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Introduction

Power inverters, as electronic devices, play a pivotal role in converting DC power into AC power. This transformation enables the usage of AC-powered devices even in situations where only DC power is accessible (Sandeep and Srinivas, 2023). Power inverters are categorized into various types based on their power capacity, waveform output, and intended applications (Mohammed et al., 2023). On the other hand, a photovoltaic system, often known as a PV system or solar power system, is the process by which light exposure causes semiconducting materials to produce voltage and current. In practical applications, solar cells, which are discrete devices that exhibit altered electrical characteristics upon exposure to light, are commonly employed to accomplish this phenomenon. The cells have the capability to be interconnected either in series or parallel configurations in order to get the appropriate voltage and current outputs, respectively. They are often composed of silicon, either monocrystalline or polycrystalline (Rabindra and Venkateswarlu, 2021). Renewable energy sources like solar and wind have gained prominence due to the rising demand for clean energy. Utilizing renewable energy has a lot of benefits. Large-scale usage of these renewable resources, however, dramatically affects the stability of the power network in a variety of ways. As a result, research priorities change to consider other ways to take advantage of these RPPs' (Renewable Power Plants) unrealized potential for enhancing power system stability (Varma and Maleki, 2019). This study demonstrates an in-depth illustration of a business report for the implementation and significance of power inverters for making photovoltaic power systems.

Overview of the business idea

As more people turn to renewable energy sources like solar and wind power, the need for power converters and inverters is growing globally. The global adoption of renewable energy projects by governments and organizations is creating a rising market for inverters that can efficiently convert DC power from solar panels or wind turbines into usable AC power (Armin Razmjoo et al. 2023). Out of all renewable energy sources, the PV industry has expanded quickly in the last 30 years in the commercial, industrial, and residential sectors, particularly in nations with abundant solar energy resources (Megahed and Radwan, 2020). The main drivers of this increase are the benefits to the environment and the declining cost of photovoltaic systems (Eslami and Nahani, 2021; Ali et al., 2019).

Favourable government laws, subsidies, and policies that promote the use of renewable energy sources have a major impact on the market for power converters and inverters. Demand for power inverters is rising as a result of global government initiatives to encourage the deployment of renewable energy systems, such as feed-in tariffs, tax credits, and renewable portfolio standards (Shahin, 2020). Power inverters can be costly initially, especially if they are complex and potent devices. Certain customers may be discouraged from purchasing power conversion systems due to the upfront costs, particularly in large-scale applications like industrial installations or utility-scale renewable energy projects, which could limit market growth (Obaideen et al., 2021). The market for power inverters is very competitive due to the large number of global manufacturers and suppliers. Because of the increased rivalry and declining profit margins for enterprises, certain market participants may find it challenging to expand further (Ali et al., 2019).

Analysis of the current market

The current market of Power Inverters for use in Photovoltaic Power Systems has been growing rapidly due to the utilization of renewable resources like Solar energy. This has been possible due to various reasons such as increased environmental awareness to use more green energy, enhanced technological advancement, current market trends, and global expansion (Delloso *et al.* 2021). Most people are switching to Photovoltaic Power Systems because it utilizes unlimited natural resources like solar energy to produce electricity. Installation of PV systems also helps to reduce the electricity bill significantly as it conserves solar energy in the form of electricity in solar panels.

The above statistics showcase the demand for solar PV is expected to reach a total of 125.2 gigawatts in 2024. The United States initiated a process to impose import duties on Chinese and Taiwanese Solar products, which has led to trade disputes around the world (Statista, 2023). The solar-based photovoltaic system has expanded from a small market to a promising market which keeps growing substantially due to the incorporation of various sustainable approaches in their operations (Bughneda *et al.* 2021). The adoption of sustainable approaches has contributed in many ways by recycling materials and managing the waste properly which helps to reduce their carbon footprint and waste production significantly. This helps to attract a large number of eco-conscious customers and shareholders who are willing to invest in this

market (Shah *et al.* 2021). However, this market also lacks in some areas and it needs to be addressed properly. One of the major problems is high prices for existing solar photovoltaic power invertors as it is specifically designed for large-scale projects. Thus, its purchasing and installation costs are expensive for residential users and this causes them to remain using the traditional power invertors.

This problem needs to be addressed by focusing on the development of innovative solutions such as manufacturing cost-efficient and highly efficient solar power invertors that can be compatible with both residential use and large-scale projects (Saitov *et al.* 2020). In addition, the installation and maintenance process should be done with ease and budget-friendly. Integration of digital technology into power invertors can be of great use. Technology such as predictive maintenance, and cloud-based features enhance the performance and efficiency of the solar-based photovoltaic inverter. These efficient features which are adjusted according to the customer's needs help to gain the attention of a wide range of stakeholders and lead in the market share (Hinokuma *et al.* 2021).

Demonstration of execution of business idea

The execution of any business model follows a project pattern, from conception to completion. This paper outlines the major steps in demonstrating the execution of PV system business ideas.

Set a solar project or renewable energy use goal

PV system project execution can be made more seamless and focused by setting a goal for renewable energy usage or renewable energy project development that is accessible to the public (Pascaris *et al.* 2021). In addition to providing guidance, it serves as a statement of intent to stakeholders and to you. Setting a goal, assessment, and evaluation of the project in the correct direction helps to make it successful (Ali *et al.* 2021). The assessment and evaluation process involves a variety of methods such as the identification of clear objectives, selecting a proper site for the establishment of the project, and adhering to government regulations and financial planning which helps in the growth and development of the solar project.

Assess solar site prospects; catalogue and gather data

Assessment of solar sites also involves dealing with various regulations regarding land ownership and land-using permission in order to establish the solar project without any legal disputes (Randle-Boggis *et al.* 2020). In addition, environmental factors such as climate change and weather conditions should be considered while choosing the solar project as they can heavily influence the growth of a project. The initial step in comprehending the opportunities offered by your site involves the collection of relevant policy, market, and site information, as well as utility data. This information plays a crucial role in soliciting project proposals from developers and serves as the fundamental basis for conducting site assessments to identify the most suitable sites (Obaideen *et al.*, 2021).

Create a Request for Proposals (RFP)

Creating and releasing a solar Request for Proposals (RFP) is the next step after gathering the information and data required for solar site opportunities. A Request for Proposal (RFP) is a document that lists the general terms and conditions for requesting goods and services from vendors in the market (Patel, 2023). This can entail a variety of needs in the case of solar projects. If the planning claims to use renewable energy, then it is essential to save the Renewable Energy Certificates (RECs) from the project. RFP can be created with the assistance of the following resources (Mehos *et al.* 2020). To develop and issue a request for proposal

there should be the adoption of appropriate strategies which involve determining the scope of the project, evaluating the costs, submitting guidelines, putting contract terms and conditions, setting the timeline, and putting contact information. After working on this structure, the proposal can be shared with stakeholders for review and approval.

Analysis of location and legal entity

To manufacture a highly efficient photovoltaic power inverter, two essential components such as location and legal entity are required.

Location

The population and manufacturing of photovoltaic power inverters require a suitable location that is close to various facilities such as supply chains, market accessibility, and government compliances regarding the manufacture (Syahputra and Soesanti, 2021). Remaining close to the semiconductor and solar panel supply chain provides a timely supply of raw materials, and reduces high transportation and shipping costs. Accessibility to solar markets is important as it enhances networking with other marketers and improves the distribution system (Agyekum, 2021). In addition, skilled labour availability is also necessary for the operation of the project. Also, following government compliance regarding the manufacturing of power, Inverters is necessary as it can hugely influence the financial system of a project or an organization.

Legal Entity

The manufacturing and development of photovoltaic system power inventors need a proper legal entity that helps to deal with legal issues and mitigates risks in business significantly. This involves selecting a suitable legal corporation that can protect and safeguard the business during critical issues like product defects or replacement (Hamidinasab *et al.* 2023). Appropriate legal corporation has a great influence on the financial aspect of the business as it helps them to access funding for projects and provide greater contracts for the business associated with them. These corporations also safeguard vital components such as non-disclosure agreements, sensitive information, and intellectual property of a business to deal with major issues like plagiarism and copyright. It helps manufacturing businesses like photovoltaic-based power inverter businesses to remain confidential and relevant in the competitive marketplace (Thirunavukkarasu and Sawle, 2021).

Internal environmental analysis

To analyse the internal environment of the photovoltaic power inverter businesses, SWOT Analysis has been used to clearly depict the strengths, weaknesses, opportunities, and threats of a business.

Strengths

Photovoltaic Power Inverter is a great alternative to the electricity-based power inverter as it conserves solar energy and turns the alternative current to direct current without any usage of electricity which can reduce the overall electricity bill. Many technological researchers and experts hired by inverter manufacturers focus on developing innovative features such as the operation of power inventors during power loss and voltage regulation (Awan, 2022).

Weaknesses

Manufacturing of power inventors has various drawbacks as well. This market is heavily dependent on the solar industry which has a tendency to fluctuate and become unstable due to changes such as improper regulation of resources, environmental compliances, and high competition (Elavarasan *et al.* 2020). All of these factors adversely impact the production process of photovoltaic power inventors and their demand in the market. Photovoltaic power inverter requires integration of technology with innovative features to improve their efficiency which can be extremely expensive for them and this can affect their overall revenue.

Opportunities

Power Inverters are an emerging market that is growing exponentially and this is a great opportunity for manufacturers to focus on the market gaps which can be fulfilled by the addition of valuable features to the inverters. Energy storage batteries are in high demand and the stored energy needs to be turned into electricity by passing through power inventors. Manufacturers can focus on producing power inventors which can become efficient mediators for the continuous flow of electricity and its proper usage (Smith and Margolis, 2019).

Threats

The Power Inverter market faces various threats such as high competition for the production of better-quality inverters and gaining a large market share as compared to its competitors. Extreme competition can lead to a decrease in profitability and adversely affect the long-term sustainability of the manufacturing process (Rahim *et al.* 2023). There are extremely stringent policies regarding the manufacturing of photovoltaic power inverters which can create difficulties for the manufacturers. Non-compliance with government policies could lead to payment of hefty charges and penalties which could affect the overall financial budget and brand reputation.

Evaluation of target market and capturing process

Manufacturing and development of photovoltaic power inverters need a thorough evaluation of their target market and capturing process which helps to increase their reach and influence.

Evaluation of photovoltaic power inverter's target market

The first step in the evaluation of the target market is market research which involves observing the regions where power inverters are mostly used, and going through case studies and reports about those regions (DiOrio *et al.* 2020). This is followed by the next step which is customer segmentation which involves the customer being segmented on the basis of residential, industrial, or commercial use. Competitor analysis is extremely important for assessing the existing power inverter business to understand their crucial strategies and identify the gaps that can be capitalized substantially (Shahin *et al.* 2020). Checking the availability of important facilities such as supply chain, market accessibility, and energy resource availability are important factors in regulating the manufacturing process.

Evaluation of photovoltaic power inverter's capturing process

The capturing process requires a strategic approach to deal with the target customers. The first step is to research and gather feedback from customers to develop and manufacture power inverters that are tailored according to customer needs (Gissey *et al.* 2021). The next step involves strategic marketing and promotion which showcases the durability and efficiency of the product through varying mediums. This helps to attract the target audiences which can lead to huge sales and revenue growth. Another strategic move is to set the relevant price of the product which can resonate with the affordability of the customer according to their purpose

(Kuleshov *et al.* 2019). Focusing on after-sales services such as easy installation and maintenance of power inverters is important as it helps to build trust and relationships with customers. As customers are shifting towards eco-friendly options, they expect their manufacturers to follow sustainability and ethical practices in their product development process.

Brief financial plan

Budgeting and calculating the initial capital

In financial planning, proper budgeting and calculating the initial cost are important (Nazer *et al.* 2020). This planning involves calculations related to purchasing inverters, installation, and maintenance of the PV systems. The manufacturing company can take loans from banks and investors by properly analysing the refund criteria and interest rates which helps them to initiate their business activities. Proper budgeting and calculating will help to create a clear idea about the finances which can lead to the right decision-making for the business.

Monitoring and re-evaluating the financial plan

This step is crucial in financial planning because regular monitoring and reporting of PV performance helps to pinpoint the major issues that can be resolved with appropriate solutions (Almeida *et al.* 2021). This helps to mitigate major risks related to PV's efficiency and performance. In addition, regular monitoring and evaluation can help in tackling major economic changes such as inflation rates and economic downturns. In order to make this possible, manufacturing companies can borrow investments from financial institutions and shareholders which helps to propel the business in critical situations.

Conclusion

Power inverters as touching PV systems now include more safety measures, more efficiency, and higher dependability as a result of technological advancements. Present-day power inverters offer advanced monitoring competence, which allows system owners to keep track of energy production, operating performance, and potential issues remotely. Furthermore, some inverters embrace maximum power point tracking (MPPT) algorithms to optimize energy capture which helps in increasing the overall running of the photovoltaic system. To this end,

power inverters are a key ingredient of photovoltaic power systems, which allows the conversion and distribution of solar energy in a well-organised and viable manner.

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