1. Project Constraints

Cost Optimization Priority: Emphasis will be placed on cost-effective solutions by carefully evaluating trade-offs between schedule and resource allocation.
Timeframe Limitation: The project must be completed within a 36-month period.
Land Area Adjustment: The current Hudson location, covering approximately 16 acres, will be expanded to about 29 acres by demolishing existing buildings and utilizing part of the parking lot for the solar farm.
Simplified Budget Assumption: Although the budget is assumed to be unlimited for simplification, in practice, a defined budget would serve as a key constraint influencing project boundaries.
Additional Constraints: Further constraints are detailed in the accompanying table.

	High Importance	Medium Importance	Low Importance	Assumptions
Schedule	Yes			36-month timeline
Scope			Yes	Hudson's energy needs
Resources		Yes		Availability of necessary materials, skilled labour, and equipment

2. Scope Triangle

3. Cost Estimation Worksheet

Assumptions:

Work Hours and Schedule: The project operates with 8-hour shifts, 52 weeks per year.

Labor Costs:

College-educated labor: $150/hour.
Non-college-educated labor: $75/hour.

Internal team labor costs are already included in the company's budget, so no additional expenses apply.

Equipment and Machinery: All required equipment and construction machinery are owned by the company, incurring no additional costs.

Solar Panel Requirements and Costs:

Approximately 48,815 solar panels (each 2m x 1.2m) are needed to cover the 29-acre area.
Unit price per panel: $150.
Estimated total panel cost: $732,225.

Project Schedule Flexibility:

Tasks may overlap or run simultaneously.

Delays may occur due to factors such as building permit approvals or material delivery timelines.

Phases	**Tasks**	**Description**	**Measurement Metrics**	**Estimated total cost in US $**
Initiation				**$6000**
Task 1	Plan acceptance and prepare project draft	Obtain stakeholder approval for the project plan and create a detailed draft outlining objectives, timelines, resources, costs, and risks to guide execution.	20 days	$0
Task 2	Stakeholder meeting	A discussion with key stakeholders to review project progress, address concerns, align on objectives, and ensure continued support and collaboration.	5 days	$300 (hospitality cost)

Task 3	Site Analysis and Feasibility Study	Analyse the site's feasibility for the solar farm, considering location, layout, sunlight availability, regulatory requirements, and other key factors.	25 days	$0
Task 4	Initial Permits Research	Identify required permits, approvals, and compliance with environmental regulations, zoning laws, and building codes.	10 days	10 days × 3 hours/day × 1 person = 30 hours 30 hours × $150/hour = **$4,500**
Task 5	Risk Assessment and Environmental Impact Study	Identify financial, technical, environmental, and social risks, develop mitigation plans, and conduct an environmental impact study.	25 days	$1200
Task 6	Develop Initial Budget	The budget should reflect the costs associated with permits, site feasibility, and identified risks, based on realistic estimates from the previous tasks.	10 days	$0
Planning				$7380250
Task 1	Get Building Permit	Hand in the documents and obtain the building permit.	30 days	$2000 – fixed fee $2000 – insurance cost
Task 2	Project Scheduling	Project scheduling.	15 days	$0

Task 3	Solar Panel Layout Design	Design the solar panel layout for optimal sun exposure and efficiency, including the arrangement of panels, inverters, wiring, batteries, and grid controller. Calculate the required number of panels based on their size.	30 days	30 days * 8 hrs * 1 man = 240mhrs 240 * 150 = $36000
Task 4	Vendor Selection and Sourcing	Select vendors and source materials for the project.	15 days	$7322250
Task 5	Resource Scheduling	Schedule resources and allocate necessary equipment.	10 days	$0
Execution				**$798600**
Task 1	Site Preparation	Clear and prepare land for panel installation, divide the property into quarters. The area of the solar farm is approximately 666,000 square feet.	20 days	20 days × 5 men × 8 hours = 800 man-hours 800 man-hours × $75 = **$60,000**
Task 2	Equipment Transportation	Transport equipment from parking lot to site.	5 days	5 days × 6 men × 8 hours = 240 man-hours 240 man-hours × $75 = **$18,000**
Task 3	Foundation	Lay foundations for solar panel structures with engineers' supervision.	30 days	30 days × 8 hours × 8 men × $75 + 4 men × $150 = **$288,000**
Task 4	Install Solar Panels	Install solar panels according to design	40 days	40 days × 8 hrs × 4 men × $150 + 8 men × $75 = **$384,000**

		specifications. Ensure that the orientation and tilt of the panels are optimized for maximum sunlight exposure. Wire the panels together to form a complete solar array.		
Task 5	Install and Connect Inverters and Batteries	Install and connect inverters and batteries, ensuring all connections are secure and preventing electrical short circuits.	15 days	15 days × 2 men × 6 hrs = 180 man-hours 180 man-hours × $150 = **$27,000**
Task 6	Connection to Hudson Light and Power Grid	After the installation and connection of the solar panels and inverters, conduct any necessary pre-inspection tests to ensure the system functions correctly. Once confirmed, connect the system to the Hudson Light and Powers grid	10 days	10 days × 2 men × 4 hrs = 80 man-hours 80 man-hours × $150 = **$12,000**
Task 7	Final Testing and Quality Assurance Inspection	Perform final testing and conduct a quality assurance inspection of all components. This includes verifying the correct functionality, checking for any wiring issues,	8 days	8 days × 2 men × 4 hrs = 64 man-hours 64 man-hours × $150 = **$9,600**

		and ensuring safety measures are in place. If all tests pass, prepare the system for operation and document everything for reference.		
Maintenance				**$9600**
Task 1	System Monitoring Setup	Install monitoring software to track energy output.	5 days	$0
Task 2	Training For Staff	Train the maintenance team on system operations.	5 days	$0
Task 3	Routine Inspections	Perform maintenance inspections.	12 inspections (1 per day)	$0
Task 4	Panel Cleaning	Conduct quarterly cleaning to maintain efficiency.	8 days per year	$9600
Task 5	Performance Evaluation	Conduct annual performance evaluation and reporting, defining KPIs.	5 days	$0
Task 6	Warranty and Support Setup	Set up manufacturer warranty and support options	5 days	$0
Contingency Fund				$1000000
Total estimated costs				**$9194450**