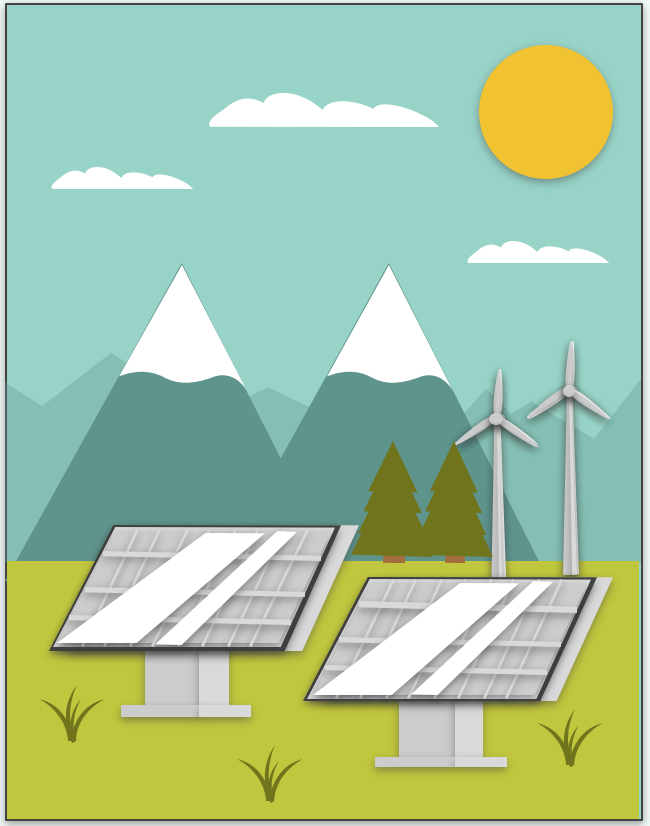
USC Solar Roof System



Group 4

Michelle Gelman
Najeeb Gohil
Simran Kang
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Naseem Pashai
Francisco Rocha
Rahul Sheth

ISE 515 - Engineering Project Management
Dr. Yalda Khashe
7/16/2024

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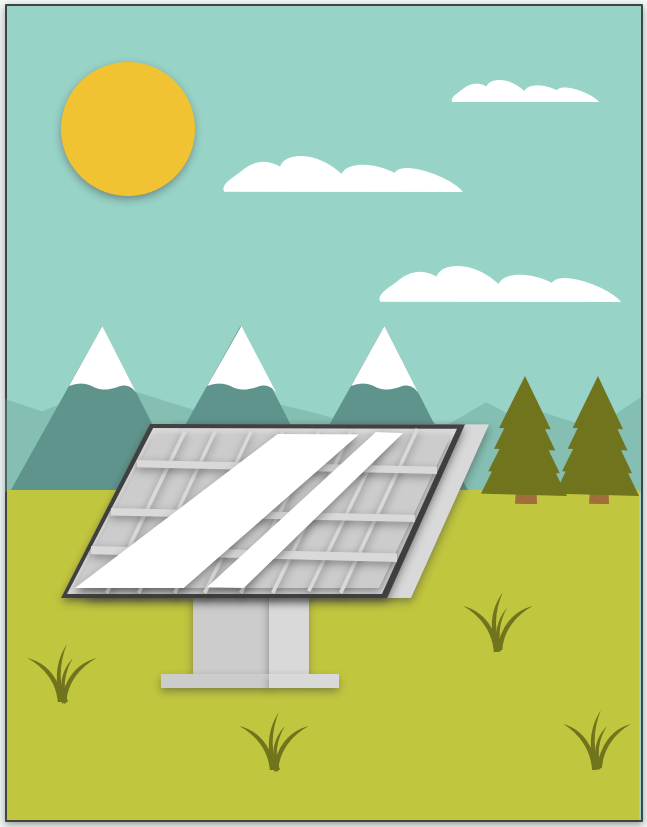


01

Project Scope

Overview of project goals, requirements, and objectives

Problem Introduction

Stakeholders

Presidential Working Group (PWG) at USC

State of California

Los Angeles Department of Water and Power

Strategic Initiatives

Assignment Earth:

Net Campus Carbon Neutrality by 2025

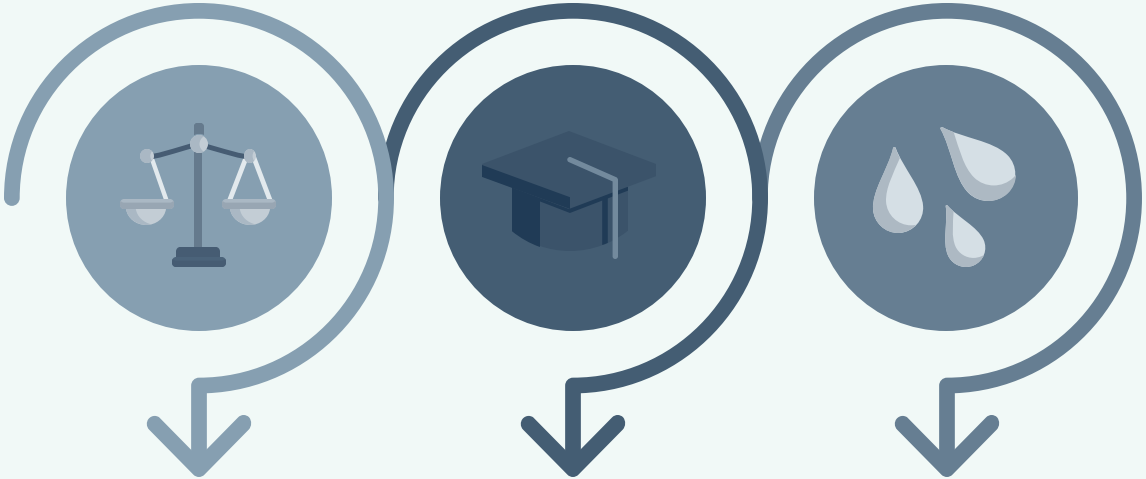
Executive Order B-55-18:

Net Campus Carbon Neutrality by 2045

EEEB + Smarter Grid

Energy Rebates and improved Grid utility efficiency

Market & Business Case



Executive Order B-55-18:

Save California $200 Billion in health care costs by 2045

Assignment Earth

Carbon offset purchasing expected to increase 6x by 2035

Smart Grid Program

USC purchases 30% of LADWP Springbok 3 Solar Farm Capacity

Market & Business Case

Executive Order B-55-18:

Save California $200 Billion in health care costs by 2045

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Carbon offset purchasing expected to increase 6x by 2035

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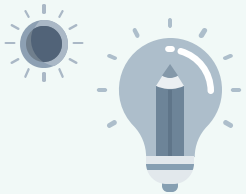
Solar Roof Project



Cost Saving on-campus project with higher ROI

Scope Definition

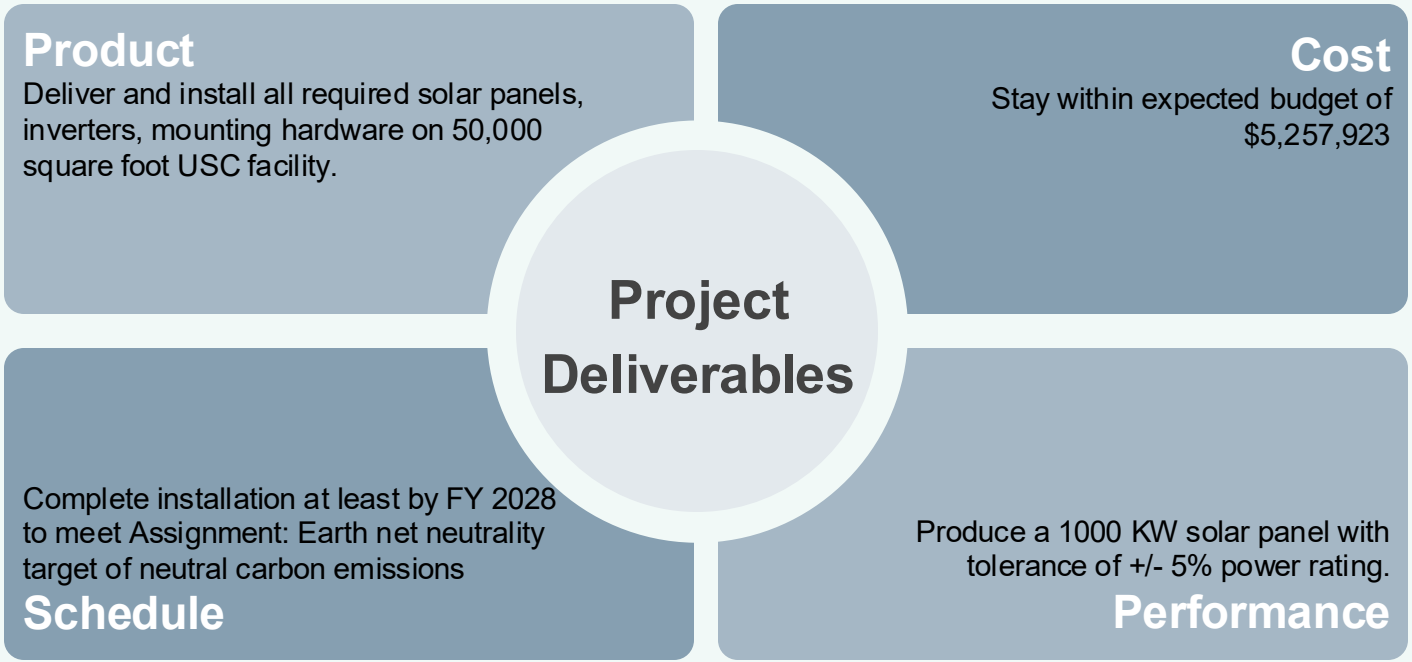
USC Solar Roof Installation

Building capacity of 50,000 square feet and an energy capacity of 1000

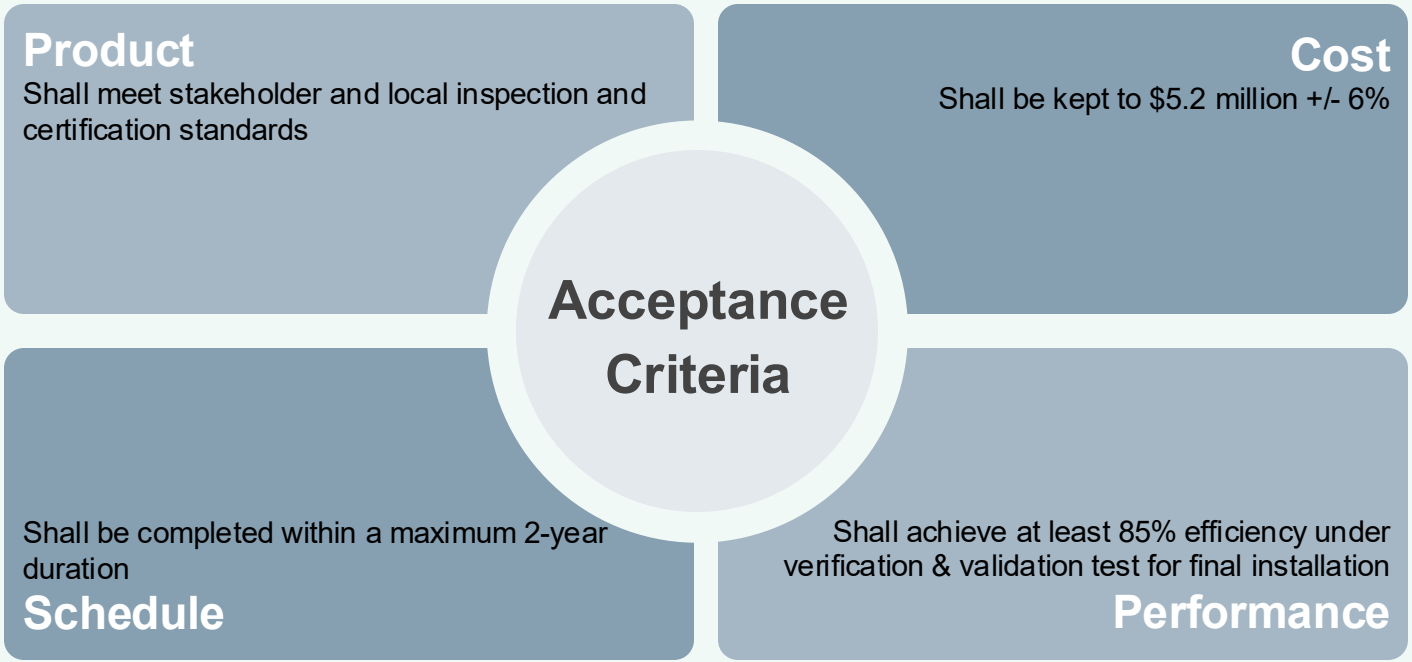
USC Fiscal Year 2028

Achieve a platinum rating for the Sustainability Tracking, Assessment & Rating System (STARS) report.

Scope Management



Scope Management



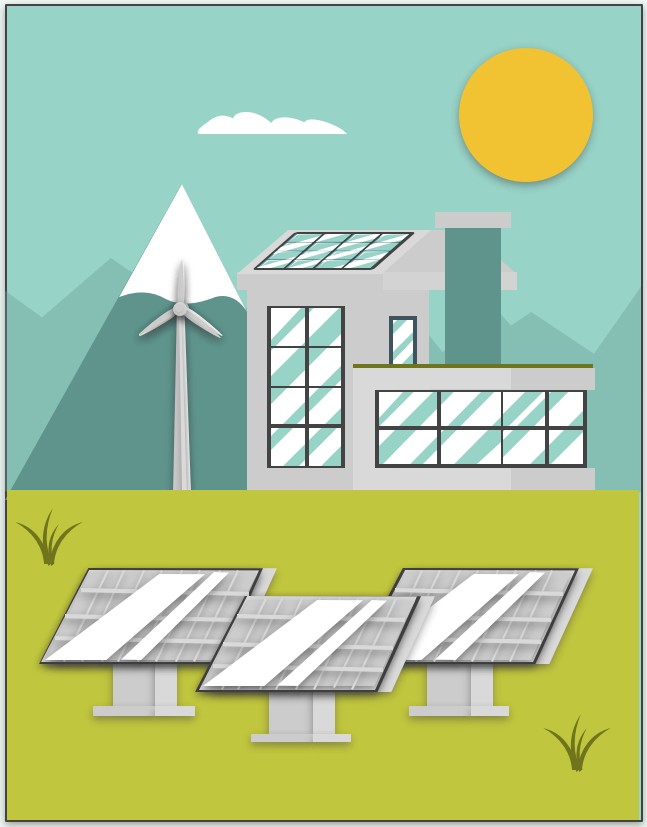
Date Submitted:	01/01/2025
Project Name:	USC Solar Roof System
Description of Scope	
Summary:	Install a 1,000 KW solar panel system on a 50,000 square foot roof at USC.
Major Deliverables:	1. Solar Roof System with 1,000 kW generation capability 2. Documentation to City of Los Angeles and USC a. Requirements verification & validation documentation
Not covered in Scope:	1. Ongoing maintenance activities post- training and handover 2. Installation on other USC buildings
Milestones	
	Baselining Cost, Schedule, and Configuration Management
	Site Surveying and Analyses
	Design Requirement Definition
	Design Selection
	Engineering Development Testing
	System Assembly, Integration, and Installation
	Verification and Validation
	Training and Project Closeout
Resource Requirements	
	Labor (PM, Engineering, Legal, Technicians, Ops, Supply Chain, Quality, Safety, Subcontractors/Suppliers)
	Materials (Solar Panels, Steel, Electrical & Mechanical System components)
	Facilities (Lab, Office Space)
	Equipment (Construction, Transportation, PPE, Engineering Lab Equipment)
	Software (ArcGIS, AutoCAD, PLM Software)

Statement of Work (SOW)

Risk and Concerns	
	Environmental (weather, natural disasters, etc.)
	Scope Creep
	Cost and Schedule Overrun
	Procurement (Long Lead Items)
	Inadequate Requirements Definition
Acceptance Criteria	
Testing/Qualification Approach	Design Review with City of Los Angeles and USC, First Article Inspection for materials, System Modeling and Engineering Development Tests, Final System Verification Test, Safety Test, Final City Inspection of built system, Customer Approval
Termination of Project	Successful development and installation of all solar panels within 1 year and within budget
Estimated Time and Costs	
Estimated Time to Complete Project Work:	1 Year
Estimated Costs to Complete Project Work:	$5.2 Million

SOW

continued



02

Work Breakdown Structure

Decomposition of scope to meet project objectives and establish deliverables

Deliverables

1. Project Planning

1.1 Project Management
1.2 Resource Management
1.3 Configuration Management

2. Site Assessment & Preparation

2.1 Site Surveying
2.2 Site Readiness
2.3 Design Requirements Definition

3. Design & Engineering

3.1 Computer-aided System Modeling
3.2 Design Selection

4. Procurement & Installation

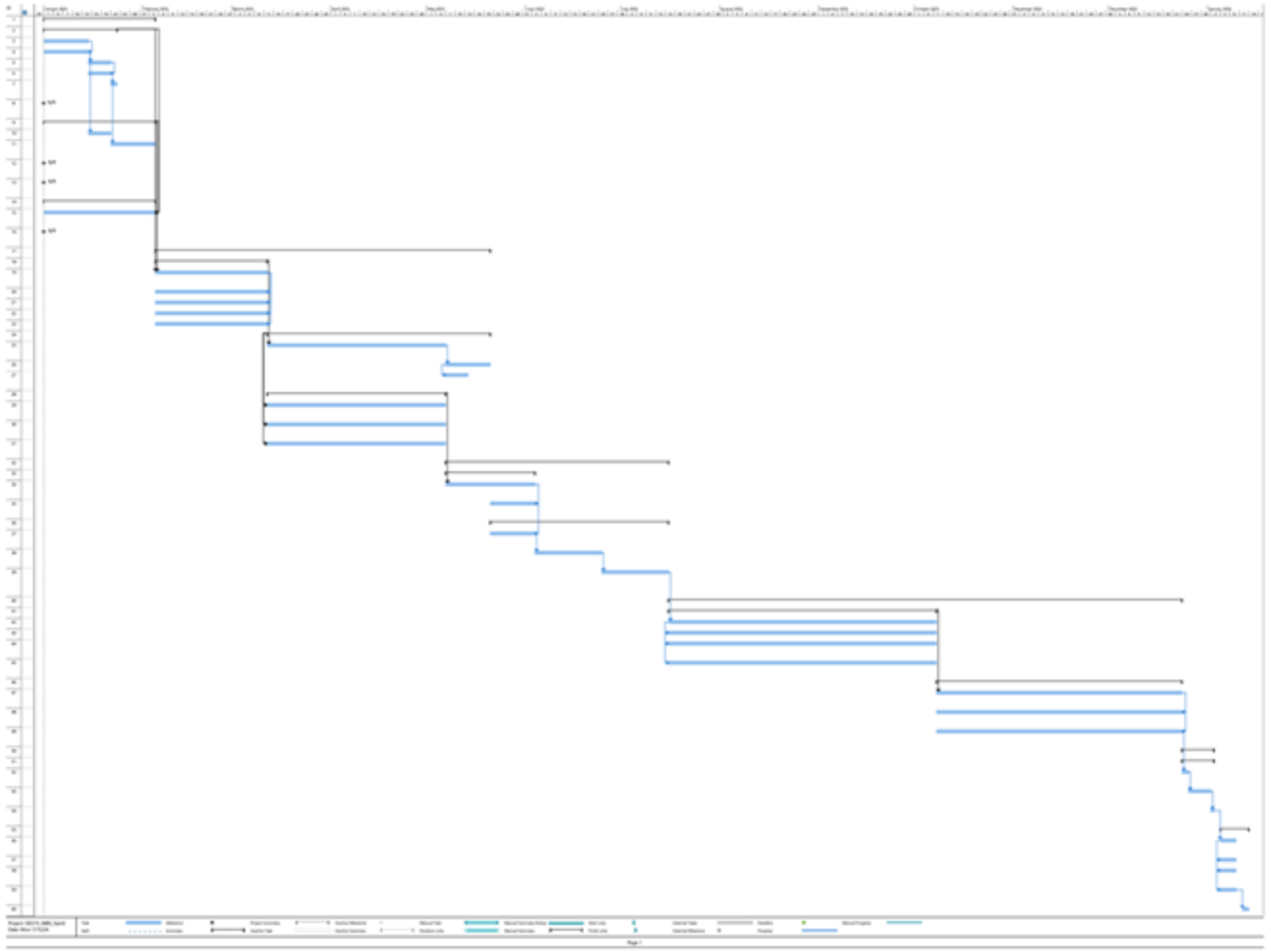
4.1 Components Receipt & Inspection
4.2 System Integration & Installation

5. Verification & Validation

5.1 Commissioning & Testing

6. Training & Project Closeout

6.1 - 6.4 Training Activities
6.5 Final Programmatic Review

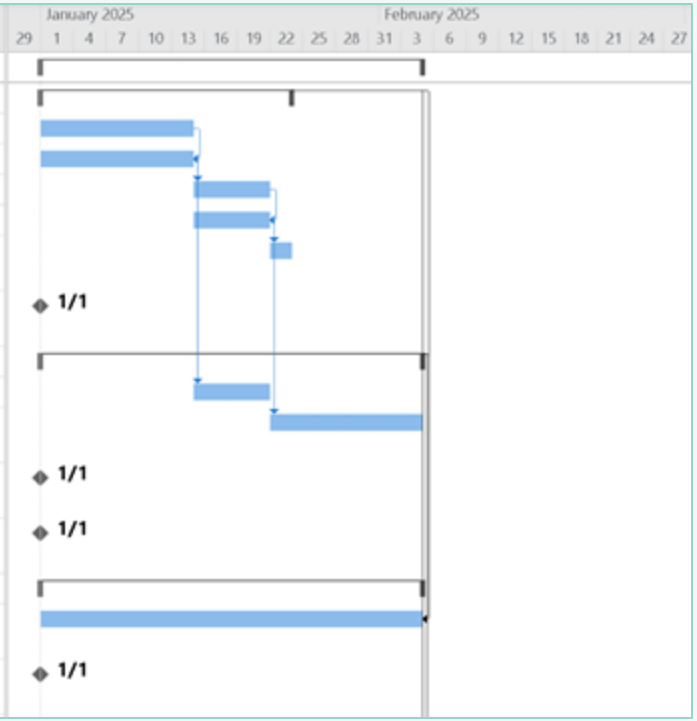


Solar Roof Project Gantt Chart

1/1/25 - 1/13/26

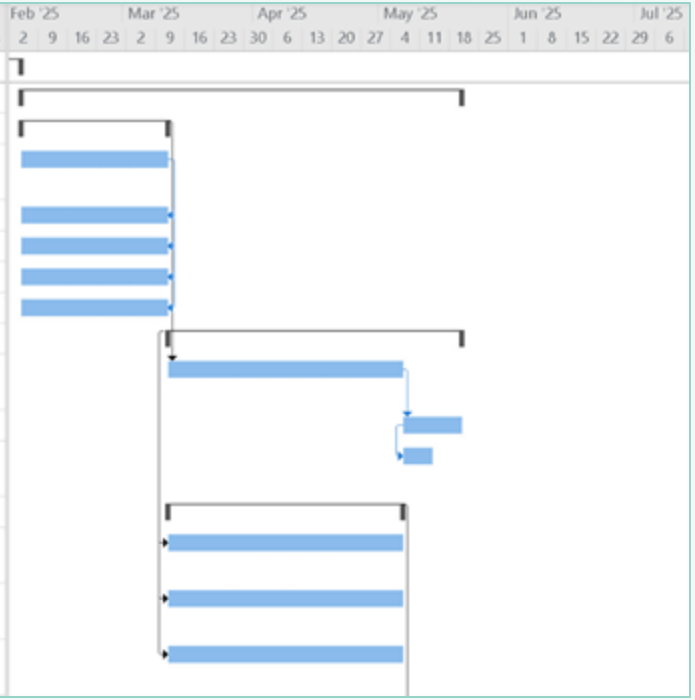
1. Project Planning

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
1.1	**Project Management**	**17 days**	**Wed 1/1/25**	**Thu 1/23/25**	
1.1.1	Baseline Schedule	10 days	Wed 1/1/25	Tue 1/14/25	
1.1.2	Baseline Cost	10 days	Wed 1/1/25	Tue 1/14/25	3FF
1.1.3	Define KPIs & OKRs	5 days	Wed 1/15/25	Tue 1/21/25	4
1.1.4	Manage stakeholder(s) need(s)	5 days	Wed 1/15/25	Tue 1/21/25	5FF
1.1.5	Manage programmatic risk & assess feasability	2 days	Wed 1/22/25	Thu 1/23/25	6
1.1.6	Support throughout project lifecycle	0 days	Wed 1/1/25	Wed 1/1/25	
1.2	**Resource Management**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
1.2.1	Define staffing requirements	5 days	Wed 1/15/25	Tue 1/21/25	4
1.2.2	Identify & manage supplier/subcontractor need(s)	10 days	Wed 1/22/25	Tue 2/4/25	6
1.2.3	Interface w/Ops, QA, Safety, SMEs, etc.	0 days	Wed 1/1/25	Wed 1/1/25	
1.2.4	Support throughout project lifecycle	0 days	Wed 1/1/25	Wed 1/1/25	
1.3	**Configuration Management**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
1.3.1	Baseline documentation & reporting	25 days	Wed 1/1/25	Tue 2/4/25	2FF,9FF
1.3.2	Support throughout project lifecycle	0 days	Wed 1/1/25	Wed 1/1/25	



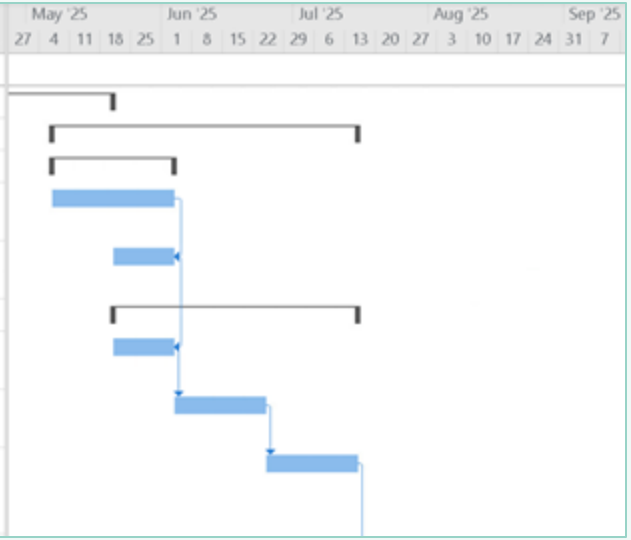
2. Site Assessment & Preparation

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
2	**Site Assessment & Preparation**	**75 days**	**Wed 2/5/25**	**Tue 5/20/25**	
2.1	**Site Surveying**	**25 days**	**Wed 2/5/25**	**Tue 3/11/25**	
2.1.1	Define location of panel installation	25 days	Wed 2/5/25	Tue 3/11/25	2,9
2.1.2	Conduct shading analysis	25 days	Wed 2/5/25	Tue 3/11/25	19FF
2.1.3	Conduct structural analysis	25 days	Wed 2/5/25	Tue 3/11/25	19FF
2.1.4	Conduct electrical analysis	25 days	Wed 2/5/25	Tue 3/11/25	19FF
2.1.5	Conduct technical risk analysis	25 days	Wed 2/5/25	Tue 3/11/25	19FF
2.2	**Site Readiness**	**50 days**	**Wed 3/12/25**	**Tue 5/20/25**	
2.2.1	Obtain necessary permits & approvals	40 days	Wed 3/12/25	Tue 5/6/25	18
2.2.2	Clear & prepare site	10 days	Wed 5/7/25	Tue 5/20/25	25
2.2.3	Establish site safety parameters	5 days	Wed 5/7/25	Tue 5/13/25	26SS
2.3	**Design Requirements Definition**	**40 days**	**Wed 3/12/25**	**Tue 5/6/25**	
2.3.1	Baseline product specifications from customer need(s)	40 days	Wed 3/12/25	Tue 5/6/25	24SS
2.3.2	Develop product specifications from site surveying analyses	40 days	Wed 3/12/25	Tue 5/6/25	24SS
2.3.3	Define installation approach & Design requirements	40 days	Wed 3/12/25	Tue 5/6/25	24SS



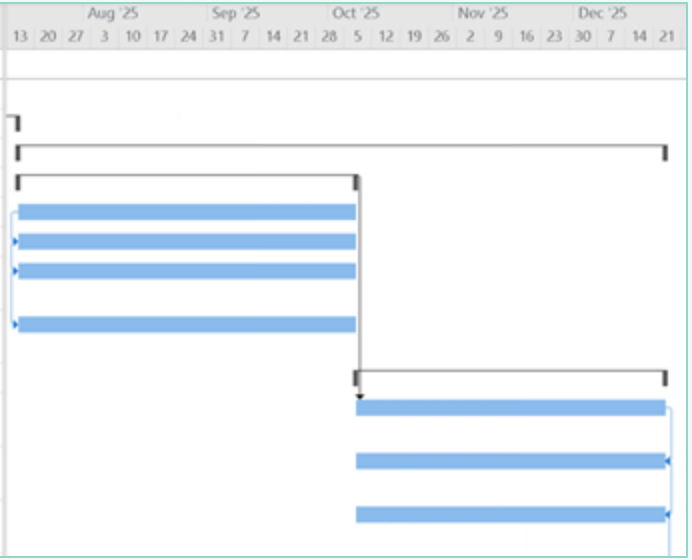
3. Design & Engineering

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
2	**Site Assessment & Preparation**	**75 days**	**Wed 2/5/25**	**Tue 5/20/25**	
3	**Design & Engineering**	**50 days**	**Wed 5/7/25**	**Tue 7/15/25**	
3.1	**Computer-aided System Modeling**	**20 days**	**Wed 5/7/25**	**Tue 6/3/25**	
3.1.1	Brainstorm system design options	20 days	Wed 5/7/25	Tue 6/3/25	28
3.1.2	Render preliminary system models & blueprints	10 days	Wed 5/21/25	Tue 6/3/25	34FF
3.2	**Design Selection**	**40 days**	**Wed 5/21/25**	**Tue 7/15/25**	
3.2.1	Conduct tradeoff analysis to determine final system design	10 days	Wed 5/21/25	Tue 6/3/25	35FF
3.2.2	Prototype Structural & Electrical sub-systems	15 days	Wed 6/4/25	Tue 6/24/25	37
3.2.3	Perform Engineering Development Tests to ensure product meets requirements	15 days	Wed 6/25/25	Tue 7/15/25	38



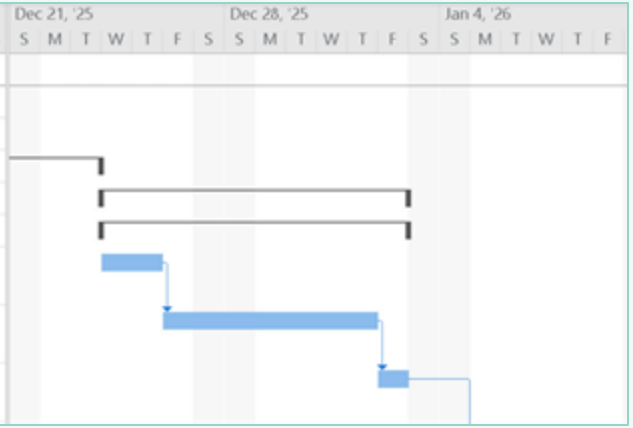
4. Procurement & Installation

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
2	**Site Assessment & Preparation**	**75 days**	**Wed 2/5/25**	**Tue 5/20/25**	
3	**Design & Engineering**	**50 days**	**Wed 5/7/25**	**Tue 7/15/25**	
4	**Procurement & Installation**	**115 days**	**Wed 7/16/25**	**Tue 12/23/25**	
4.1	**Component(s) Receipt & Inspection**	**60 days**	**Wed 7/16/25**	**Tue 10/7/25**	
4.1.1	Test & inspect solar panels	60 days	Wed 7/16/25	Tue 10/7/25	39
4.1.2	Test & inspect inverters	60 days	Wed 7/16/25	Tue 10/7/25	42SS
4.1.3	Test & inspect mounting components	60 days	Wed 7/16/25	Tue 10/7/25	43SS
4.1.4	Test & inspect electrical components	60 days	Wed 7/16/25	Tue 10/7/25	44SS
4.2	**System Integration & Installation**	**55 days**	**Wed 10/8/25**	**Tue 12/23/25**	
4.2.1	Assemble Mechanical & Electrical sub-systems	55 days	Wed 10/8/25	Tue 12/23/25	41
4.2.2	Test subsystem assembly to Acceptance requirements	55 days	Wed 10/8/25	Tue 12/23/25	47FF
4.2.3	Install solar panels & energy system	55 days	Wed 10/8/25	Tue 12/23/25	48FF



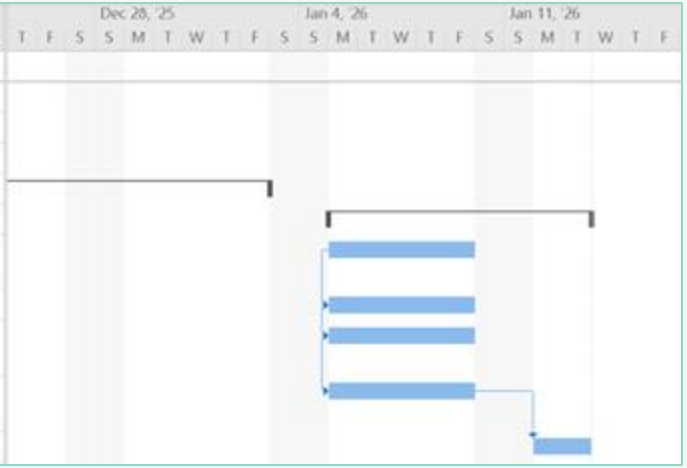
5. Verification & Validation

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
2	**Site Assessment & Preparation**	**75 days**	**Wed 2/5/25**	**Tue 5/20/25**	
3	**Design & Engineering**	**50 days**	**Wed 5/7/25**	**Tue 7/15/25**	
4	**Procurement & Installation**	**115 days**	**Wed 7/16/25**	**Tue 12/23/25**	
5	**Verification & Validation**	**8 days**	**Wed 12/24/25**	**Fri 1/2/26**	
5.1	**Commissioning & Testing**	**8 days**	**Wed 12/24/25**	**Fri 1/2/26**	
5.1.1	Pass initial installation & safety inspection	2 days	Wed 12/24/25	Thu 12/25/25	49
5.1.2	Test system start-up performance to requirements	5 days	Fri 12/26/25	Thu 1/1/26	52
5.1.3	Complete final certification & operations approval	1 day	Fri 1/2/26	Fri 1/2/26	53



6. Training & Project Closeout

WBS	Task Name	Duration	Start	Finish	Predecessors
1	**Project Planning**	**25 days**	**Wed 1/1/25**	**Tue 2/4/25**	
2	**Site Assessment & Preparation**	**75 days**	**Wed 2/5/25**	**Tue 5/20/25**	
3	**Design & Engineering**	**50 days**	**Wed 5/7/25**	**Tue 7/15/25**	
4	**Procurement & Installation**	**115 days**	**Wed 7/16/25**	**Tue 12/23/25**	
5	**Verification & Validation**	**8 days**	**Wed 12/24/25**	**Fri 1/2/26**	
6	**Training & Project Closeout**	**7 days**	**Mon 1/5/26**	**Tue 1/13/26**	
6.1	Train preventative maintenance activities	5 days	Mon 1/5/26	Fri 1/9/26	54
6.2	Train routine inspection activities	5 days	Mon 1/5/26	Fri 1/9/26	56SS
6.3	Train emergency maintenance activities	5 days	Mon 1/5/26	Fri 1/9/26	57SS
6.4	Train system disassembly at End of Life	5 days	Mon 1/5/26	Fri 1/9/26	58SS
6.5	Conduct final programmatic review	2 days	Mon 1/12/26	Tue 1/13/26	59

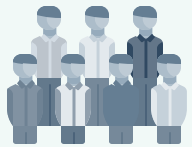


Departments	1. Project Planning			2. Site Assessment & Preparation			3. Design & Engineering		4. Procurement & Installation		5. Verification & Validation	6. Training & Project Closeout	
	1.1 Project Management	1.2 Resource Management	1.3 Configuration Management	2.1 Site Surveying	2.2 Site Readiness	2.3 Design Requirements Definition	3.1 Computer-aided System Modeling	3.2 Design Selection	4.1 Component(s) Receipt & Inspection	4.2 System Integration & Installation	5.1 Commissioning & Testing	6.1-6.4 Training Activities	6.5 Conduct Final Programmatic Review
Project Management Team	x	x				x							x
Engineering Team (Design & Test)		x	x	x		x	x	x	x	x	x	x	x
Mechanical Engineering Team				x		x	x	x	x	x	x	x	
Electrical Engineering Team				x		x	x	x	x	x	x	x	
Business Analytics Team	x		x										x
Site Management Team				x	x	x				x	x	x	
Legal Team		x	x		x						x		x
x = Cost Account Indicator													

Organizational Breakdown Structure

RAM

			Lead Project Personnel												
Deliverables	Output	Task and Code	Business Manager	Construction Team	Design Engineers	Electrical Engineering Manager	Engineering Manager	Technicians	Legal Team	Mechanical Engineering Manager	Planner	Production Engineers	Project Manager	Safety Officer	Supply Chain Manager
1. Project Planning	1.1 Project Management	1.1.1 Baseline Schedule		S	S	N	S	N		N	R	S	A	N	N
		1.1.2 Baseline Cost	S										N		R
		1.1.3 Define key performance Indicators (KPIs) and Objectives and Key Results (OKRs)	R				S						S		S
		1.1.4 Manage stakeholder(s) need(s)	R				S						S		
		1.1.5 Manage programmatic risk and assess feasibility	S				S						R	S	S
		1.1.6 Support throughout project lifecycle	S				S				N		R		S
	1.2 Resource Management	1.2.1 Define staffing requirements	N	S			S				N		R		S
		1.2.2 Indentify and manage supplier/ subcontractor need (s)	S				N				N		R		S
		1.2.3 Interface with Operations, Quality Assurance (QA), Safety, Subject Matter Experts (SMEs), and other functional support groups			S	S	R			S		S	N	S	s
		1.2.4 Support throughout project lifecycle	S				S					N	R		S
	1.3 Configuration Management	1.3.1 Baseline documentation and reporting	S				S		R			N			N
		1.3.2 Support throughout project lifecycle	S				S		R		S				
2. Site Assessment and Preparation	2.1 Site Surveying	2.1.1 Define location of panel installation		S	S	S	S			R			N	N	
		2.1.2 Conduct shading analysis			S	S	S			R				N	
		2.1.3 Conduct structural analysis			S		S			R				N	
		2.1.4 Conduct electrical analysis			S	R	S							N	
		2.1.5 Conduct technical risk analysis			S	S	R			S				S	
	2.2 Site Readiness	2.2.1 Obtain necessary permits and approvals							R				N		
		2.2.2 Clear and prepare site		R			N				N				
		2.2.3 Establish site safety parameters		N									N	R	
	2.3 Design Requirements Definition	2.3.1 Baseline product specifications from customer need(s)	S		S	S	S			S		S	R		
		2.3.2 Develop product specifiactions from site surveying analyses			S	S	R			S		S			
		2.3.3 Define installation approach and Design requirements		N	S	S	S			S		R		S	
3. Design and Engineering	3.1 Computer-aided System Modeling	3.1.1 Brainstorm system design options			R	S	S			S					
		3.1.2 Render preliminary system models and blueprints			R	N	N			N		N			
	3.2 Design Selection	3.2.1 Conduct tradeoff analysis to determine final system design	S		S	S	R			S			A		
		3.2.2 Prototype structural and electrical sub-systems				S	N	S		S		R			
		3.2.3 Perform engineering development tests to ensure product meets requirements			S	R	N			S		S			
	4.1 Component(s) Receipt and Inspection	4.1.1 Test and inspect solar panels				S		R		S		N			
		4.1.2 Test and inspect inverters				S		R				N			
		4.1.3 Test and inspect mounting componenets						R		S		N			

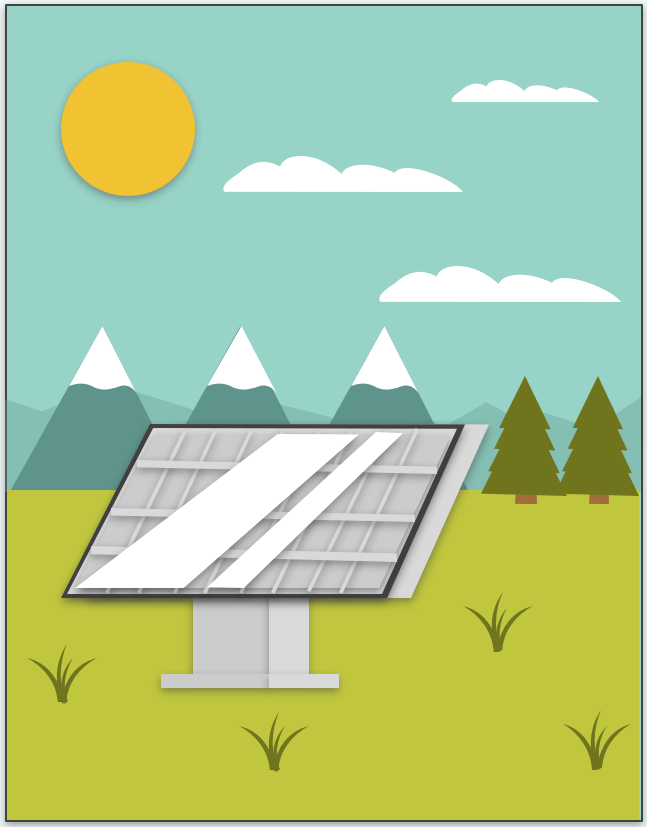


			Lead Project Personnel												
Deliverables	Output	Task and Code	Business Manager	Construction Team	Design Engineers	Electrical Engineering Manager	Engineering Manager	Technicians	Legal Team	Mechanical Engineering Manager	Planner	Production Engineers	Project Manager	Safety Officer	Supply Chain Manager
4. Procurement and Installation		4.1.4 Test and inspect electrical components				S		R				N			
	4.2 System Integration and Installation	4.2.1 Assemble Mechanical and Electrical sub-systems		S			N	R				S	N		
		4.2.2 Test subsytem assembly to Acceptance requirements				S		R		S		S			
		4.2.3 Install solar panels and energy system per section 2.3.3		R		S	N	S		S		S	N		
5. Verification and Validation	5.1 Commissioning and Testing	5.1.1 Pass initial installation and safety inspection				A	A	R		A		A		A	
		5.1.2 Test system start-up performance to requirements				S	N	R					N		
		5.1.3 Complete final certification and operations approval				A	R			A		A	N	A	
6. Training and Project Close Out	6.1 Train preventive maintenance activities					R				R		S			
	6.2 Train routine inspection activities					R				R		S			
	6.3 Train emergency maintenance activities					R				R		S			
	6.4 Train system disassembly at End of Life					R				R		S			
	6.5 Conduct final programmatic review												R		

R=Responsible	S=Support
N=Notification	A=Approval

RAM

continued



03 Risk Assessment

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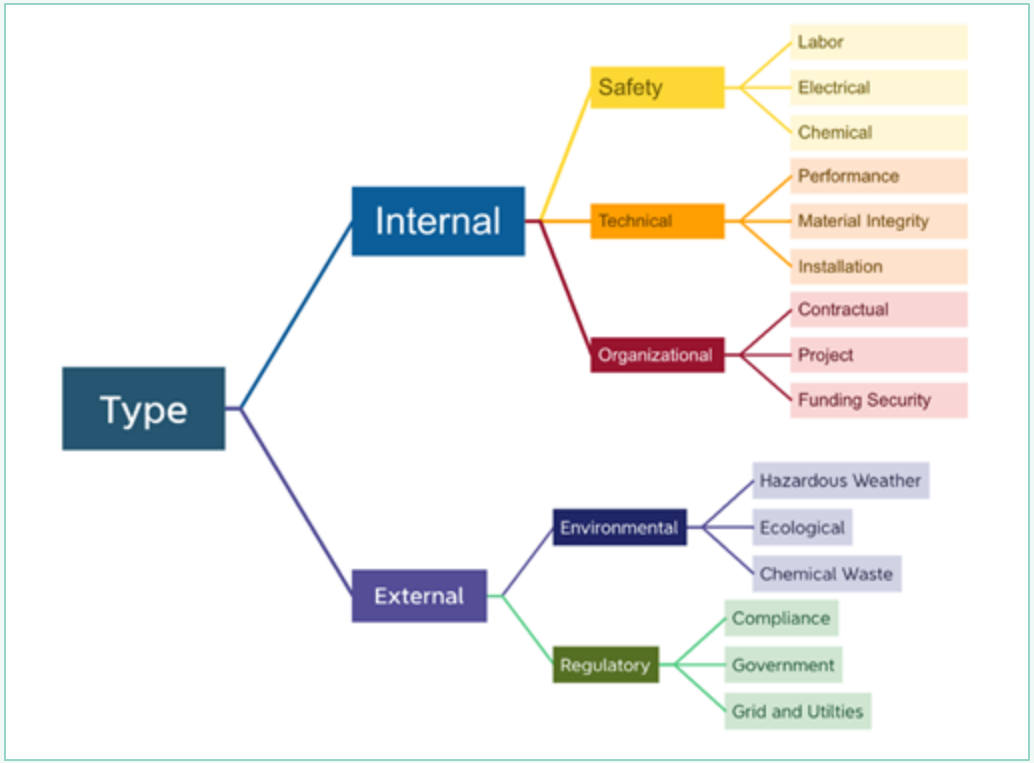
Resource Breakdown Structure (RBS)



Risk Identifications

The project management team were able to identify five risk groups that can potentially affect the project.

- **Environmental Risk:** potential hazardous risks and dangers to the environment
- **Organizational Risk:** risk that can be produced by human error in the organization that would affect operations
- **Regulatory Risk:** government/stakeholder regulations that can affect the project
- **Safety Risk:** workplace hazards that can potentially be disruptive to the project
- **Technical Risk:** performance failures that can negatively impact the project

Risk Analysis Definitions

❖ **Likelihood Scale:**

- **Rare:** Most certainly will never occur at all under baseline project conditions
- **Unlikely:** Typically won't occur under baseline project conditions
- **Probable:** May occur at least once under normal project conditions
- **Likely:** Expected to occur a few times under normal project baseline conditions
- **Most Certain:** Frequent occurrence under normal project baseline conditions

❖ **Consequence Scale:**

- **Inconsequential:** The risk has a negligible effect on moving between project gates, schedule reliability and performance
- **Minimal:** The risk has minimal effect on moving between project gates, schedule, reliability, and performance processes
- **Moderate:**The risk creates moderate setbacks on moving between project gates, schedule, reliability, or performance processes
- **Significant:**The risk creates significant barriers to moving between project gates, schedule, reliability, or performance processes
- **Severe:** The risk has major ramifications on halting project gates, schedule, reliability, or performance processes

Qualitative Risk Impact Matrix

		Consequence				
		Inconsequential	**Minimal**	**Moderate**	**Significant**	**Severe**
Likelihood	**Rare**		E.E.4, E.E.5	E.E.3, E.HW.4, O.C.1, O.C.2	O.F.1, R.G.1	T.MI.1, T.I.1
	Unlikely	E.E.1	E.E.6	R.G.1,S.L.2, T.I.1	S.E.2, S.L.1	
	Probable		E.HW.5, T.I.3, E.HW.3	E.HW.1, E.HW.6, T.P.1,		
	Likely	E.HW.2,T.P.4	E.E.2, LR.GU.2, T.P.3	R.G.3, R.G.4, T.I.2, T.P.2	E.CW.1, R.G.4,	
	Most Certain					
Legend	Low Risk	Moderate Risk	High Risk	Very High Risk		

Qualitative Risk Impact Matrix

		Consequence				
		Inconsequential	**Minimal**	**Moderate**	**Significant**	**Severe**
Likelihood	**Rare**		E.E.4, E.E.5	E.E.3, E.HW.4, O.C.1, O.C.2	O.F.1, R.G.1	T.MI.1, T.I.1
	Unlikely	E.E.1	E.E.6	R.G.1,S.L.2, T.I.1	S.E.2, S.L.1	
	Probable		E.HW.5, T.I.3, E.HW.3	E.HW.1, E.HW.6, T.P.1,		
	Likely	E.HW.2,T.P.4	E.E.2, LR.GU.2, T.P.3	R.G.3, R.G.4, T.I.2, T.P.2	E.CW.1, R.G.4,	
	Most Certain					
Legend	Low Risk	Moderate Risk	High Risk	Very High Risk		

Project Phase Risk Load

Environmental Risks

Historical evidence about ecological impacts, generalize to urban areas

These risks will require *preliminary impact analysis and design considerations* at the least.

Technical Risks

Monitoring needed post-closeout of the installation project.

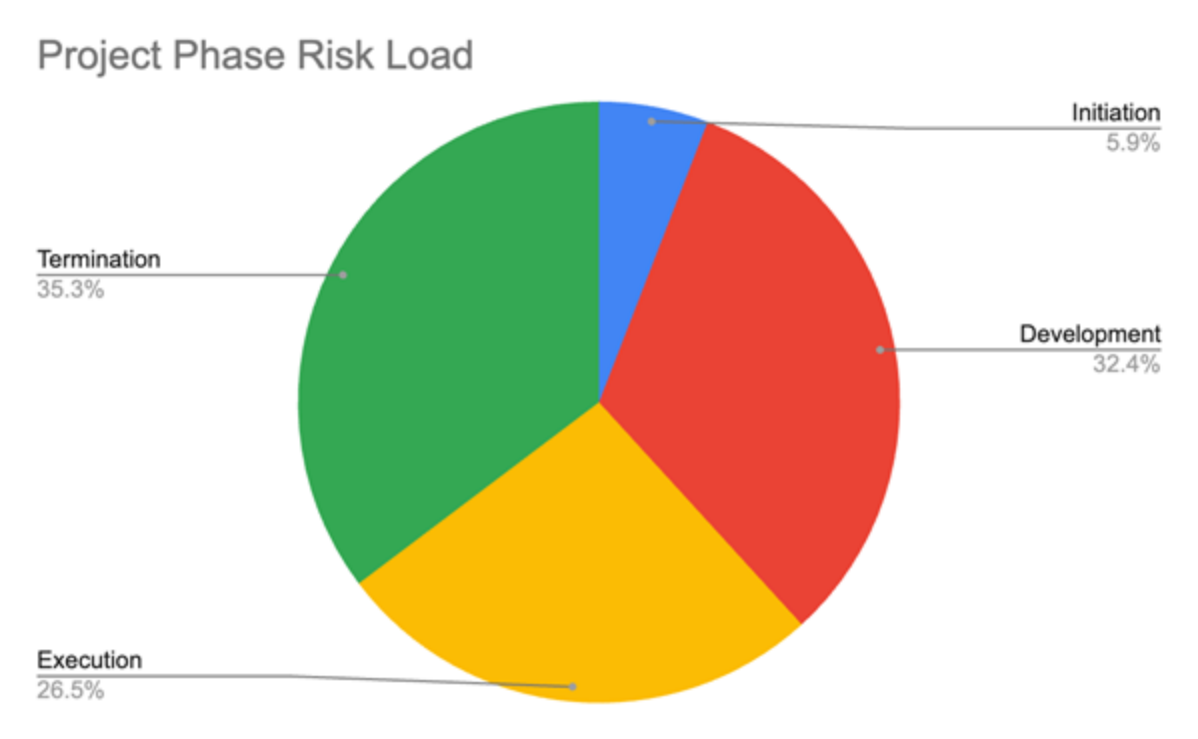
These risks will require *disclosure*, *monitoring and maintenance checks.*

Regulatory Risks

Governments and and federal agencies are highly irregular.

These risks require *transfer* or development with *disclosure and acknowledgment.*

Project Phase Risk Load



Risk Mitigation Strategies

To prioritize which risk factors to address first, the project management team would focus on the constructed qualitative risk matrix. This matrix helps identify the most severe to inconsequential risk in the USC Solar Roof System project. There are four risk categorization mitigation strategies that help label the risk such as acceptable, minimizing, shared, and transferable. By utilizing these methods, the risks can be processed to identify which risk to address first in the project.

- **Acceptable:** accepted the risk and responsible for the consequences
- **Minimizing:** reduce the impact of the risk on the project
- **Shared:** responsibility is shared with other organizations to minimize risky activities
- **Transferable:** risk reduction method that defers the risk to a third party such as insurance

Risk Mitigation Strategies

Risk	Likelihood	Consequences	Mitigation Approach	Mitigation Category
Lead and cadmium environmental leaching (Very High Risk)	Likely	Significant	Ensure the solar panel material and coating is water-tight for entire panel EOL or require ongoing leakage maintenance checks. Source lead-free solders for PV panels.	Minimize
Political Instability in regions where contractors operate cause sourcing delays (Very High Risk)	Likely	Significant	Establish contingency plans with multiple suppliers	Minimize
Incorrecting cable placement and panel angles (High Risk)	Unlikely	Moderate	Perform checks on cable placement and panel angels to ensure proper installation	Minimize
Live cable wiring increasing risk of electrical shock (High Risk)	Unlikely	Significant	Wearing correct PPE and using proper tools and equipment in handling the wire, as well as training	Minimize

Quantitative Risk Assessment

- Risk is made up of probability of the event occurring and the consequences of the event
- The probability of failure is made up of 3 sections: Maturity, Complexity, and Dependency
- consequences of failure are made up of 4 parts: Cost, Schedule, Reliability, and Performance

Probability of Failure (Pf)

Score	Maturity	Complexity	Dependency
Low (0.1)	Existing solar panel system ready to implement (COTS)	Simple design	No impact on the project. The project is not dependent on the solar panel implementation.
Minor (0.3)	Minor modifications to readily available solar panel system	A minor increase in the complexity of the design	Due to the maturity/ complexity of the project, there is a minor impact on the schedule, cost, or implementation of the solar panels
Moderate (0.5)	Major Modifications to readily available solar panel system	Moderate increase in complexity of design	Moderate project impact (schedule, cost, or implementation due to maturity/ complexity level)
Significant (0.7)	A significant change from readily available solar panels development of new subsystem required	Significant increase in complexity design	Significant impact on the project timeline, cost, or other factors due to the development of new subsystems
Major (0.9)	Ground-up/brand-new solar panel system	Extremely complex design	Major impact on project due to ground-up development of solar panel system

Consequence of Failure (Cf)

Score	Cost	Schedule	Reliability	Performance
Low (0.1)	Budget not exceeded	Less than 1-week delay in schedule	Minimal (non-noticeable) reliability impact	Performance requirements are met. Redesign in not required
Minor (0.3)	Budget exceeds target by 1-6%	2-3 weeks delay in schedule	A small decline in reliability impact	A small decline in performance. No redesign is required. All performance requirements are met
Moderate (0.5)	Budget exceeds target by 6-10%	4-5 weeks delay in schedule (critical path impacted	Some reduction is reliability (noticeable)	Degradation of performance occurs. Performance requirements are met but without proper margins
Significant (0.7)	Budget exceeds target by 10-15%	6-7 weeks delay in schedule (critical path must be delayed	Significant reliability decline	Significant decline in performance. Redesign is required and some performance requirements are not met
Major (0.9)	Budget exceeds target by more than 15%	More than 7 weeks delay in schedule (client is impacted by schedule delay	Solar panels do not meet reliability goals	No performance requirements are met. A complete redesign is required.

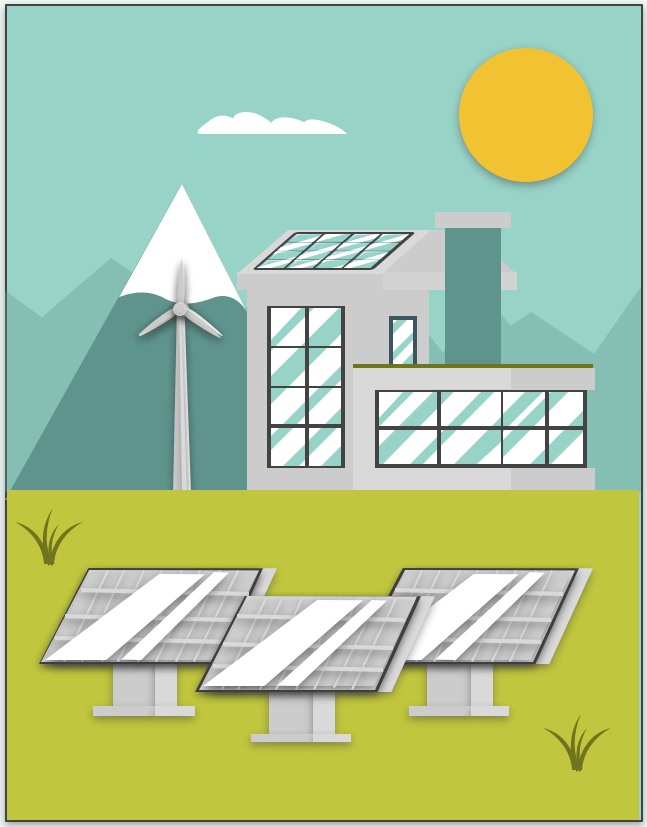
Calculation of risk factor

- the **calculated risk factor is 0.557**
- According to the rule of thumb for risk factors, this is considered a **medium risk** for the project, since the RF is between 0.3 and 0.7.

$$Pf = \frac{(Pm + Pc + Pd)}{3}$$

$$Cf = \frac{(Cc + Cs + Cr + Cp)}{4}$$

$$RF = Pf + Cf - (Pf \cdot Cf)$$



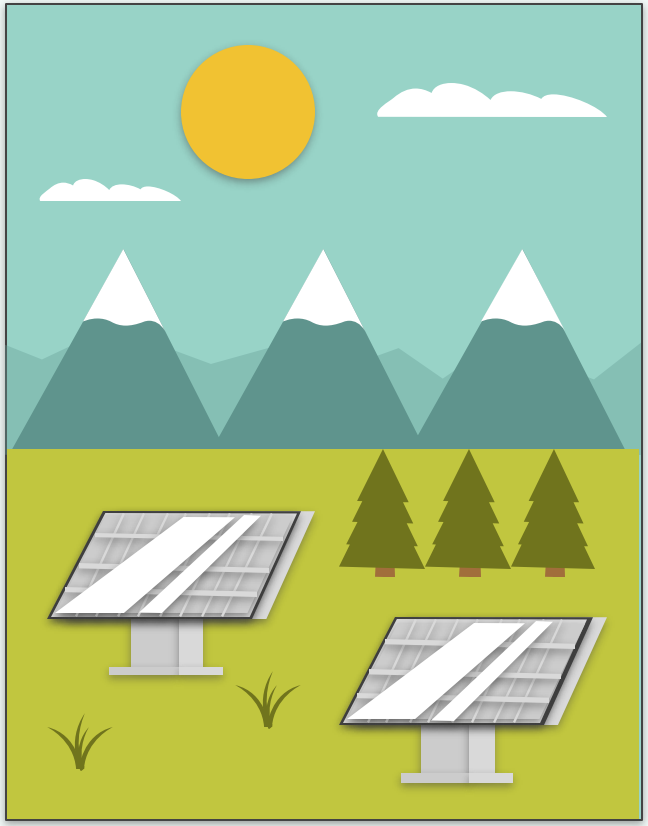
04

Cost Estimation and Budgeting

An estimate of key categories of the project: labor costs, materials costs, equipment and facilities cost

$4,572,107

Estimated Project Budget

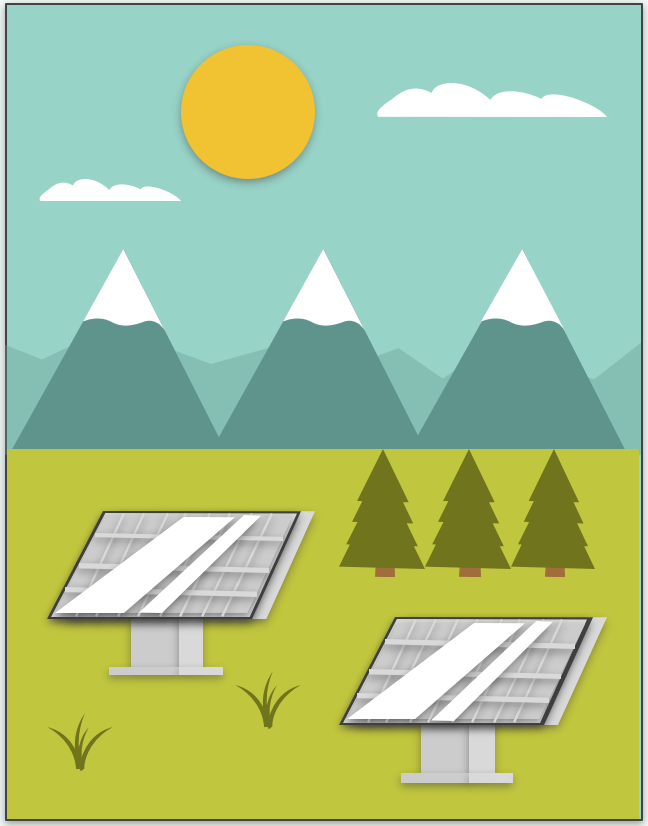


$5,257,923

Project Cost (15% Markup)

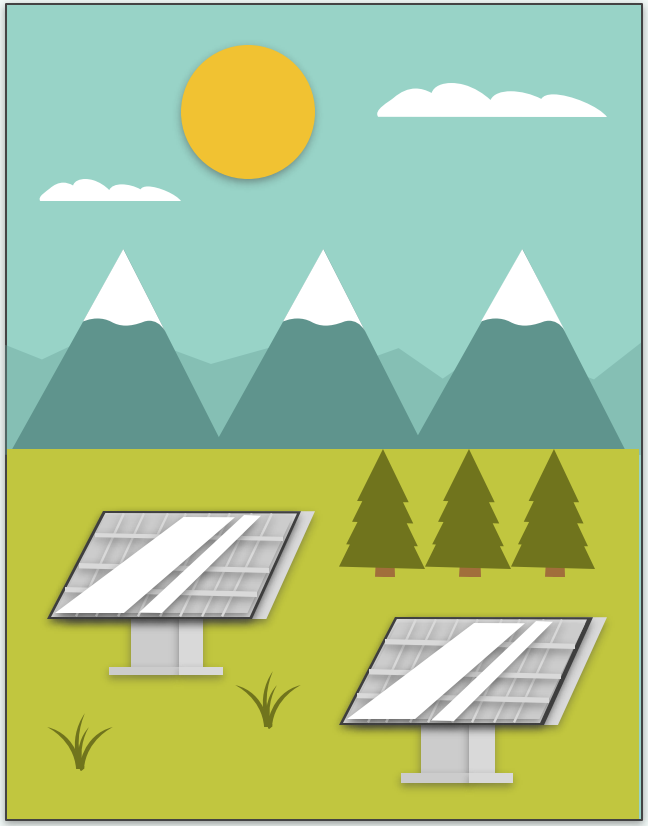
$685,816

Profit



$3,200,475

USC Project Cost **w/CA tax credit**



$748,248.70

Labor Worked w/ Additional Overhead (≈ $65000)

$523,858

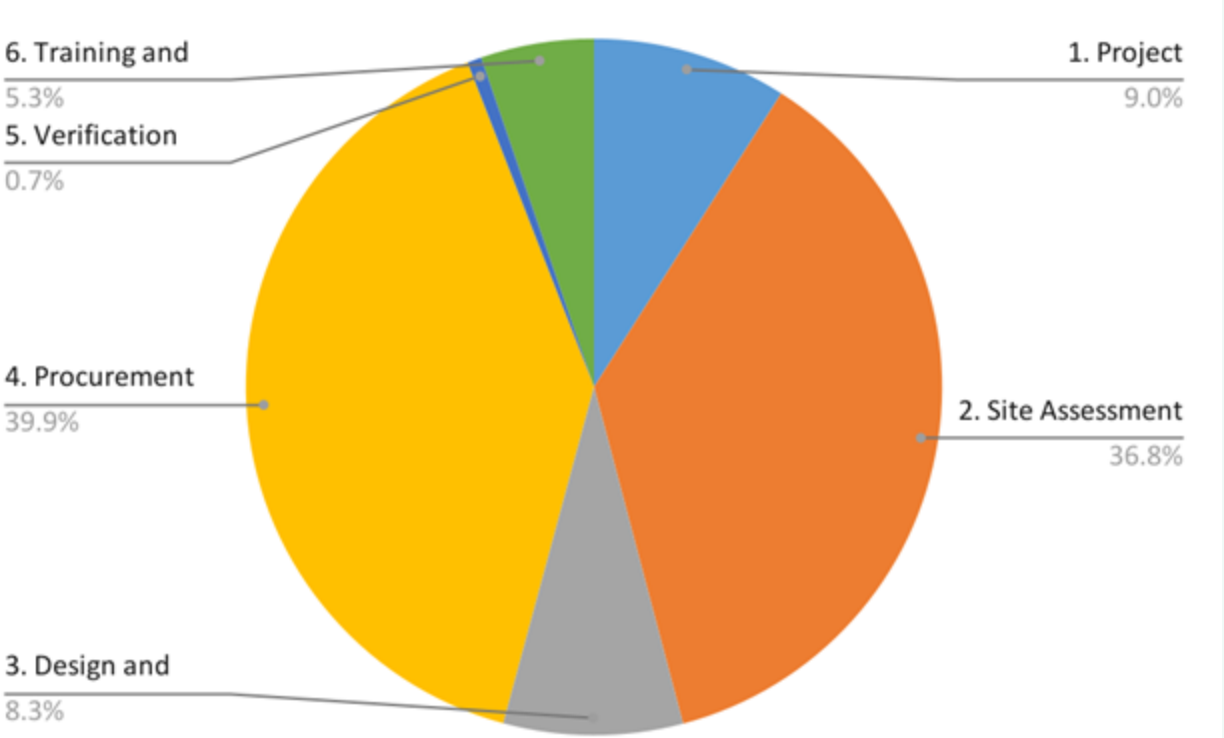
Materials, Equipment, & Permits

$40,000

Facilities (Lab)

$3,300,000

Solar Panels



Financial Model

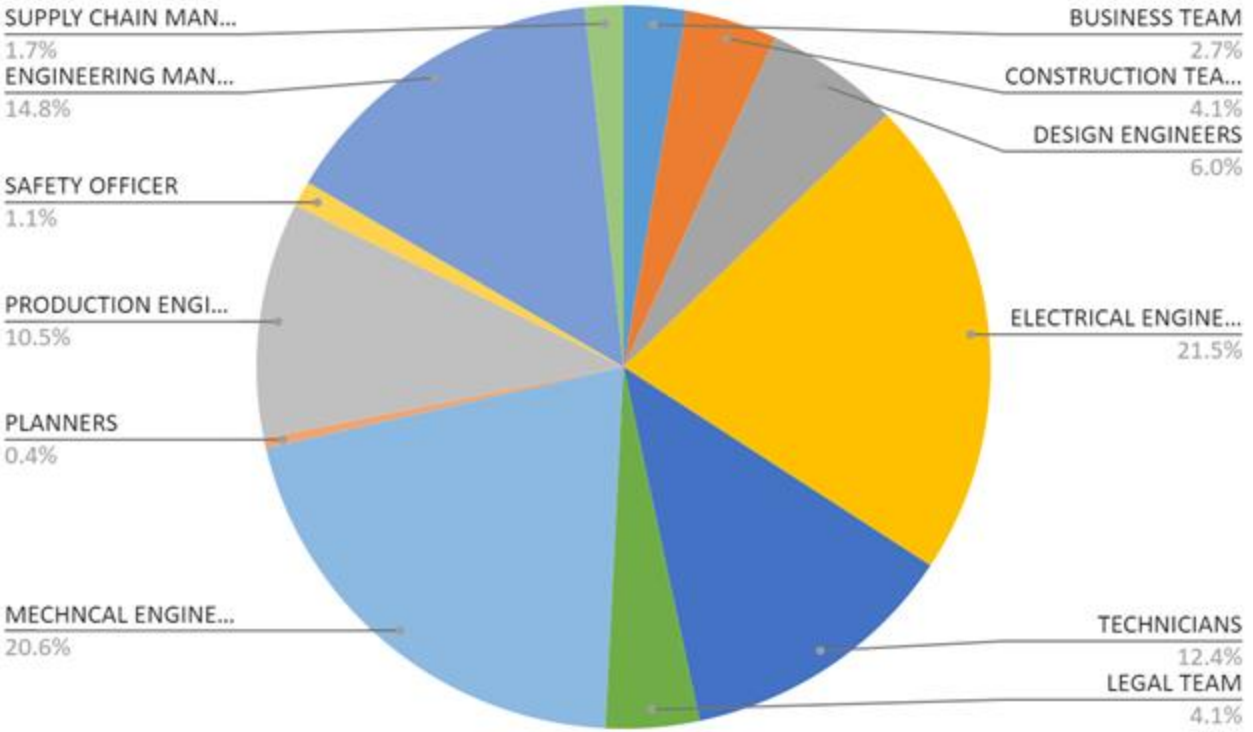
Deliverables

Labor Cost – Calculations

POSITION	# ON TEAM	MEDIAN SALARY	MEIDAN SALARY X TEAM MEMBERS	COMBINED SALARY	COMBINED AVG SALARY	COMBINED AVG HOURLY RATE
BUSINESS TEAM						
BUISNESS MANAGER	1	$158,094	$158,094	$425,559	$106,389.63	$51.15
FINANCIAL ANALYST	2	$74,226	$148,452			
BUS ANALYST	1	$119,012.50	$119,013			

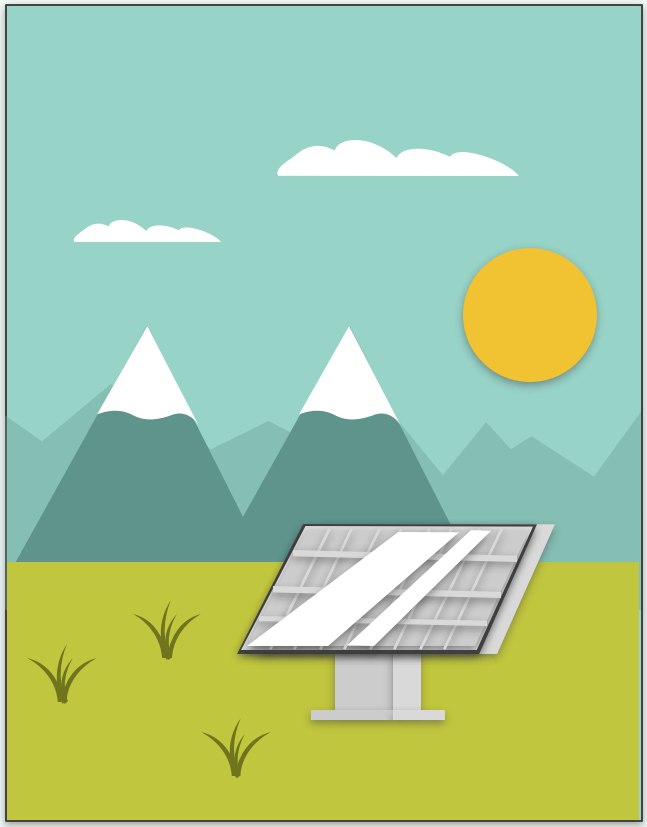
Deliverables	Output	Task and Code	Business Manager	Construction Team	Design Engineers	Electrical Engineering Manager	Engineering Manager	Technicians	Legal Team	Mechanical Engineering Manager	Planner	Production Engineer
1. Project Planning	1.1 Project Management	1.1.1 Baseline Schedule		2.5	2.5		2.5				10	2.5

ESTIMATED WORK HOURS	ADDITIONAL OVERHEAD HOURS	ESTIMATED COST
377.33	20	$20,323.15

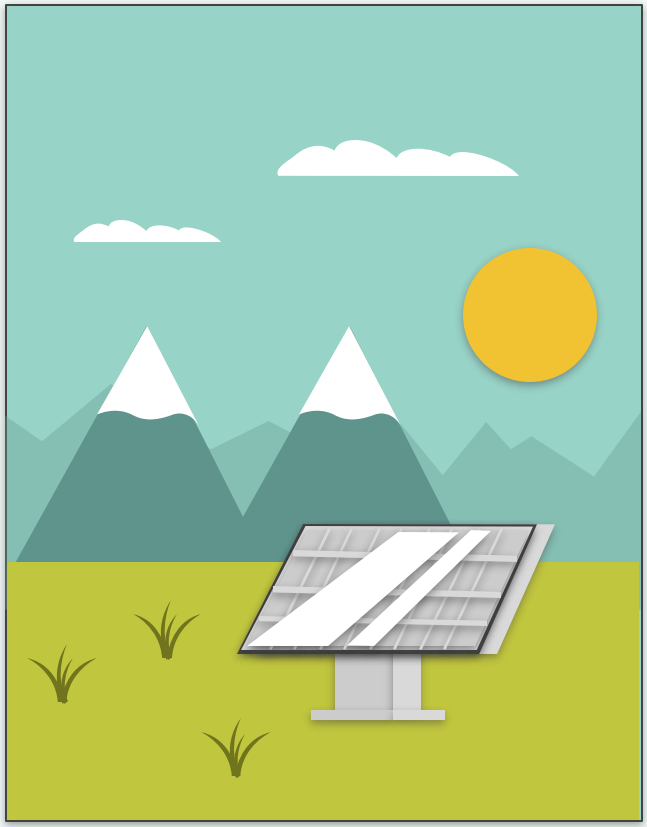


Financial Model

Labor Hours



Questions?



Thank You!

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