

# Energy management system

hemanth boinipally, Bala Ashish Yeruva, and Diya Sanghavi

## MISSION STATEMENT

There is a problem with supplying electricity to all parts of the world; to address this, we are developing a project that will allow us to use renewable energy to supply it to various parts of the world at a low cost and with ease of access; we are considering homeowners who have unused energy as vendors and homeowners who cannot access electricity as lenders; the vendors can lend the power from solar panels, generators, and other sources. Using solar panels would assist to reduce air pollution, water usage, reliance on nonrenewable energy sources, and improve long-term human health. To provide a reliable, cost-effective, and easy-to-use energy management system that helps users monitor, control, and optimize their energy usage, while supporting the transition to a more sustainable and resilient energy system." This mission statement focuses on the key benefits and goals of the energy management system, and emphasizes the importance of sustainability and resilience in the energy sector. It also highlights the user-centric design of the system, and the emphasis on providing a high-quality user experience.

## STAKEHOLDERS

### Internal Stakeholder:

An internal stakeholder is a person or group who is affected by a business process. An internal stakeholder is a person or group who genuinely cares about a project. What is the function of a stakeholder in the discussion about An internal stakeholder is said to be employed in the decision-making process. This procedure involves huge corporations, government entities, and non-profit organizations.

### External Stakeholder:

The primary job of internal stakeholders is to invest in or exit a business. External stakeholders, on the other hand, have little influence over the company's operations. Do not participate in any company's internal matters, as you may have guessed from the names of external stakeholders.

### Internal Stakeholders :-

**UI/UX Developers:** UI/UX designers are in charge of designing and implementing all of the experiences that a user has when dealing with a digital tool, such as a website. The user interface/user experience designer will collaborate closely with our marketing team and designers to guarantee seamless web/mobile design and the successful implementation of UI/UX best practices and principles across all of our digital platforms. UI/UX designers are in charge of designing and implementing all of the experiences that a user has when dealing with a digital tool, such as a website. The user interface/user experience designer will collaborate closely with our marketing team and designers to guarantee seamless web/mobile design and the successful implementation of

UI/UX best practices and principles across all of our digital platforms.

**Q/A Engineers:** Quality assurance is the primary function of QA. A QA engineer is responsible for enhancing software development processes and preventing production problems. In other words, they ensure that the software development team is doing things correctly. The job description of a QA engineer includes a variety of responsibilities. Checking if the product complies with the requirements, Assessing risks, Planning ideas to improve product quality, Planning tests, Analyzing the test results. **Developers:** developers have to do works like Software research, design, implementation, and management, New program testing and evaluation, Identifying areas for improvement in existing programs and then implementing these improvements, Writing and deploying effective code, assessing operational feasibility, Creating methods for quality assurance, Putting software tools, processes, and measurements in place, Existing systems must be maintained and upgraded., User education, Collaboration with other developers, UX designers, business analysts, and systems analysts

**Project Managers:** Project managers are in charge of planning and supervising projects to ensure they are finished on time and within budget. Project managers plan and allocate project resources, create budgets, track progress, and keep stakeholders updated throughout the process. All of this is done within the framework of a company's goals and vision. Project managers are needed for a wide range of initiatives, including construction, information technology, human resources, and marketing.

**Business Analysts:** A business analyst is an essential member of any project team. They gather information, document processes, and confirm final documents with users as the primary interaction between users and the project manager.

### External Stakeholders :-

**Customers:** The customer's role is not only to accept results but also to guide the team, address their concerns, and make sure that they're doing things the way they should.

**End Users:** An end user is a hands-on user of a product who uses the delivery on a regular or daily basis. They play an extremely important role in product development. End users provide feedback to developers, which helps to ensure that software products are actually used by the people who need them.

**Government :** Government allows citizens to have a voice in how their society is run. It also allows the government to get feedback on the project and make necessary changes. Without Government, Software projects would be carried out without input from those who will be most affected by them.

**Suppliers :** Suppliers Are important as the software projects are heavily dependent on the supplies.

**Sales Supervisor :** Sales Supervision is important because the software projects should be financially fruitful for the company to survive.

**Marketing Team :** Marketing team is an extension of the sales team as the marketing team market the product for the public display .

**Customer Service Team :** Gaining a new customer is as important as looking after an old one, The customer service team takes care of the customers issues and troubleshooting problems. **Installation Companies:** Installation companies diversify the company and help with the reach of the product and organization.

**Component Manufacturers:** Component manufacturers are important as they are the source of the hardware which is the muscle of the project.

**Roofers:** Roofing software is a type of cloud-based business management software that has been designed exclusively for the roofing industry. It was created to help roofing companies and their various teams effectively and efficiently manage tasks and roofing projects.

**HVAC installers:** Hvac installers improve with resource allocation and customer service

### **Key Drivers**

Key drivers are the most important aspects influencing a company's or business's performance. A major driver is something that has a significant impact on how well the business performs. It can also provide early warning indicators of poor performance or outcomes. Let's take a look at some crucial driver selection recommendations and examples.

**Number of locations:** as the business is about solar energy the manufacturing plants are meant to be opened at every major country like USA, RUSSIA, CHINA,UK,INDIA as we can find skilled and unskilled workers with ease and has population with good literacy rate where they can understand the concept and has the idea about the solar panels. However,our target is to get electricity to the rural areas more so, we will have stores opened near them and we have sales site where can people can get our products from any spot in worldTraffic volume to your business website:Website traffic refers to the number of people who visit a website. Web traffic is measured in visits, sometimes known as "sessions," and is a standard approach to assess an online business's ability to attract customers.When ecommerce initially took off in the 1990s, web traffic was seen as the most crucial statistic for measuring a website's popularity because alternative metrics to gauge online performance did not yet exist. Analyzing a website's performance becomes far more detailed as digital marketers become more savvy.Effectiveness of the sales team;".Sales effectiveness = output per salesperson."George bronten following this statement , our sales team has best effectiveness compared to regular industry standards . they did plan to educate rural people of pros of our business and are contacting social media influencers as advertising means due to budget constraints and they would reach corner of the globe very easilyNumber and price of offerings: as we are planning to sell our products all over the world. The pricing would be different for every place . as there are different manufacturing costs in each place. For example, India has low manufacturing

cost and labor costs compared to the USA or Canada. So, the selling cost would be low too .as the cost of living is also low in india we should sell our product accordingly.Customer satisfaction: customer plays an important role in the business because he is the final destination for any company. Mouth publicity plays a major role in the business .so, we have given out our product to some influential people all over the world and some to some volunteers as beta testers and we have got a great response from themStaff turnover: as the company is on a global scale we need a lot of unskilled labor and quite a number of skilled labor .where the unskilled workers' pay range would be between 5,000 dollars to 50,000 dollars and skilled workers' pay range would be ranging from 25,000 dollars to 125,000 dollars. there is sales team who will also be in range of skilled workers

### **Key Requirements:-**

- 1) Application accessibility
- 2) Energy consumption and management
- 3) Management of the power sources
- 4) Performance Management
- 5) Expense Management

### **User Requirements:-**

- 1) Users are able to see the distribution of energy used
- 2) Users can add other sources for energy and also able to manage the amount of energy got from each source
- 3) Users can manage their energy expense in the software
- 4) Users are able to view the performance of the system and the system will also notify the user when it has to be changed.
- 5) Users will also be able to find and contact the nearest service providers for the power sources
- 6) The payment options should be able to accept multiple currencies according to the country
- 7) The system should have voice recognition and voice assistance for physically disabled people(blind, people without hand etc)
- 8) The system should have a chat feature so that the user can talk directly to the person from where they are getting energy
- 9) The system should ensure safety and security of the data of the users
- 10) The system should have multiple methods for payments and should change according to the country

### **Business Requirements :-**

- 1) Availability of energy to all the areas and all the people.
- 2) Economical costs
- 3) Easy to understand, install and use
- 4) Give offers on special occasions/festivals
- 5) Environment friendly
- 6) Customer services at every step
- 7) Using marketing strategies so that each and every person is aware of it
- 8) The product should be weatherproofed, hence people around the globe can use it without any hassle.

### **System requirements :-**

#### **Customer Unit**

Customer unit let the users know the power quantity values / battery level and the quantifying values related to power company / solar panels.

#### **Solar Panel Unit:**

A solar cell panel, solar electric panel, photo-voltaic (PV) module, PV panel or solar panel is an assembly of photovoltaic solar cells mounted in a (usually rectangular) frame, and a neatly organized collection of PV panels is called a photo voltaic system or solar array. Solar panels capture sunlight as a source of radiant energy, which is converted into electric energy in the form of direct current (DC) electricity. Arrays of a photovoltaic system can be used to generate solar electricity that supplies electrical equipment directly, or feeds power back into an alternate current (AC) grid via an inverter system.

Battery Monitoring Unit Ex: foxBMS (Open Source)

Batteries store chemical energy and convert it to electrical energy, which can be thought of as the flow of electrons from one place to another. In a battery, components called electrodes help to create this flow.

Input Displays Ex: RaspberryPi (Open Source)

A monitor or input display is a device comprising a visual display, circuitry, power supply, and casing. output of video images as well as texts. It allows people to interact with the computer, activate, and run programs. It lessens stress and establishes a better environment for heightened production. Monitors are of three types: light-emitting diodes, cathode ray tubes, and liquid crystal display. Using them is also cost-effective.

Quality requirements:-

Quality requirements for a power supply program would depend on the specific needs and use cases of the program. Some common quality requirements for a power supply program might include:

**Reliability:** A power supply program should be able to provide a consistent and reliable source of power to meet the needs of the system or devices it is powering.

**Efficiency:** A power supply program should be able to convert electrical power from the source to the load with minimal losses, so as to minimize waste and maximize the amount of usable power.

**Safety:** A power supply program should be designed and implemented in a way that ensures the safety of users and the equipment being powered. This might include features like overcurrent protection, overvoltage protection, and short circuit protection.

**Scalability:** A power supply program should be able to accommodate different power requirements and be easily expandable as the needs of the system or devices it is powering change.

**Compatibility:** A power supply program should be compatible with the system or devices it is powering, and should be able to provide the correct type and amount of power required.

**Cost-effectiveness:** A power supply program should be cost-effective, providing a good value for the money and minimizing the overall cost of ownership.

Security requirements:-

In addition to the quality requirements mentioned above, there may also be security requirements for a power supply program, depending on the specific use case and the sensitivity of the information or data being powered. Some common security requirements for a power supply program might include:

**Encryption:** A power supply program should encrypt data transmitted over the power supply network to prevent unauthorized access or tampering.

**Authentication:** A power supply program should authenticate devices and users on the power supply network to prevent unauthorized access or use.

**Access control:** A power supply program should implement access control mechanisms to limit access to the power supply network and restrict certain actions or operations to authorized users or devices only.

**Auditing and logging:** A power supply program should track and log access to the power supply network, as well as any actions or events that occur on the network, to enable security auditing and incident response.

**Physical security:** A power supply program should also consider physical security measures to protect the power supply hardware and infrastructure from unauthorized access or tampering. This might include measures like secure enclosures, locks, and surveillance systems.

Key Constraints:

The key constraints for an energy management system would depend on the specific goals and requirements of the system, as well as the context in which it is being used. Some common constraints that an energy management system might face include:

**Budget:** An energy management system may have a limited budget, which could constrain the scope and capabilities of the system, as well as the resources available for implementing and maintaining it.

**Time:** An energy management system may have deadlines or time constraints for achieving certain goals or objectives, which could limit the time available for planning, design, implementation, and testing.

**Technology:** An energy management system may be constrained by the availability and capabilities of technology and equipment, such as sensors, actuators, and control systems.

**Regulations:** An energy management system may be subject to regulations or standards that specify requirements for energy management, such as standards for energy efficiency or renewable energy.

**Stakeholders:** An energy management system may have multiple stakeholders with different interests and goals, which could create conflicting constraints or requirements that the system must address.

**Environmental:** An energy management system may have constraints related to the environmental impact of energy usage, such as requirements for reducing greenhouse gas emissions or conserving natural resources.

Elicitation process:-

Elicitation requirements for an energy management system would focus on identifying and understanding the needs and goals of the users of the system, as well as the constraints and limitations that the system must consider. Some common elicitation requirements for an energy management system might include:

**Identifying stakeholders:** Elicitation should identify all the stakeholders of the energy management system, including users, managers, and other parties with a stake in the system.

Gathering user requirements: Elicitation should gather user requirements for the energy management system, including the specific needs and goals of the users, as well as any constraints or limitations they face.

Identifying system constraints: Elicitation should identify the constraints and limitations that the energy management system must consider, including budget, time, technology, regulations, and other factors.

Defining system objectives: Elicitation should define the objectives and goals of the energy management system, such as reducing energy usage or increasing energy efficiency.

Prioritizing requirements: Elicitation should prioritize the requirements and constraints identified during the elicitation process, so that the most important and urgent needs are addressed first.

Validating requirements: Elicitation should validate the requirements and constraints identified during the elicitation process, to ensure that they are accurate, relevant, and consistent with the goals of the energy management system.

Validation and analysis :-

For an energy management system would focus on ensuring that the system meets the needs and goals of the users, and that it functions as intended. Some common activities for validation and analysis of an energy management system might include:

User testing: The system should be tested by a representative group of users to ensure that it is easy to use and understand, and that it provides the features and functionality that users need.

Performance testing: The system should be tested to ensure that it can handle the expected workload and traffic, and that it performs reliably and efficiently.

Compliance testing: The system should be tested to ensure that it complies with any relevant regulations or standards, such as standards for energy efficiency or data privacy.

Security testing: The system should be tested to ensure that it is secure and protects against unauthorized access or tampering.

Compatibility testing: The system should be tested to ensure that it is compatible with the other systems and devices it will be used with, and that it provides the correct type and amount of power.

Usability testing: The system should be tested to ensure that it is user-friendly and easy to use, and that it provides a good user experience for users of all abilities and backgrounds.

User stories:

User stories for an energy management system would describe the specific ways in which users would interact with and benefit from the system. user stories for an energy management system might include:

Pavan kandadi (finance student in stevens) - met in person[11-9-2022]

As a homeowner, I want to monitor my energy usage in real-time, so that I can identify areas where I can save energy and reduce my bills.

Monica thyagaraj(software student in Stevens) - met in person[11-9-2022]

As a house owner, I want to be notified when my energy usage reaches a certain threshold, so that I can take action to avoid overages and excess charges.

Reddy Rushikesh(software employ in Accenture) - talked via zoom[11-10-2022]

As a building manager, I want to be able to control the lighting and heating in different areas of the building, so that I can reduce energy usage and save money.

Rithika Bejjanki(computer science student in uncc)- contacted via phone call[11-10-2022]

As a property owner, I want to be able to track the energy usage of different tenants in my building, so that I can allocate costs and bill tenants accurately.

Anitha Boinipally(homemaker)- contacted via whats app[11-10-2022]

As a parent, I want to be able to monitor the energy usage of my kids, so that I can teach them about energy conservation and help them develop good habits.

Akash kotturi(talked in person)-contacted in person[1/12/2022]

As a user, I want to be able to customize the alerts and notifications that I receive from the energy management system, so that I can focus on the information that is most relevant to me.