BIRZEIT UNIVERSITY

greenspark

"Turning Waste into Sustainable Energy"

Team Members: Fatima Alzahra Jack, Lama Khattib, Lana Hamayel, Rana Kamal, Ola Obaid, Ahlam Abuqare
Instructor: Dr. Sahar El-Jallad

Section: 1
ECON3372: Project Management and Economics for Engineering
Second Semester 2024/2025
October 6, 2025

Contents

1 Executive Summary

The GreenSpark Waste-to-Energy Project aims to tackle two major challenges in Jericho, Palestine: waste management and energy generation. This project involves the construction of a facility that will process 1,200 tons of municipal solid waste per day and convert it into 40 MW of renewable electricity. The electricity will be supplied to the local grid and sold to the electricity distribution company, offering a reliable, sustainable energy source for the region. In addition to reducing the growing waste in the Jericho landfill, the project will help to reduce carbon emissions and provide an alternative to fossil-fuel-based energy. By transforming waste into electricity, the GreenSpark facility will contribute to energy self-sufficiency, reducing Palestine's reliance on imported energy. The project also aims to create jobs and stimulate the local economy by providing employment opportunities in construction, operations, and maintenance. With its focus on environmental sustainability, renewable energy, and economic development, the GreenSpark project will serve as a model for future waste-to-energy initiatives in Palestine, making a significant impact on both the environment and the local community, and contributing to a greener, more sustainable future for the region.

2 Defining the Project

2.1 Project Scope

The GreenSpark Waste-to-Energy Project will convert 1,200 tons of municipal waste per day into 40 MW of electricity at the Jericho landfill, supplying the local grid. It will reduce waste, cut carbon emissions, and provide local energy while creating jobs.

2.2 Project Objective

The main objectives of the GreenSpark Waste-to-Energy Project are to:

- Develop a waste-to-energy facility at the Jericho landfill to convert municipal waste into renewable energy.
- Generate clean electricity to reduce Palestine's reliance on traditional energy sources.
- Promote environmental sustainability by decreasing landfill waste and lowering carbon emissions.
- Create economic opportunities through local job creation and skill development in the renewable energy sector.
- Contribute to Palestine's energy self-sufficiency by providing a sustainable and alternative energy source.

2.3 Deliverables

The key deliverables of the GreenSpark Waste-to-Energy Project include:

- A fully operational waste-to-energy facility at the Jericho landfill that converts organic waste into renewable energy.
- Clean electricity generation connected to the local grid to support energy needs.
- A comprehensive training program for local workers on plant operation and maintenance.
- A detailed environmental impact report showcasing the benefits of reduced waste and carbon emissions.
- Ongoing maintenance and support system to ensure the long-term operation of the facility.

2.4 Milestones

The key milestones for the GreenSpark Waste-to-Energy Project include:

- Initial Project Approval: 1st July 2025
- Completion of Feasibility Study: 15th August 2025
- Environmental and Regulatory Approvals: 15th December 2025
- Design and Engineering Phase Completed: 31st January 2026
- Groundbreaking Ceremony: 1st March 2026
- Main EPC Contractor Selection: 30th April 2026
- Construction Phase Begins: 1st January 2027
- Major Equipment Installation Complete: 30th September 2027
- Commissioning and Testing Phase: 1st November 2027 - 30th June 2028
- Facility Testing and Validation Complete: 30th June 2028
- Commercial Operations Launch: 1st July 2028
- Project Closure and Final Handover: 1st July 2029

2.5 Technical Requirements

- Waste processing systems - Moving grate incinerators, overhead cranes, tipping hall, and conveyor systems to handle 1,200 TPD municipal solid waste capacity.
- Thermal conversion units - High-pressure boilers, 40MW condensing steam turbine, and electrical generators to convert waste heat into electricity.
- Emission control equipment - SNCR systems, fabric filters, SCR units, and continuous emissions monitoring (CEMS) to meet EU emission standards.
- Electrical infrastructure - 33kV substation, transformers, and grid connection equipment to integrate generated power into the local electrical network.
- Control and monitoring systems - SCADA systems, automated process controls, and real-time monitoring of temperature, pressure, and emissions parameters.

- Safety and fire protection - CO2 suppression systems, deluge systems, emergency shutdown procedures, and compliance with international safety standards
- Environmental systems - Bottom ash and fly ash handling equipment, water treatment systems, and environmental monitoring equipment.
- Support infrastructure - Maintenance facilities, spare parts storage, laboratory facilities, and administrative buildings.

2.6 Limits and Exclusions

The GreenSpark project is focused exclusively on processing municipal solid waste for energy generation. The following limits and exclusions define the boundaries of the project scope:

- The facility will not process hazardous, medical, or industrial waste.
- Waste sorting is limited to the facility level; no pre-sorting at household or municipal level.
- Electricity supply is limited to the local grid only.
- Collection or transportation systems for municipal waste are excluded.
- Public education or awareness campaigns are outside project scope.
- Steam supply to external users or district heating systems is excluded.
- Advanced waste treatment technologies (gasification/pyrolysis) are not included.
- Carbon credit certification and trading mechanisms are excluded.

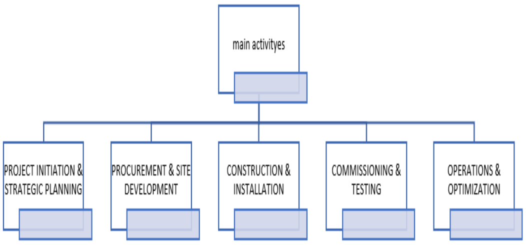
2.7 Project Priorities

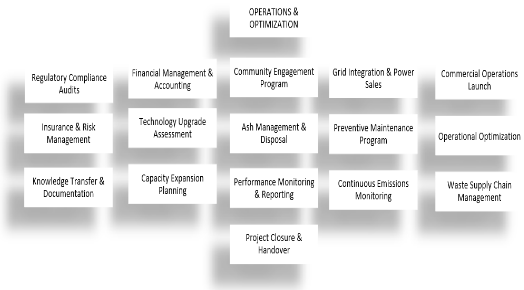
The GreenSpark project prioritizes critical elements to ensure successful execution and long-term sustainability. These priorities guide decision-making when tradeoffs are necessary:

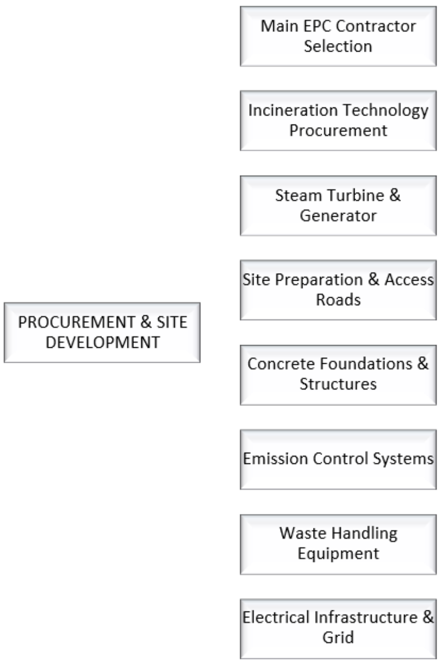
- **Time**: Adhering to the proposed schedule is essential to meet regulatory deadlines and secure timely integration with the local grid.
- **Cost**: Staying within the allocated budget is crucial to maintain financial feasibility and attract continued investor support.

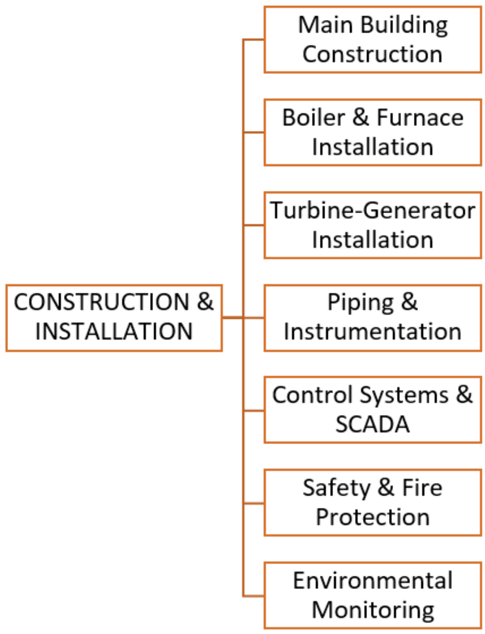
- **Performance**: Ensuring the facility operates efficiently, meets energy generation targets, and complies with environmental standards is a top priority.
- **Sustainability**: Minimizing environmental impact through clean technology and emission control is key to achieving long-term community and ecological benefits.
- **Stakeholder Satisfaction**: Gaining public and governmental support is important to reduce resistance and ensure smooth implementation and operation.

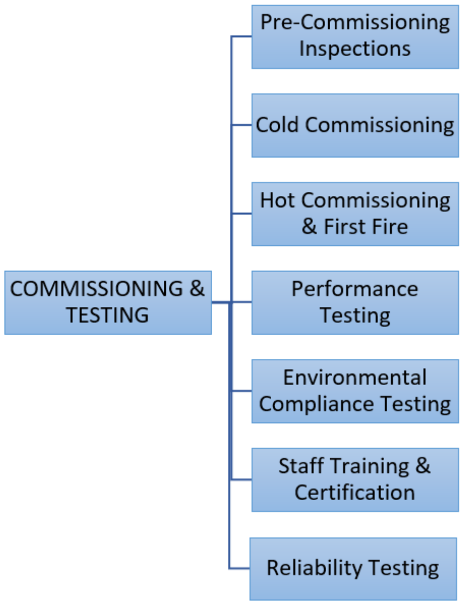
2.8 Work Breakdown Structure (WBS)

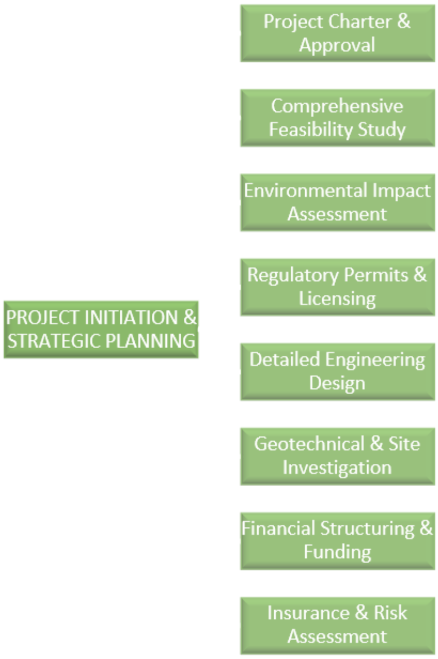




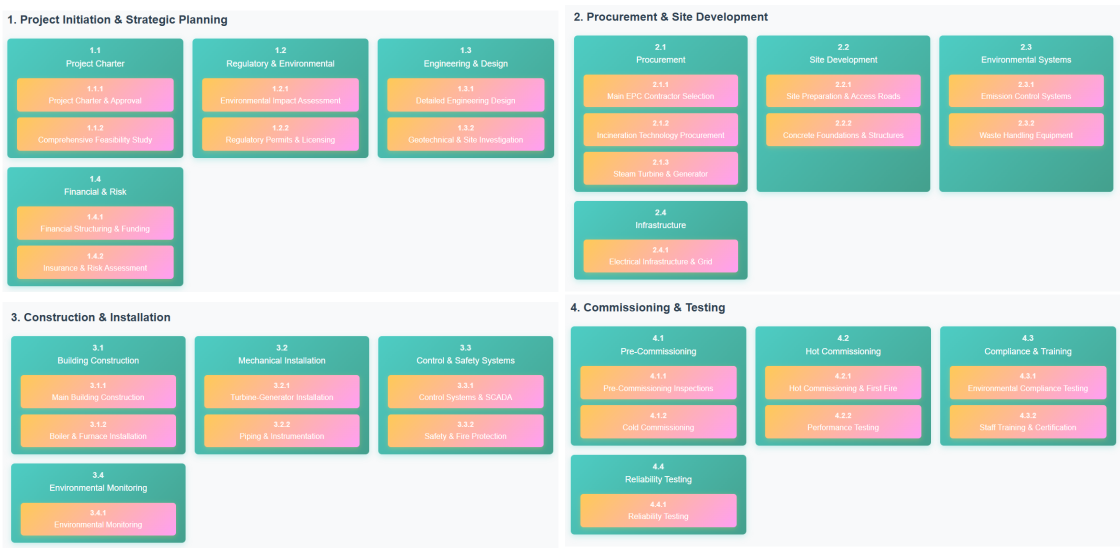


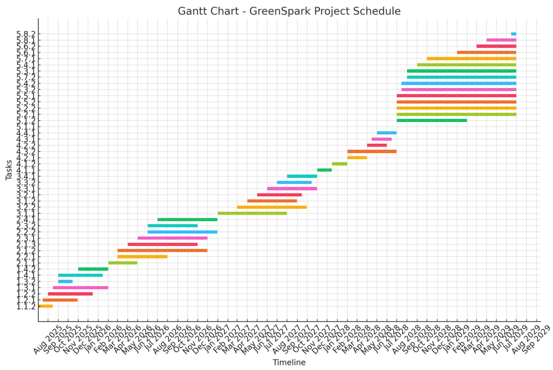






2.9 Coding the WBS for the Information System





3 Estimating Project Times and Costs

3.1 Estimating Project Times

Project initiation might need 7 months, in order to prepare project charter, study project feasibility, including what waste to use, what technology, and what is the effect on the environment and society. However, project procurement and site development need longer time nearly a year (11 months) to get all equipment for the work ready to be installed such as incineration technology, steam turbines, and generator. In this year, also the basic infrastructure is made, whether it was concrete foundations and structures, access roads, control systems, or electricity and grid. Then after preparing the infrastructure, another 10 months are needed to complete the construction and installation. Then half a year is spent on commissioning and testing, to test the performance of the project systems according to commissioning steps that are used worldwide and quality testing required. At last, the project starts operating to achieve optimization in a year, to ensure that proper management is set for different aspects, technologies are upgraded, and monitoring and maintenance programs are consistent.

3.2 Estimating Project Costs

The estimated total cost for the project is $14 M, and this cost is distributed across ten major categories of the project. The first one requires the largest portion: $1,220,000 for incineration unit preparation. Secondly, electrical generation equipment requires a high cost of nearly $610,000. Buying safety and environmental sensors and alarms will cost $75,000. Providing legal approval will necessitate $25,000. The cost of civil works is about $360,000, which is spent on constructing the building for the factory. Another area classified as storage for sorted waste needs $150,000 to be ready. Electrical, protection, safety installations, and testing roughly require $100,000. In addition to this, the salaries of technicians and engineers, and any required training, total $65,000. Meanwhile, basic utilities such as water, lighting, and internet will cost $25,000.

4 Project Plan

4.1 Communication

Effective communication is crucial for the GreenSpark Waste-to-Energy Project. The strategy ensures clear, timely, and transparent information exchange among all stakeholders, including the project team, government authorities, and the local community.

Communication tools will include email for routine updates and meetings, and project management software (e.g., Microsoft Project, Asana) to track progress and deadlines. Video conferencing (Zoom, Teams) will be used for virtual meetings, especially with remote stakeholders. Regular progress reports will provide updates on milestones, challenges, and next steps, while key in-person meetings will be held with local authorities and contractors.

A communication schedule will be followed:

- **Monthly Reports:** Sent at the end of each month, covering progress, delays, and upcoming actions.
- **Quarterly Meetings:** Held to review overall progress, address concerns, and discuss financials.
- **Urgent Updates:** Communicated via email or messaging for swift action.
- **Kick-off and Closing Meetings:** To set expectations and review final deliverables.

Regular stakeholder engagement will be ensured through internal meetings, external updates, and community outreach, promoting transparency and support for the project.

4.2 Procurement

The procurement process for the GreenSpark Waste-to-Energy Project focuses on acquiring materials, equipment, and services needed for the facility. It will involve selecting both local and international vendors to ensure timely delivery, cost-effectiveness, and quality.

The procurement approach includes:

- **Tendering Process:** Formal tenders will be issued for major equipment, such as incinerators, turbines, and emission control systems. Vendors will be chosen based on cost, quality, delivery timelines, and compliance with standards.
- **Vendor Selection:** Vendors will be selected through a transparent bidding process, focusing on product quality, reliability, and adherence to environmental and safety standards.
- **Supply Chain Management:** A supply chain management system will be set up to ensure smooth delivery of materials, with careful planning for transportation, storage, and inventory management.
- **Local and International Sourcing:** Efforts will be made to source locally where possible, while also procuring necessary international equipment to meet project needs.
- **Contract Management:** Clear contracts will be established with vendors, specifying delivery schedules, payment terms, and penalties for delays.

This approach will help ensure the project receives high-quality materials on time and within budget, while managing risks effectively.

4.3 Human Resources

The operation needs a combination of workers. Project management unit to connect each aspect with the others and insure that the project will be done on time, within budget and according to specifications. Electrical engineers to design the required protection and connection to the grid. Chemical experts to ensure that the project is environmentally safe. A group from Jerusalem District Electricity Company (JDECO) to implement their specifications all work together in coordination with the government to achieve the best result.

4.4 Quality Plans

The project will ensure compliance with both international and local environmental and energy standards, such as ISO 14001 and ISO 50001, through the implementation of rigorous quality assurance and control measures. Regular audits and inspections will be conducted throughout all phases of the project—design, construction, and operation—to maintain high standards. Stakeholder engagement and a continuous feedback loop will be established to drive ongoing improvement, while comprehensive risk assessments and mitigation plans will be integrated at every stage. The facility will utilize certified, proven waste-to-energy technologies and incorporate real-time monitoring systems to track emissions, energy output, and waste conversion rates. All construction and equipment installations will be verified against detailed engineering specifications, with performance closely monitored and documented through monthly reporting and stakeholder review meetings.

5 Project Budget

It is essential to monitor project spending and forecast profitability to ensure the GreenSpark initiative is completed within its predefined budget. Funding sources such as app subscriptions, end-user contributions, international grants, and private sector support must be clearly outlined. Both fixed and variable costs—such as the plant construction cost, operational expenses, and staff salaries—should be identified while considering factors like inflation and equipment depreciation over time. Additional expenditures on promotional campaigns, transportation, and community awareness events should also be accounted for. Budget performance should be tracked by comparing the planned value curve with the earned value and actual cost. This approach allows greater flexibility in responding to changes in donor requirements and community demands, helping to keep potential cost overruns within acceptable limits and ensuring the long-term financial sustainability of the project.

Budget Categories

Category	Description	Estimated Cost (USD)
1. Capital Costs		
Incineration Unit	Waste-to-energy combustion system, including emission filters and control units	1,220,000
Electrical Generation Equipment	Turbines, transformers, and grid connection system	610,000
Civil Works	Construction of buildings, foundations, and landfill modifications	360,000
Storage & Sorting Facility	Pre-processing area for waste classification and storage	150,000
2. Operational Setup		

Category	Description	Estimated Cost (USD)
Installation & Commissioning	Labor, testing, and calibration of the system	100,000
Staff Recruitment & Training	Technicians, engineers, safety officers	65,000
Safety & Environmental Systems	Sensors, alarms, fire safety, emission monitoring	75,000
3. Ongoing Costs (First Year)		
Staff Salaries (First Year)	5 engineers, 10 technicians, admin team	250,000
Fuel/Operational Supplies	Backup fuel, lubricants, spare parts	90,000
Waste Transport & Handling	Internal logistics from landfill to plant	55,000
Maintenance & Repair	Routine and emergency services	65,000
Utility Costs	Water, lighting, network, internet	25,000
4. Miscellaneous & Contingency		
Legal & Compliance	Environmental impact assessments, permits	25,000
Public Awareness & Outreach	Education campaigns for waste sorting	30,000
Contingency Reserve (10%)	Unforeseen expenses	303,210
Total Estimated Budget		
Total Estimated Budget		3,684,210
In ILS (Israeli New Shekels)		14,000,000

6 Risk Management Plan

While Waste-to-Energy does produce many benefits, it also has many disadvantages. Here are some of the cons of waste-to-energy incineration. Environmental risks: some chemicals produced from the waste-to-energy process may seep into groundwater or soil, posing a threat to agricultural land and drinking water sources. Additionally, WTE plants can generate hazardous waste or non-combustible ash that requires special treatment. If it is not properly managed, these byproducts can pose a serios environmental risks. One way to mitigate these risks is to build facilities on land that is unsuitable for agriculture. Health risks: Waste-to-Energy facilities can emit air pollutants such as sulfur dioxide, nitrogen oxides, and particulate matter, all of which can harm air quality. People living near these may be exposed to toxic substances, increasing the risk of respiratory problems and serious health conditions such as cancer. Economic challenges: Waste-to-energy plants are often costly to build, operate, and maintain, placing a significant financial burden on governments or private companies. This can be especially challenging in developing regions with limited financial resources. Political and security challenges: In politically sensitive areas such as the West Bank, high levels of political tension and security risks may disrupt operations and threaten the safety of workers and facilities. Political instability can also delay project approvals, increase operational uncertainty, and make long-term planning more difficult. When international organizations are involved, negotiating agreements and securing funding may be complicated by local political dynamics.

6.1 Risk Response Strategies

Environmental risks: To mitigate environmental risks, it is recommended to construct WTE facilities on land that is unsuitable for agriculture. This approach not only preserves arable land for food production but also minimizes ecological disruption. Health risks: To reduce potential health risks, WTE plants should be located in remote or sparsely populated areas. This spatial separation helps limit human exposure to emissions and other operational byproducts, thus safeguarding public health. Economic challenges: Overcoming economic barriers requires a combination of international and domestic support. Funding from NGOs, development agencies, and government sources is crucial to cover the high initial capital costs. Such financial backing ensures long-term sustainability and makes WTE technology more accessible to underserved communities. Political and security challenges: Addressing these challenges necessitates the implementation of robust risk management strategies and transparent governance mechanisms. Strong collaboration between local authorities, international stakeholders, and community representatives is essential to build trust, promote accountability, and ensure project resilience in politically sensitive or unstable areas. So, if a waste-to-energy project is approved in the West Bank, it is essential to conduct a comprehensive risk assessment and identify effective technological and environmental solutions to mitigate potential harm.

Appendix

A. Project Timeline: Key project milestones include:

- Initial Project Approval: 1st July 2025
- Feasibility Study Complete: 15th August 2025
- Groundbreaking Ceremony: 1st March 2026
- Commercial Operations: 1st July 2028

B. Major Equipment Specifications: Key equipment includes:

- **Incinerator:** 1,200 TPD capacity, cost $1,000,000.
- **Steam Turbine:** 40 MW, cost $600,000.
- **Emission Control:** EcoFilter 3000, cost $75,000.

C. Procurement Plan:

- Tendering for major equipment.
- Vendor selection based on cost, quality, and standards.
- Supply chain management for smooth logistics.

D. Budget Breakdown: Key budget categories:

- **Capital Costs:** $2,390,000 (Incineration unit, turbines, civil works).
- **Operational Setup:** $240,000 (Installation, recruitment, safety systems).
- **Ongoing Costs:** $525,000 (Salaries, fuel, waste handling).
- **Contingency:** $358,210 (Legal, outreach, unforeseen expenses).

E. Risk Management: Risk mitigation strategies include:

- **Environmental:** Facility placement to prevent contamination.
- **Health:** Emission control and facility location.
- **Economic:** Funding from government and NGOs to cover high costs.
- **Political:** Transparent governance to manage political instability.

F. Glossary of Terms:

- **WTE:** Waste-to-Energy
- **TPD:** Tons Per Day
- **MW:** Megawatt
- **EPC:** Engineering, Procurement, and Construction