration with grid electricity and backup generators, making the system highly adaptable to Nigeria's fragmented energy environment. Designed with affordability, climatic conditions, and diverse user needs in mind, it also includes time-control, surge protection, and comprehensive monitoring features. Users can monitor, control, and optimize their solar energy system both on-site and remotely, ensuring reliability, cost-effectiveness, and enhanced user satisfaction.

4. COMMERCIAL VIABILITY

The commercialization prospects for the ImoleDe Smart Solar Energy Device and Management System are substantial, driven by Nigeria's off-grid and underserved energy market valued at over $9.2 billion annually and an estimated 80 million people lacking reliable access to electricity (World Bank). Demand continues to grow as households, SMEs, schools, and clinics increasingly recognize the high costs and environmental burden of diesel generators and seek sustainable alternatives. The solution offers a clear competitive advantage by going beyond conventional solar hardware to integrate intelligent energy management, predictive maintenance, real-time monitoring, and smart load control, thereby ensuring higher efficiency, durability, and user satisfaction. The business model combines direct device sales, subscription-based software services for advanced analytics, and pay-as-you-go financing in partnership with microfinance institutions, reducing barriers to entry for low and middle-income households. Strategic alliances with solar installers, cooperatives, and rural electrification agencies will further accelerate adoption and scalability. By aligning strong market demand with a diversified revenue model and clear value-added differentiation, the research demonstrates significant potential for long-term commercial success and sustainable impact.

5. PRELIMINARY RESULTS

Prototype testing has demonstrated the feasibility of the ImoleDe Smart Solar Energy Device and Management System under controlled conditions, corresponding to Technology Readiness Level (TRL) 5 - 6. The system has moved beyond conceptual design and laboratory validation, showing reliable performance in simulated operational environments. The next phase will involve pilot deployment in real-world settings, advancing to TRL 7, where the solution will be tested in households, SMEs, and community microgrids. These pilots will validate performance in diverse operating conditions and provide evidence for scalability, local manufacturing potential, and commercial viability. This staged progression ensures that the technology matures systematically, reducing risks and strengthening the pathway toward full commercialization. NASENI support will accelerate the movement from pilot demonstration to full commercialization, positioning the system as a flagship renewable energy innovation in Nigeria.

6. ALIGNMENT WITH NASENI OBJECTIVES

This research directly supports NASENI's mandate to foster national industrialization, sustainability, and job creation while advancing the Renewed Hope Agenda. It promotes renewable energy adoption and reduces dependence on fossil fuel generators, thereby cutting carbon emissions and strengthening sustainability. By prioritizing local assembly and eventual component manufacturing, it builds technical capacity, encourages local manufacturing, and generates employment. The integration of IoT and AI into renewable energy solutions positions Nigeria to participate more actively in the global digital and green economy, while the provision of affordable and reliable energy to households, SMEs, and rural communities enhances productivity and livelihoods. Through these combined impacts, the research contributes meaningfully to Nigeria's industrial development, renewable energy targets, and innovation-driven economic growth.

7. TECHNICAL FEASIBILITY

The technical feasibility of the ImoleDe Smart Solar Energy Device and Management System is well established, with the technology currently at TRL 4–5 following laboratory validation of its core concepts, and with this research set to advance it to TRL 7–8 through prototyping, pilot deployment, and commercialization. The system architecture connects solar panels, battery storage, and grid supply to a microcontroller-based smart device that integrates IoT sensors, AI-driven load prioritization, surge protection, and switching modules for intelligent energy distribution. This device monitors inputs such as solar charge rates, battery status, grid availability, and building energy demand, then allocates power to prioritized loads through automated switching. A communication module links the system to the ImoleDe mobile application, enabling real-time monitoring, remote control, and performance optimization. The modular design allows scaling from single households to larger community microgrids, while materials and protective features are tailored to Nigeria's hot, humid, and dust-prone environments. In addition, the potential for local component sourcing and assembly supports NASENI's mandate to strengthen indigenous manufacturing and industrial development.

8. FINANCIAL FEASIBILITY

The financial feasibility of the ImoleDe Smart Solar Energy Device and Management System demonstrates strong potential for rapid commercialization and profitability. Table 1 presents the pricing model, to remain competitive with existing solar management systems but offering superior functionality. To support research and development, prototyping, pilot deployment, and early commercialization, a funding requirement of approximately ₦500 million is identified. Revenue projections indicate steady growth as shown in Tables 3a, 3b and 3c. These projections are presented in Tables 4 - 6 and they confirm the research's commercial viability, scalability, and potential to deliver both financial returns and socioeconomic impact.

The pricing model is a strategic approach to determine the optimal price for their products or services. It helps the business balance our revenue goals with customer affordability and perceived value. By selecting the right pricing model, we hope the business can optimize her pricing strategy, increase revenue, and maintain a competitive edge in the market.

Table 1: Pricing Model

Plan	Target Users	Assumed Monthly Price (₦)	Revenue Potential
Basic Home Kit (1–5 devices)	Small households	150,000	Entry-level adoption
Standard Home Kit (6–10 devices)	Medium households	250,000	Strong middle tier
Deluxe Home Kit (11–20 devices)	Large homes and SMEs	500,000	High-value recurring
Utility-Scale (50+ devices)	Estates, schools, hospitals, industries	2,500,000	Enterprise and licensing revenue

A financial projection framework is a structured approach used to estimate a company's future financial performance. It provides a clear and organized methodology for forecasting revenue, expenses, profits, and cash flows. By using a financial projection framework, accurate and reliable financial forecasts, enabling informed decision-making and strategic planning is ensured. Table 2 presents the 3-year financial projection

Table 2: Financial Projection Framework

Year	Focus	Revenue Trend	Cost Trend	Outcome
Year 1	Build and Deploy	Moderate (Household kits)	High (RandD, manufacturing, marketing)	Establish brand presence
Year 2	Scale Adoption	Strong (Standard and Deluxe uptake)	Stabilizing (optimized production and distribution)	Market share growth
Year 3	Expansion	High (Utility-Scale contracts)	Relatively lower than revenue	Profitability and regional expansion

Monthly Revenue Projection

The monthly revenue projection is created by analyzing historical data to identify trends and patterns, and determine the business model and to understand revenue streams. Tables 3 - 5 presents the monthly revenue projection.

Table 3a: Annual Revenue Year 1

Plan	Adoption (Users)	Price (₦)	Monthly Revenue (₦)
Basic Home Kit	200	150,000	30,000,000
Standard Kit	100	250,000	25,000,000
Deluxe Kit	50	500,000	25,000,000
Utility	5	2,500,000	12,500,000
Total			92,500,000

Annual Revenue Year 1 = ₦1.11B

Table 3b: Annual Revenue Year 2

Plan	Adoption (Users)	Price (₦)	Monthly Revenue (₦)
Basic Home Kit	400	150,000	60,000,000
Standard Kit	200	250,000	50,000,000
Deluxe Kit	100	500,000	50,000,000
Utility	10	2,500,000	25,000,000
Total			185,000,000

Annual Revenue Year 2 = ₦2.22B

Table 3c. Annual Revenue Year 3

Plan	Adoption (Users)	Price (₦)	Monthly Revenue (₦)
Basic Home Kit	600	150,000	90,000,000
Standard Kit	300	250,000	75,000,000
Deluxe Kit	150	500,000	75,000,000
Utility	20	2,500,000	50,000,000
Total			290,000,000

Annual Revenue Year 3 = ₦3.48B

A cost structure refers to the various expenses a business incurs to operate and produce its goods or services. It's a comprehensive breakdown of all the costs associated with running a company, including fixed, variable, direct, and indirect costs. By analyzing and understanding ImoleDe's cost structure, we can optimize their expenses, improve profitability, and make informed strategic decisions. This is presented in Table 4. Components of a cost structure includes

1. Fixed Costs: Expenses that remain constant regardless of production levels, such as: rent, salaries, insurance, depreciation

2. Variable Costs: Expenses that fluctuate with production volume, including: raw materials, utilities, direct labor, manufacturing supplies

3. Direct Costs: Expenses directly attributed to producing specific goods or services, such as: raw materials, direct labor, manufacturing supplies

4. Indirect Costs: Expenses necessary for overall operations but not directly attributed to specific products or services, including: utilities, rent, administrative salaries, and depreciation

Table 4: Cost Structure

	Category	Amount (₦)	Notes
S/N	Fixed Costs		
1	Manufacturing and Research and Development	250,000,000	Annual
2	Hosting (cloud, monitoring)	15,000,000	Annual
3	Infrastructure and Logistics	50,000,000	Annual
4	Software Dev. and Maintenance	50,000,000	Annual
5	Operations/HR (20% of subtotal)	73,000,000	20% × 365M
	Total Fixed Costs	438,000,000	≈ ₦36.5M/month
	Variable Costs		
1	Marketing and Sales	10,000,000	Annual
2	Customer Support and Maintenance	15,000,000	Annual
3	Transaction Fees	3% of revenue	Variable
	Baseline Variable Costs	25,000,000 + 3% of revenue	Annual

Table 5 presents the types and quantities of products or services sold monthly. For ImoleDe, this could include: number of smart energy units sold, subscription plans (basic, premium), installation services, maintenance packages, etc

Table 5: Sales Mix

Sales Mix (per month)	Monthly Net Revenue (₦)	Break-even Time
10 Utility customers	24.25M	~20 months
20 Utility customers	48.5M	~10 months
100 Deluxe customers	48.5M	~10 months
200 Standard customers	48.5M	~10 months
Mixed (10 Deluxe + 5 Utility)	36.4M	~13 months
Mixed (20 Deluxe + 10 Utility)	72.7M	~6.5 months

Assumptions

Fixed Costs: ₦438M annually

Variable Costs: ₦25M + 3% of revenue annually

Break-even Revenue: ₦477M/year (~₦39.8M/month)

Revenue growth pattern:

Year 1: Early adoption (slow ramp-up)

Year 2: Strong scaling (schools, utilities, large households)

Year 3: Expansion (large-scale utility adoption, licensing)

Figure 6: Yearly Projection

Year	Focus	Revenue (₦)	Total Costs (₦)	Net Profit (₦)	Notes
Year 1	Build and Market Entry	600,000,000	477,000,000	123,000,000	Break-even crossed, small profit
Year 2	Scaling Adoption	1,200,000,000	601,000,000	599,000,000	Rapid growth with utility clients
Year 3	Expansion and Licensing	2,400,000,000	821,000,000	1,579,000,000	Strong profitability, market leadership

Monthly Break-even Analysis

For an effective net revenues per unit (after 3% fee):

a. Basic Kit (₦145,500)

b. Standard Kit (₦242,500)

c. Deluxe Kit (₦485,000)

d. Utility Kit (₦2,425,000)

And the monthly break-even revenue target = ₦39.8M

Figure 7: Break-even units

Plan	Net Revenue per Unit (₦)	Units Needed to Break Even / Month
Basic Kit (1–5 devices)	145,500	274 units
Standard Kit (6–10 devices)	242,500	164 units
Deluxe Kit (11–20 devices)	485,000	82 units
Utility Scale (50+ devices)	2,425,000	17 units

Figure 8: Mixed Scenario

Scenario	Sales Mix (per month)	Monthly Net Revenue (₦)	Break-even State
Entry Focus	150 Basic + 50 Standard	145,500×150 + 242,500×50 = 31.1M	Below break-even
Mid-tier Push	100 Standard + 50 Deluxe	24.25M + 24.25M = 48.5M	Break-even in 1 month
Utility-driven	10 Utility clients	24.25M	Below break-even
Balanced Mix	10 Utility + 20 Deluxe	24.25M + 9.7M = 34M	Slightly below break-even
Strong Utility	20 Utility clients	48.5M	Break-even in 1 month

Relying only on Basic or Standard kits requires very high volumes. Furthermore, the deluxe and Utility sales are the fastest path to monthly break-even. Just 17 Utility clients per month are enough to cover all costs. This model shows that even modest adoption of Standard and Deluxe Kits achieves break-even quickly. Utility contracts accelerate profitability.

9. SOCIOECONOMIC AND ENVIRONMENTAL IMPACT

The ImoleDe Smart Solar Energy Device and Management System will deliver significant socioeconomic and environmental benefits, directly addressing Nigeria's pressing energy challenges while supporting inclusive development. By providing affordable and reliable power to households, SMEs, schools, and health facilities, the research will expand energy access and reduce the disparities caused by unreliable grid supply. A major benefit is cost savings, as users will be able to reduce or eliminate their dependence on fuel-powered generators, resulting in substantial annual savings on energy expenditures. Local assembly, installation, and maintenance activities will create new jobs across the value chain, thereby enhancing technical capacity, stimulating entrepreneurship, and contributing to Nigeria's industrial development. From an environmental perspective, the system will lower greenhouse gas emissions and reduce air and noise pollution associated with diesel generators, aligning with Nigeria's climate commitments and global sustainability targets. Furthermore, the research reinforces national policy priorities by supporting Nigeria's renewable energy transition and advancing NASENI's mandate to localize technology production, promote industrial growth, and drive sustainable innovation.

The innovation aligns with Sustainable Development Goal 7 - ensures access to affordable, reliable, sustainable and modern energy for all. Lack of access to energy supplies and transformation systems is a constraint to human and economic development. Furthermore, energy efficiency and increase use of renewables contribute to climate change mitigation and disaster risk reduction, thereby maintaining and protecting ecosystems.

With only 45% of Nigeria's population has access to electricity, with significant disparities between urban and rural areas (Source: World Bank). ImoleDe brings an option of efficiency and improved availability of energy supply to consumers during their time of need as a necessity and this can bring numerous societal and economic benefits. These include: improved standard of living, increase in GDP per capita, increase in life expectancy, improved standard of life, higher human development index (HDI), and increased productivity and job creation.

a. Improved Standard of Living

Access to modern energy services is a critical component of standard of living. According to the International Energy Agency (IEA), in 2020: 89% of the global population had access to electricity and 34% of the global population had access to clean cooking fuels and technologies [7].

b. Increase in GDP per capita

Energy access is also strongly correlated with GDP per capita of a Country. According to the World Bank, in 2020: countries with high energy access (above 90%) had an average GDP per capita of $14,333. While countries with medium energy access (50-90%) had $4,333. Countries with low energy access (below 50%) had an average GDP per capita of $1,444 [8].

c. Increase in Life Expectancy

Energy access is also correlated with life expectancy. According to the World Health Organization (WHO), in 2020: Countries with high energy access (above 90%) had an average life expectancy of 77.4 years, while countries with medium energy access (50-90%) had an average life expectancy of 469.4 years. Countries with low energy access (below 50%) had an average life expectancy of 61.4 years [9].

d. Improved Standard of Life

Electricity consumption is a key indicator of standard of life. According to the IEA, in 2020: The average electricity consumption per capita in high-income countries was 12,143 kWh, 2,444 kWh for middle-income countries and 444 kWh low-income countries [7].

e. Higher Human Development Index (HDI)

Human Development Index (HDI) is a composite index measuring standard of life. According to the United Nations Development Programme (UNDP), in 2020: countries with very high HDI (above 0.8) with average electricity consumption per capita of 10,333 kWh. 4,444 kW for countries with high HDI (0.7-0.8) and 1,777 kWh for countries with medium HDI (0.5-0.7) [10].

f. Increased Productivity and Job Creation

Reliable energy supply can increase productivity by 20% and improve competitiveness by 15% . It can also create up to 100,000 jobs in the energy sector (Source: Nigerian Ministry of Power). Only 45% of Nigeria's population has access to electricity, with significant disparities between urban and rural areas [11].

1. Statista (2024). Retrieved from https://www.statista.com/statistics/1306967/per-capita-electricity- demand in nigeria/#:~:text=The%20per%20capita%20electricity%20demand, peaked %20at%20173%20kilowatt%20hours.

2. Statista (2024). Retrieved from https://www.statista.com/statistics/1403728/nigeria-power-supply-daily-hours-availability-by-age/#:~:text= Furthermore%2C%20on%20averag e%2C%20most%20of,hours%20of%20electricity%20per%20day.
3. Techpoint Africa (2024) Retrieved from https://techpoint.africa/2023/11/06/how-much-do-nigerians-earn/
4. Rural Electrification Agency (REA). (2020, July 18). The Weekend Read: Expand and Connect. Retrieved December 29, 2024
5. Business Day Newspaper (2024), Retrieved from https://businessday.ng/energy/article/ nigeria-grows-sales-of-solar-products-by-38-to-628000-in-one-year/?amp=1
6. Guardian Newspaper (2024). Retrieved from https://guardian.ng/news/households-consider-solar-alternatives-amid-high-onboarding-cost/
7. International Energy Agency (IEA). (2020). Energy Access. Retrieved from https://www.iea.org › reports › access-to-electricity
58. World Bank. (2020). GDP per Capita. Retrieved from NY.GDP.PCAP.CD
9. World Health Organization (WHO), in 2020 life expectancy. Retrieved from https://www.who.int› health-topics › energy-and-health https://data.worldbank.org › indicator › Retrieved from › overview
10. United Nations Development Programme (UNDP) (2020) human development index. https://hdr.undp.org › content
11. World Bank. (2020). Nigeria Overview. https://www.worldbank.org › en › country › nigeria

10. RISK ASSESSMENT AND MITIGATION

While the research demonstrates strong technical and commercial viability, potential risks have been carefully considered and mitigation strategies have been built into the implementation plan. Technical risks, such as device failure or underperformance, will be minimized through the integration of predictive maintenance algorithms, robust component testing, and redundancy in critical system design. Market risks, particularly the challenge of high upfront costs that may discourage adoption, will be addressed through innovative financing approaches, including micro-financing, leasing models, and partnerships with financial institutions to promote pay-as-you-go solutions. Policy risks, such as changes in renewable energy incentives or regulatory frameworks, will be mitigated by establishing strong private-sector partnerships, diversifying revenue streams through subscription-based software services, and aligning the research with national energy transition goals to ensure long-term policy relevance. Collectively, these measures provide a resilient framework for reducing uncertainties, safeguarding investment, and ensuring the research's sustainability. Figure 9 presents the possible risks and mitigation strategies.

11. CONCLUSION

The feasibility analysis of the ImoleDe Smart Solar Energy Device and Management System demonstrates that the research is both technically and commercially viable, with significant potential to transform Nigeria's energy landscape. The system's integration of intelligent digital management with renewable energy generation addresses critical gaps in existing solar solutions by providing real-time monitoring, predictive maintenance, smart load prioritization, and remote control capabilities. Financial researchions confirm the pathway to profitability within three years, supported by a diversified revenue model and scalable deployment strategies. Beyond commercial viability, the research offers considerable socioeconomic and environmental benefits, including expanded energy access, reduced household and SME energy costs, job creation through local manufacturing and maintenance, and meaningful contributions to Nigeria's renewable energy transition and climate commitments. Risks associated with technology performance, market adoption, and policy shifts have been identified and effectively mitigated through robust design features, innovative financing mechanisms, and strategic partnerships. Overall, the research is positioned as a sustainable, impactful, and scalable innovation that aligns with NASENI's mandate to drive industrial growth, foster indigenous technology, and advance national development priorities.

Table 9: Possible Risks and Mitigation Strategies

Risk Category	Specific Risk	Impact	Likelihood	Mitigation Strategy
Technical	Sensor inaccuracies due to low-cost components	High	Medium	Use calibrated sensors; test before deployment
Technical	Device overheating in tropical climates	Medium	High	Use heat-resistant enclosures; include temperature sensors
Software	Firmware bugs causing system crashes	High	Medium	Implement OTA updates; rigorous testing
Software	AI model misclassification of energy usage patterns	Medium	Medium	Continuous model training with local data
Cybersecurity	IoT device hacking	High	High	Use secure protocols (TLS), strong authentication
Cybersecurity	Data breaches from cloud storage	High	Medium	Encrypt data; use trusted cloud providers
Financial	Budget overruns due to inflation	High	High	Include contingency in budget; monitor market prices
Financial	Unstable exchange rates affecting imported components	Medium	High	Source locally where possible; bulk purchase
Operational	Power outages during installation or updates	Medium	High	Use UPS or battery backup during critical operations
Operational	Theft or vandalism of installed units	High	Medium	Use tamper-proof enclosures; community engagement
Regulatory	Lack of clear IoT regulations	Medium	Medium	Engage with regulators; follow best practices
Regulatory	Delays in certification or approvals	Medium	Medium	Start early; consult legal experts
Market	Low adoption due to lack of awareness	High	Medium	Run pilot programs; educate users
Market	Resistance to technology in rural areas	Medium	Medium	Localize interfaces; use community champions
Environmental	Heavy rainfall damaging outdoor units	High	Medium	Waterproof enclosures; elevate installations

Environmental	Dust and humidity affecting sensors	Medium	High	Use sealed units; regular maintenance
Supply Chain	Delay in delivery of components	Medium	High	Maintain buffer stock; diversify suppliers
Supply Chain	Poor quality control from local vendors	Medium	Medium	Vet suppliers; inspect deliveries
Human Resources	Lack of skilled technicians for installation	High	Medium	Train local technicians; partner with institutions
Human Resources	Brain drain or staff turnover	Medium	Medium	Offer incentives; create knowledge documentation
Social	Community distrust of monitoring systems	Medium	Medium	Transparent communication; emphasize privacy protection
Infrastructure	Poor internet connectivity affecting data sync	High	High	Use offline-first architecture; sync when online
Infrastructure	Inconsistent mobile network coverage	Medium	High	Use multi-network SIMs; allow local data storage
Legal	Liability issues from system failures	Medium	Low	Include disclaimers; offer warranties
Strategic	Misalignment with national energy policies	High	Medium	Align with government programs; seek partnerships