SOLAR MICROGRID PROJECT FEASIBILITY PROJECT PLAN

Group 5:

ADHIRAJ BUDUKH, LYDIA FECKER, QUINN FERGUSON,
MADDIE RENNIE, BETTINA VALENTINER

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2. Scoping Study

The Hudson, MA Solar Microgrid Project focuses on establishing a sustainable energy solution for the local Hudson community at 75-77 Reed Road. This initiative aims to integrate solar technology while providing a reliable power source for 800 homes and surrounding Hudson businesses.

Boundaries:

- Location: The project will be located at 75-77 Reed Road in Hudson, MA, serving the immediate community.
- Technology: The microgrid will utilize solar energy solutions, including photovoltaic panels and associated systems

Deliverables:

- Solar Panel Installation: A fully operational solar panel array designed to meet the community's energy needs.
- Microgrid Control System: A comprehensive system to manage energy distribution, monitor performance, and optimize efficiency and connected to the local company Hudson Light and Power.
- Battery Storage: A reliable battery system for storing excess energy generated by solar panels to ensure consistent power availability.
- Backup Generator: A gasoline backup generator to provide additional power security during periods of low solar generation.
- Connection to Local Grid: A seamless integration with Hudson Light & Power's existing grid to enhance energy reliability.

Features:

- Energy Monitoring: A system to monitor energy production and consumption in real-time, allowing for transparency and informed decision-making.

- User Interface: An intuitive platform for residents to track their energy usage and savings.
- Community Education: Programs aimed at informing residents about the benefits of renewable energy and energy conservation practices.

Functions:

- Clean Energy Generation: Produce renewable energy to power local homes, reducing the community's dependence on fossil fuels.
- Efficient Energy Storage: Store surplus energy for later use, helping to balance supply and demand, and reliability.
- Power Continuity: Ensure reliable electricity supply even during outages or periods of low solar activity.

Environmental Benefits: Decrease greenhouse gas emissions by substituting traditional power sources with solar energy, contributing to broader sustainability goals.

This project aims to create a resilient solar microgrid that supports the Hudson community's energy needs while promoting environmental sustainability and reducing overall reliance on fossil fuels.

3. Site Location

The proposed site at 75-77 Reed Rd Hudson, MA consists of roughly 40 acres of vacant land that is viable for the development of a smaller scale solar farm. The site receives on average 143 kWh/ft^2 of direct irradiation per year with an expected specific photovoltaic output of 1431.3 kWh/kWp per year. The average temperature for the area is 49.7 degrees Fahrenheit, but it can dip down as low as 0 degrees in the winter with an average annual snowfall of 48 inches, meaning that maintenance may be more intensive in the colder months. The site has a flat topography and once the previous buildings are demolished, it will be largely free from obstructions. However, the site has some areas of significant vegetation that will need to be cleared before development starts. Large portions of the site are also taken up by parking lots left by the previous owners of the location. Some of these lots could be reused as a part of the solar farm complex, but a few could be cleared to more effectively use the space.

Figure 1. Solar Farm Site and Area Estimation

4. Human Resources

Table 1: Roles and Responsibilities of Key Persons

Role (skilled personnel)	Responsibilities
Solar Engineer	• Responsible for designing solar energy systems, including photovoltaic (PV) panels and their configuration to maximize energy output. • Conducts site evaluations to assess solar radiation, shading, and other environmental factors that influence system performance. • Oversees the installation and integration of solar systems, ensuring compliance with safety standards and industry regulations.
Structural Engineer	• Ensures the structural integrity of solar panel mounts and supports, analyzing loads from environmental factors such as wind and snow. • Prepares designs and calculations for foundations and support structures that meet building codes and safety standards. • Collaborates with other engineers and construction teams to facilitate the safe installation of solar systems.
Electrical Engineer	• Designs the electrical systems needed to connect solar panels to inverters, batteries, and the grid, ensuring efficient energy transfer. • Develops and reviews electrical schematics and specifications to guarantee compliance with electrical codes and safety standards. • Connecting the solar farm to Hudson Light House. • Monitors the installation of electrical components and conducts testing to ensure proper functionality.
Surveyor	• Conducts land surveys to assess topography and site conditions, providing crucial data for project planning and panel layout.

	• Establishes property boundaries and identifies potential issues that could impact the solar farm installation and connection to the grid. • Generates topographical maps and 3D models that help optimize the placement of solar panels for maximum efficiency.
Project Manager	• Oversees the overall planning, execution, and completion of the solar farm project, ensuring it stays on schedule and within budget. • Coordinates between different teams (engineering, procurement, construction) and communicates progress to stakeholders. • Engages with the Hudson community, educating them about the solar farm project and addressing any concerns they may have. • Manages project risks and implements mitigation strategies to address any arising issues.
Compliance Officer	• Ensures that the project adheres to all regulatory requirements, including environmental, safety, and construction standards. • Conducts environmental impact assessments and prepares necessary documentation for permits and approvals. • Regularly audits project compliance to maintain legal and operational standards throughout the development process.
Supply Chain Manager	• Manages the procurement of materials and equipment needed for the solar farm project, ensuring timely delivery to avoid delays. • Negotiates contracts with suppliers and vendors, oversees logistics, and maintains inventory control. • Works to optimize the supply chain for cost-efficiency while ensuring quality and compliance with project specifications.
Solar Operations Manager	• Oversees the operation and maintenance of the solar farm post-installation, ensuring all systems perform optimally. • Develops maintenance schedules and manages team members to conduct routine inspections and repairs. • Analyzes operational data to identify areas for improvement and implement strategies to enhance energy generation.
Construction Manager	• Responsible for supervising the construction process on-site, ensuring adherence to safety, quality, and schedule standards. • Coordinates subcontractors and ensures that all work complies with technical specifications and regulatory requirements. • Conducts regular site inspections to monitor progress and resolve any construction-related issues.
Financial Officer	• Manages the financial aspects of the project, including budgeting, forecasting, and financial reporting. • Collaborates with the project team to ensure financial resources are allocated efficiently to support project goals. • Analyzes financial data to track performance against budget and identifies cost-saving opportunities throughout the project lifecycle.

5. Permitting and Regulatory Compliance

Local Level

- **Zoning Permit**: Ensure compatibility with local zoning laws or obtain a special permit/variance.
- **Building Permit**: For solar arrays, battery storage, and control systems, ensuring structural and fire safety.
- **Electrical Permit**: For wiring and grid connection; inspection required by local authorities.
- **Planning Board Approval**: Required for assessing community impact.

State Level

- **MassDEP Permits**: For land use, stormwater management, and environmental impact.
- **Interconnection Approval**: From Hudson Light & Power under Massachusetts standards.
- **EFSB Review**: If the project impacts public utility infrastructure.
- **MassCEC Certification**: For renewable energy incentives.

Federal Level

- **FERC Approval**: If connected to broader energy systems.
- **NEPA Review**: If federal funds/support are involved.
- **ESA Compliance**: Ensure no harm to endangered species or habitats.
- **FAA Approval**: The site is over 20,000 feet (3.79 miles) from any public-use airport with a runway longer than 3,200 feet and over 10,000 feet (1.89 miles) from smaller public-use or military airports, so FAA approval is not required.

<u>Applicable Regulations</u>

Environmental

- **Wetlands Protection Act**: Prevent harm to nearby wetlands.
- **Clean Water/Air Acts**: Manage water pollution and emissions (e.g., from backup generators).
- **Global Warming Solutions Act**: Align with Massachusetts climate goals.

Zoning

- Confirm site zoning compatibility for solar installations.3
- Adhere to height, setback, and land-use restrictions.

Building Codes

- Comply with **Massachusetts State Building Code** (wind/fire safety) and **NEC** (electrical safety).

Important Steps

1. Conduct site-specific zoning and environmental assessments.
2. Work with Hudson Light & Power for interconnection approval.
3. Apply for state/federal incentives and certifications.
4. Engage legal consultants for compliance with all requirements.

6. Design Engineering

There are four major components that must be considered in designing the layout of a solar farm: solar panels, inverters, wiring and facilities.

Solar Panels:

The solar panels and their coverage are the most important factors of the solar farm's output so they will take up the most space in the layout. The solar panels are organized in groups consisting of 1 acre each. Space is left between each group to accommodate service routes and other hardware. For optimal sun exposure these solar panels should be oriented with a 180-degree azimuth and a 37-degree tilt. Packing each group optimally yields roughly 28.6 acres of productive solar output. At 1,250 solar panels per acre this would translate to 35,750 solar panels total on the farm, and with a rating of 500W for each solar panel, the farm could expect to produce roughly 25.1GWh of power per year.

Inverters:

Inverters take the DC energy output of the solar panels and convert it into AC for better transmission. However, if a single solar panel is faulty or malfunctioning it can affect the performance of all other solar panels that are connected to the same inverter. Therefore, to mitigate the impact of panel failures, each inverter will only service 4-5 groups of solar panels.

Wiring:

Once the inverters have converted the solar panel output, the wiring transports it to the batteries and grid controller. The further the energy has to travel the more of it that gets lost, so the wiring must be laid out to along the shortest path to maximize output.

Facilities:

The facilities provide a central location to house and maintain the batteries and grid controller. These facilities will provide protection from the elements and temperature control to maintain high battery efficiency. In this layout the facilities are placed to minimize travel distance from inverters to the batteries and grid controller while keeping them conveniently located for employees.

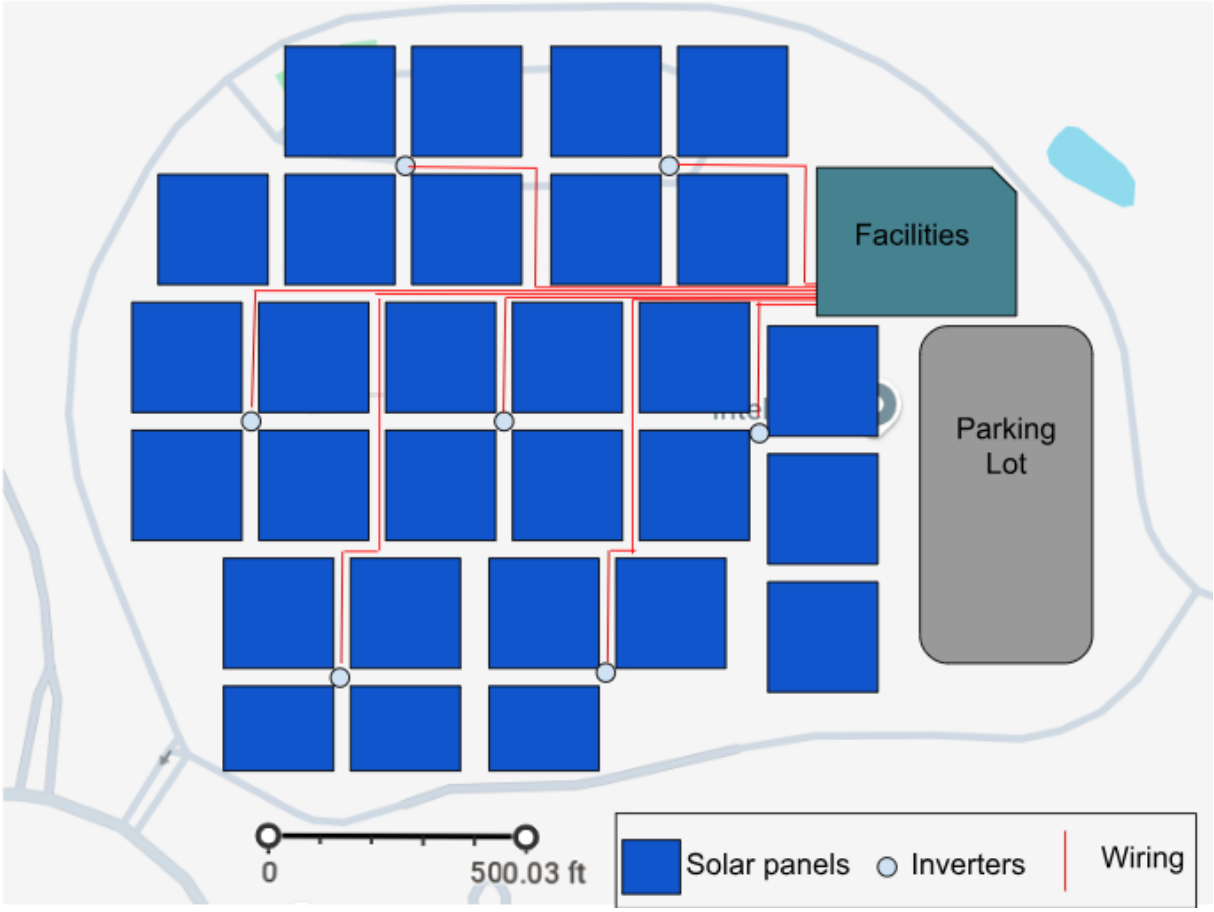


Figure 2. Proposed Layout of Solar Farm

7. Procurement of Materials

Sources for purchasing each of the following materials are listed in Table 2. Note that costs are not considered in the supplier selection since they will be paid for by an outside organization.

Table 2: Materials and Suppliers

Material	Supplier	Source for purchasing
Solar panels	First Solar	https://www.firstsolar.com/en/Products/Series-7
Mounting structures	APA Solar Racking	https://apasolar.com/products/first-solar-series-6/
Inverters	SMA	https://www.sma-america.com/products/solarinverters
Batteries	Fluence Energy	https://fluenceenergy.com/
Grid controller	Morningstar	https://www.morningstarcorp.com/product_category/solar-charge-controllers/
Cables	American Wire Group	https://www.buyawg.com/solar-power/
Transformers	MGM Transformers	https://www.mgmtransformer.com/product/SOLAR-TRANSFORMER/
Monitoring Equipment	Solar-Log	https://www.solar-log.com/en/products-solutions/monitoring-solar-log-web-eneresttm
Switchgear	Resa Power	https://www.resapower.com/systems/manufacturing/

8. Construction

The assembly of the Solar Microgrid System will occur in the following order as seen in Table 3.

Table 3: Assembly Schedule and Objectives

Objective	Key Tasks
Site Preparation	• Clearing vegetation and debris. • Demolishing remaining structures while preserving the parking lot for materials and equipment storage.
Solar Panel Installation	• Assembly of solar panel stands. • Installation of photovoltaic panels. • Alignment and securing of panels to optimize sunlight capture.
Microgrid Controller and Inverter Setup	• Installation of inverters near the solar panel clusters for efficient energy conversion. • Setup and calibration of the microgrid controller in the facilities area.
Battery Installation	• Placement of energy storage batteries in a secure, temperature-controlled environment. • Connection of batteries to the microgrid controller and solar arrays.
Cabling and Wiring	• Laying high-quality cables to connect the solar panels, inverters, batteries, and grid controller. • Ensuring minimal energy loss by optimizing cable pathways.
Testing and Quality Assurance	• Conducting system-wide tests to verify performance. • Addressing issues identified during testing.

Supervision

- Two members of the project management team will oversee the construction:
    - **Construction Manager**: Responsible for on-site supervision, coordinating subcontractors, and ensuring adherence to schedule and safety standards.
    - **Electrical Engineer**: Focused on the proper installation and connection of electrical components, verifying system compliance with technical and safety standards.

Labor

- Construction laborers provided by an external company will handle the physical tasks.
- Coordination with the project management team ensures seamless execution.

Logistics

- Materials, including solar panels, batteries, inverters, and cables, will be delivered to the parking lots of the 75-77 Reed Road property ahead of construction. This ensures all components are available when needed.

Timeline Overview

- Total Construction Duration: Approximately 11-12 weeks.

- Each phase is scheduled to prevent delays, with clear milestones for completion.

9. Grid Connection and Testing

In addition to setting up the stand-alone solar grid, additionally we will connect to Hudson Light and Power company. Hudson Light and Power was first founded in 1897 and now provides power to over 13,000 customers in the surrounding Hudson and Stowe areas. The electricity rates provided by Hudson Light and Power stand remain among the lowest in the state and have been recognized nationally as a "Reliable Public Power" provider with a small carbon footprint. Establishing a connection with Hudson Light and Power will help achieve two main objectives. First, by connecting to the grid, we hope to fuel the grid, providing the cheapest and most efficient energy costs and usages to our customers. Second, we hope to connect to the grid in case of temporary power outages and malfunctions, where we will be able to depend on Hudson Light and Power to make up for any shortcomings. To achieve a successful connection the key tasks listed below in Table 4 must be met. After successful installation, grid connections will be tested to ensure a proper connection was achieved.

Table 4: Key Grid Connection and Testing Objectives and Timeline

Objective	Key Tasks

Establish initial contact	• Call or visit Hudson Light and Power and identify location of solar grid and key contact person
	• Location Details:
	  ○ Phone: (978) 568-8736
	  ○ Address: 49 Forest Avenue Hudson MA, 01749
	• Review Standard Terms and Conditions for Electric Service and Rates document (link below)
	  ○ Standard T&C

Submit application and plans	• Complete and Sign the Authorization form
	• Review Deposit Policy
	• Submit Deposit
	  ○ Sum of no less than the average monthly bill for 3 months
	  ○ Submitted by cash or check
	• Draw up plans on where and how to connect to the grid, submit this with application

Plan installation of power lines to distribution system	• Work with Hudson Light and Power on installation providing any necessary information, grid set up • Confirm set up with personal engineers
Install power lines	• Work with Hudson Light and Power during installation providing any necessary information, transportation, safety procedures, and man–power
Test Connection	• Using multimeter, measure voltage of both sides of connections • Consult licensed electrician for specialized testing

10. Community Engagement and Outreach

One major challenge after establishing a successful microgrid will be continuing to foster a positive relationship with our customers, stakeholders, financial players, and the community at large. What is also necessary for our success is to recognize that key energy requirements change, and to be successful, we must be willing to meet the constant needs of the customers, even if the requirements change. In November of 2022 the owners of the property Portman Industrial proposed a redevelopment which was met with scrutiny from residents including the Villages at Quail Run, Westridge Condominiums, and Hudsons Children Center concerned with the "satisfactory outcome" leading to the withdrawal of the application. With the communities' doubts in mind, community engagement will be the utmost importance for months and years after our establishment. To establish this positive relationship, leadership will work on meeting four objectives.

(1) Schedule community open house

(2) Schedule regular meetings with the community and stakeholders.

(3) Plan "Keep the Lights On" program – weekly information sheets that report on efficiency of solar grid.

(4) Establish "*Gridlock*" a summer program for local high school students to get an inside look of what it takes to run a stand alone solar grid.

These four objectives are discussed in greater detail below in Table 5, highlighting key tasks to be achieved and the major takeaways

Table 5: Key Community Engagement Objectives

Objective	Key Tasks	Major Takeaways
1. Community open house	• Gather contact information (email/phone number) of main community members and stakeholders • Plan time where all members who worked on the grid are available • Invite community at large for open house session	Upon completing, invite community to ask questions and address concerns
2. Schedule regular meeting with community and stakeholders	• Gather contact information (email/phone number) of main community members and stakeholders • Determine meeting place and time that is convenient for all parties • Send out communications for town hall meetings that occur monthly at the same place and time • Create PowerPoint template highlighting the main topics to discuss (roughly 30min) ○ Other 30min with be open to Q&A and addressing any community concerns	Fosters comfortable space for local community members and stakeholders to bring about any issues, concerns, or questions

3. Plan weekly information sheets – *Keep the Lights On*	• Gather contact information (email/phone number) of main community members and stakeholders • Identify 3-5 metrics that helps define efficiency of grid • Collect metric data weekly • Send out mass email reporting metrics and other information relevant to the community covering clean energy, engineering, solar farms, renewable energy etc.	Keeps community informed on solar grid efficiency and educated on clean energy practices
4. Foster community engagement opportunities – *Gridlock* Summer Program	• Identify areas on solar farm safe enough for any visitors to be placed • Create outreach program focused on the youth and high school students in the area • Host students for 1-2 weeks in the summer to learn about the solar grid and the main major topics including green energy, solar cells, energy conversion etc.	Engaged younger community members in the importance of an establish and efficient solar farm

11. Funding and Financing

The estimated total cost of the solar microgrid project is projected to be between $2.1 million and $2.2 million.

The funding for the Solar Farm Microgrid project is being provided by the Lakeview Association in Hudson. This organization aims to raise capital from local private investors to support the realization of the project. In return for their investments, the 800 homeowners in the Lakeview Association will benefit from lower electricity rates compared to other Hudson L&P customers. This not only provides a financial relief for the residents but also promotes the use of renewable energy within the community.

12.Work Breakdown Table

The schedule of tasks, dependent tasks, and functional roles can be found in Table 6.

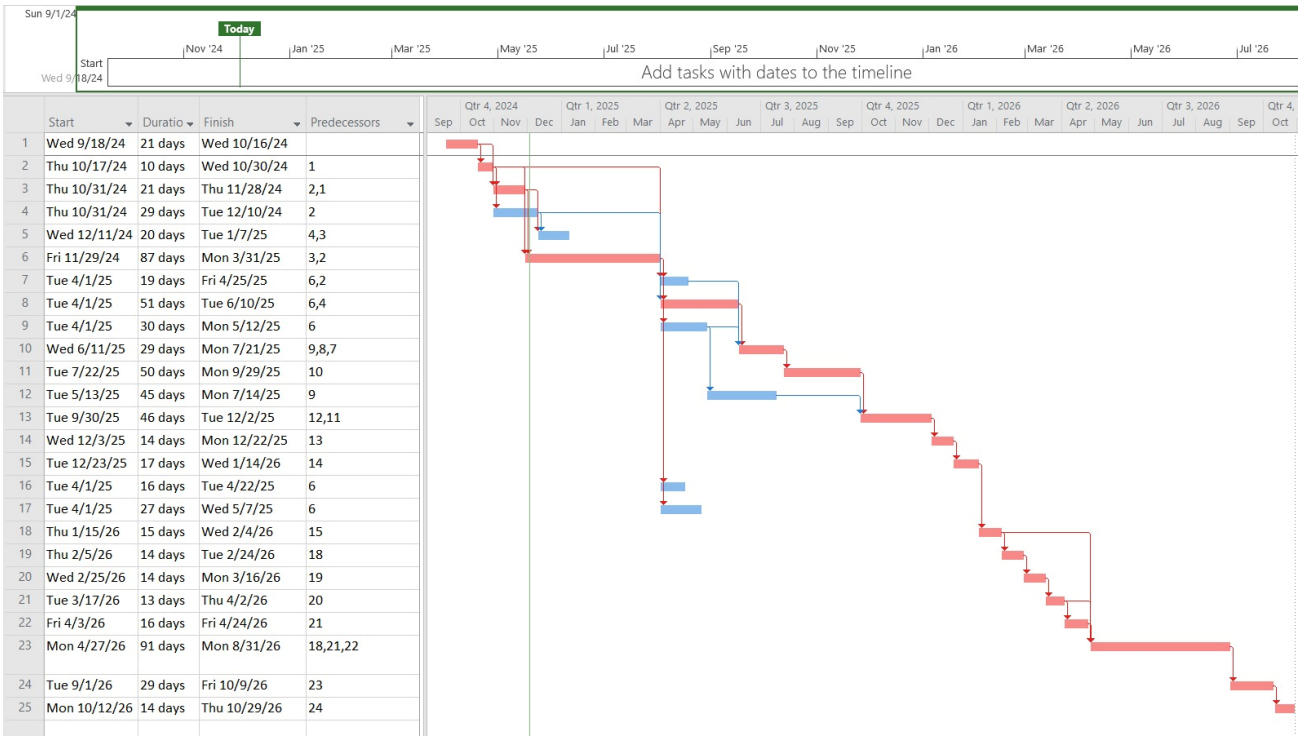
Table 6: Work Breakdown Table

Task no.	Activity (tasks)	Assigned to: Functional Role (#)	Start Date	Finish Date	Predecessors Tasks no.
1	Define Project Charter	Project Manager	Wed 9/18/24	Wed 10/16/24	--
2	Conduct Site Evaluation	Surveyor	Thu 10/17/24	Wed 10/30/24	1
3	Assess Environmental and Community Impact	Compliance Officer, Project Manager	Thu 10/31/24	Thu 11/28/24	2, 1

4	Develop Initial Design Concepts	Solar Engineer, Structural Engineer	Thu 10/31/24	Tue 12/10/24	2
5	Prepare Feasibility Report	Financial Officer	Wed 12/11/24	Tue 01/07/25	4, 3
6	Obtain Permits and Regulatory Approvals	Compliance Officer	Fri 11/29/24	Mon 03/31/25	3, 2
7	Finalize Solar Farm Layout	Design Engineering Team	Tue 04/01/25	Fri 04/25/25	6, 2
8	Select Suppliers and Procure Materials	Supply Chain Manager	Tue 04/01/25	Tue 06/10/25	6, 4
9	Clear Vegetation, Demolish Structures. and transport material to the site	Construction Manager	Tue 04/01/25	Mon 05/12/25	6
10	Install Solar Panel Mounting Structures	Structural Engineer	Wed 06/11/25	Mon 07/21/25	9, 8, 7
11	Install Solar Panels	Solar Engineer, Construction Manager	Tue 07/22/25	Mon 09/29/25	10
12	Install Inverters and Batteries	Electrical Engineer	Tue 05/13/25	Mon 07/14/25	9
13	Connect System to Grid	Electrical Engineer, Grid Engineer	Tue 09/30/25	Tue 12/02/25	12, 11
14	Conduct Initial System Testing	Solar Operations Manager	Wed 12/03/25	Mon 12/22/25	13
15	Optimize and Calibrate Systems	Electrical Engineer	Tue 12/23/25	Wed 01/14/26	14
16	Train Community Representatives	Community Engagement Specialist	Tue 04/01/25	Tue 04/22/25	6
17	Launch Community Engagement Program	Project Manager, Community Engagement Specialist	Tue 04/01/25	Wed 05/07/25	6
18	Create Maintenance Plans	Solar Operations Manager	Thu 01/15/26	Wed 02/04/26	15
19	Finalize Operational Manuals	Solar Operations Manager	Thu 02/05/26	Tue 02/24/26	18
20	Perform Comprehensive System Testing	Project Manager, Solar Engineer	Wed 02/25/26	Mon 03/16/26	19
21	Obtain Final Approvals	Compliance Officer	Tue 03/17/26	Thu 04/02/26	20
22	Conduct System Handover to key stakeholder	Project Manager	Fri 04/03/26	Fri 04/24/26	21

23	Monitor System Performance for 3 Months	Solar Operations Manager	Mon 04/27/26	Mon 08/31/26	18, 21, 22
24	Review Project Outcomes	Project Manager, Financial Officer	Tue 09/01/26	Fri 10/09/26	23
25	Publish Final Project Report	Project Manager	Mon 10/12/26	Thu 10/29/26	24

13.Gant Chart



	Start	Duratio	Finish	Predecessors
1	Wed 9/18/24	21 days	Wed 10/16/24	
2	Thu 10/17/24	10 days	Wed 10/30/24	1
3	Thu 10/31/24	21 days	Thu 11/28/24	2,1
4	Thu 10/31/24	29 days	Tue 12/10/24	2
5	Wed 12/11/24	20 days	Tue 1/7/25	4,3
6	Fri 11/29/24	87 days	Mon 3/31/25	3,2
7	Tue 4/1/25	19 days	Fri 4/25/25	6,2
8	Tue 4/1/25	51 days	Tue 6/10/25	6,4
9	Tue 4/1/25	30 days	Mon 5/12/25	6
10	Wed 6/11/25	29 days	Mon 7/21/25	9,8,7
11	Tue 7/22/25	50 days	Mon 9/29/25	10
12	Tue 5/13/25	45 days	Mon 7/14/25	9
13	Tue 9/30/25	46 days	Tue 12/2/25	12,11
14	Wed 12/3/25	14 days	Mon 12/22/25	13
15	Tue 12/23/25	17 days	Wed 1/14/26	14
16	Tue 4/1/25	16 days	Tue 4/22/25	6
17	Tue 4/1/25	27 days	Wed 5/7/25	6
18	Thu 1/15/26	15 days	Wed 2/4/26	15
19	Thu 2/5/26	14 days	Tue 2/24/26	18
20	Wed 2/25/26	14 days	Mon 3/16/26	19
21	Tue 3/17/26	13 days	Thu 4/2/26	20
22	Fri 4/3/26	16 days	Fri 4/24/26	21
23	Mon 4/27/26	91 days	Mon 8/31/26	18,21,22
24	Tue 9/1/26	29 days	Fri 10/9/26	23
25	Mon 10/12/26	14 days	Thu 10/29/26	24

Here is the duration formatted with task numbering:

1. **Task 1** - 21 days
2. **Task 2** - 10 days
3. **Task 3** - 21 days
4. **Task 4** - 29 days
5. **Task 5** - 20 days
6. **Task 6** - 87 days
7. **Task 7** - 19 days
8. **Task 8** - 51 days
9. **Task 9** - 30 days
10. **Task 10** - 29 days
11. **Task 11** - 50 days
12. **Task 12** - 45 days
13. **Task 13** - 46 days
14. **Task 14** - 14 days
15. **Task 15** - 17 days
16. **Task 16** - 16 days
17. **Task 17** - 27 days

18. **Task 18** - 15 days
19. **Task 19** - 14 days
20. **Task 20** - 14 days
21. **Task 21** - 13 days
22. **Task 22** - 16 days
23. **Task 23** - 91 days
24. **Task 24** - 29 days
25. **Task 25** - 14 days

14. One-Page Overview of the Solar Microgrid Project

Project Name: Hudson, MA Solar Microgrid Project
Location: 75-77 Reed Road, Hudson, MA
Goal: To establish a sustainable solar farm and microgrid connected to Hudson Light & Power that provides reliable, renewable energy for 800 homes while reducing greenhouse gas emissions.
Duration: The estimated duration of the project is 1.5 years, with a max. timeframe of 36 months.
Costs: The total costs are estimated to range between $2.1 million and $2.2 million.

Key Project Components:

1. **Solar Panel Installation:** Fully operational photovoltaic array designed to harness solar energy efficiently.
2. **Battery Storage System:** Stores surplus solar energy to ensure uninterrupted power supply during low solar periods.
3. **Microgrid Control System:** Manages energy distribution, monitors performance, and ensures optimal efficiency.
4. **Grid Integration:** Seamless connection to Hudson Light & Power's grid for added reliability.
5. **Backup Generator:** A gasoline-powered system to provide additional power during emergencies.

Benefits Of Project Completion:

1. **Environmental Impact:**
    - Reduces dependence on fossil fuels and minimizes carbon footprint.
    - Aligns with Massachusetts' climate goals under the Global Warming Solutions Act.
2. **Economic Value:**
    - Delivers affordable electricity to the Lakeview Association residents and surrounding businesses.
    - Promotes financial savings through renewable energy incentives and reliable electricity.
3. **Community Engagement:**
    - Programs such as the "Gridlock" summer initiative educate local students on renewable energy.

Implementation Plan

- **Milestones:**
    1. Obtain permits and regulatory approvals (Months 1–5).
    2. Complete site preparation and material procurement (Months 5–7).
    3. Assemble and connect the microgrid system (Months 7–12).
    4. Conduct testing, community training, and final system handover (Months 12–18).

Key Stakeholders

- **Project Team:** Engineers, surveyors, project managers, and compliance officers.
- **Hudson Light & Power:** Local utility partner for grid connection.
- **Community Members:** Residents benefiting from reduced electricity costs.
- **Investors:** Supporting the projects funding efforts.

This project promises a significant leap toward renewable energy adoption in Hudson, MA, fostering sustainability, economic efficiency, and community development.