Business Case

Project Title: Kerang Solar Farm and Battery Storage System

Group members:

1. Rachael Lambden (30607221) (rlam0009@student.monash.edu)
2. Finn Gleeson (33090351) (fgle0002@student.monash.edu)
3. Rui Yi Yong (31580750) (ryon0008@student.monash.edu)
4. Oscar Smith (32542089) (osmi0005@student.monash.edu)
5. Kai Zhi Yeoh (32635427) (kyeo0017@student.monash.edu)
6. Kate Byrne (32483511) (kbyr0007@student.monash.edu)

Executive Summary

The Kerang Solar Farm and Battery Storage System is a renewable energy project led by Acciona, aimed at enhancing Victoria's energy stability and affordability. The project involves the construction of a 100 MW solar photovoltaic (PV) farm and a 50 MW battery energy storage system (BESS) on a 306-hectare site in Kerang. By harnessing local solar resources, this initiative will support over 37,000 homes with clean energy while also providing backup power for 16,000 homes through its battery system. This aligns with the federal and state targets of achieving 50% renewable energy by 2030, contributing to a reduction in greenhouse gas emissions and promoting energy sustainability.

Based on initial findings, the proposed project demonstrates feasibility with an estimated total project budget of AUD 100-127.5 million and a projected timeline of approximately 31.6 months. Effective risk management strategies have been implemented to address potential challenges such as environmental impacts, logistical issues, and market fluctuations.

Engagement with key stakeholders, including local councils, environmental groups, and regulatory bodies such as AEMO, remains critical to ensure compliance, secure funding, and maintain community support. Early engagement and thorough feasibility studies will help mitigate risks and drive the project towards success.

In addition to contributing to the state's renewable energy goals, the project is poised to create local job opportunities and stimulate economic growth in the Kerang area. With a projected cost recovery period of 5-10 years, the Kerang Solar Farm stands as a testament to Acciona's commitment to a sustainable future.

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1. Statement of Work

1.1 Project statement

This project aims to provide Victorians with a reliable, renewable, and affordable energy source by developing a 100 MW solar photovoltaic (PV) farm coupled with a 50 MW battery energy storage system (BESS) in Kerang under Acciona. Building on the success of Acciona's existing $55M Kerang Solar farm which generates 40 MW of clean electricity [1], this project will further enhance energy stability, reduce greenhouse gas emissions, and improve energy affordability. In the case of this project, the solar farm will be able to provide sufficient electricity to power over 37,000 homes [1], of which the battery will be able to store power for 16,000 homes [2] for an estimated construction cost of $100-127.5M AUD [3].

This initiative supports the federal government's goal of phasing out coal power stations and meeting its 50% renewable energy target by 2030 [3]. Sustainability considerations will be integrated into the project, including the use of eco-friendly and locally-sourced materials where available to minimise environmental impact [4]. In addition, solar power is up to 70% cheaper than fossil fuel alternatives, thereby contributing to a sustainable and cost-effective energy solution for the state [5]. By harnessing the area's most abundant resource, sunlight, the project will improve energy security by exporting surplus energy into the grid, offering long-term economic benefits to Kerang and nearby areas.

1.2 Project scope

The scope of this project encompasses the design, permit approval and construction phases. The construction phase requires land procurement in Kerang, including at least 250 hectares needed for the solar farm, plus additional space for the battery [1]. Strategic selection of the site location at 00 Peacock Road provides ample space (306 hectares) and also enables easy access to connect to the grid. Site preparation will involve constructing access roads, clearing and levelling the land, as well as addressing erosion concerns. It will then involve procuring materials such as solar panels, batteries, and structural components, followed by the installation and connection of solar panels and the battery system. Finally, construction of site facilities and testing functionality of solar panels will commence to ensure readiness for commissioning. After commissioning, monitoring will take place for up to six months to ensure optimal performance. With this scope and the allocated budget, the project is estimated to take approximately 137 weeks (as explained in Section 2.3). However, the time to completion could be further reduced by hiring additional contractors to crash the project duration. The scope excludes executing operations and maintenance, creating structures that enhance biodiversity and expanding existing solar farms. For the Work Breakdown Structure (WBS), please refer to Section 11.1 Appendix A.

1.3 Project deliverables

The project deliverables include the construction of a 100 MW solar photovoltaic (PV) farm and a 50 MW battery energy storage system (BESS), ensuring alignment with Victorian solar development guidelines. The chosen location in Kerang will receive 8-10 hours of sunlight per day, enabling a reliable source of power to be provided to the state. Additionally, the project involves the construction of durable access roads, site facilities for operators, and robust electrical cabling. The solar panels and battery system will be economically efficient, eco-friendly, and have a long lifespan, with reasonable costs for refurbishment or decommissioning. The system will adhere to ISO 14001 standards for environmental management and ISO 26000 for social responsibility. Furthermore, wildlife protection measures, such as fencing, will be implemented to safeguard local ecosystems. The battery system will also be designed for long-term efficiency, allowing for a projected 20-year lifespan with periodic maintenance, ensuring alignment with AEMO grid stability guidelines and Victorian waste management practices.

1.4 Project goals

The primary goals of the project are to provide greater energy security, facilitate the transition to renewable energy, and offer an affordable power source to decrease the cost of living for Victorians. The project aims to have a positive economic impact in Kerang by increasing local spending and providing additional employment opportunities, while minimising adverse effects such as increased accommodation costs. The project will be evaluated on its ability to reduce greenhouse gas emissions, maintain energy reliability, and achieve economic efficiency in both construction and operation. The specific success criteria are detailed in Table 1 below.

Table 1: Success Criteria of Proposed Solar Farm and Battery Storage System

Criteria	Details
Electricity Generation	The farm should be able to reliably generate 100 MW of electricity and decrease costs of electricity for Victorian businesses and residents.
Solar Panel Efficiency	Efficient, eco-friendly panels with a minimum lifetime of 25-30 years should be used[6].
Battery Storage	The battery should be able to store 50 MW of electricity and have a long lifespan. It should be stored in a cool, insulated place.
Location and Infrastructure	The location should be within close proximity to the electrical grid. Tree clearing and land-levelling should prevent shade reducing efficiency.
Above-ground Cabling	Above-ground cabling should be installed as it is lower risk, easier to access and more economical compared to underground cabling [7].

Site facilities	Site buildings should protect operators from noise and elements and protect equipment.
Access Roads	Access roads must be durable and safe with appropriate signage.
Minimise Local Disruption	The solar farm should not disturb locals e.g. avoid visually unobtrusive design, ensure access roads do not drive excessive traffic and noise.
Economic Impact	The project should generate a positive economic impact on the local community (e.g. increased spending, job creation).
CO2 Emissions	Emissions during construction should be minimal.
Wildlife Protection	Fences will ensure safety of wild-life and prevent property damage.
Protection from Natural Disasters	Measures will be implemented against wind, bushfires, and floods, such as stormwater drainage systems.
Maintenance Costs	Ensure refurbishment/renewal costs are as low as reasonably practicable. Decommissioning plan must allow for land rehabilitation.
Construction Timeline	Project duration should not exceed 31.6 months.

1.5 List of stakeholders

The construction of this new solar farm will entail the engagement of several key stakeholders to ensure compliance with relevant regulations and standards, leading to efficient and successful project outcomes.

On the federal scale, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) will be essential to consult for relevant grants and sustainable energy bonuses for the solar farm. They represent the governmental body in charge of allocating federal level investments. The DCCEEW will have its interest in the project stemming from the Australian Government's goal of 43% net renewable energy by 2030. Notwithstanding, efficient use of capital and financial resources will be one of the biggest concerns for this stakeholder and will need to be properly justified [8].

The Department of Energy, Environment, and Climate Action (DEECA) is a Victoria state department which will oversee critical planning and environmental functions and will be a key stakeholder in site selection. DEECA provides comprehensive standards to what should be considered during site selection, while also assisting with state level grants and funding. Within Victoria, the Minister of Planning will ultimately be responsible for the approval of the project's planning permit, which will cover all facets including the BESS [9].

Local organisational stakeholders include irrigation authorities, environmental organisations, and council authorities. Many of these local bodies will be connected through DEECA during the site selection process. Consultation with these stakeholders will be essential to prevent disruption to existing infrastructure, while also ensuring the preservation of native flora and fauna [10].

Local residents are another key group of stakeholders to consider with the potential to affect the project in a myriad of ways. Firstly, indigenous Australians will be crucial to consult during the land selection phase, as this group may be concerned about the preservation of specific regions or historical sites within these less developed areas. Respect of land and culture will also be important to consider during the construction phase to ensure smooth operation and prevent unwanted reputation damage [11]. Local civilians of Kerang and the surrounding towns will also be directly affected by increased economic activities in local businesses, increased traffic, and potential for noise, dust and glare pollution [12]. As these surrounding towns will likely be frequented or resided in by workers, it is crucial to make sure that the majority of residents are aware and supportive of these potential changes to their environment. Land owners, farmers, and any other solar farm companies will also need to be considered to gauge cost blowouts from competition in land interest, along with the potential effects of displacing these parties.

Lastly, operational stakeholders to consider include the Australian Energy Market Operator (AEMO) and Network Service Providers (NSPs) such as AusNet. AEMO is the official energy regulator in Victoria and is responsible for connection into the National Electricity Market (NEM) [10]. Consulting with AEMO will be crucial for power related issues, as they provide insights into potential impacts on the NEM along with regulating grid connections at any given time, based on price bidding across plants using a spot market. The NSPs are then crucial for transmission within the grids to industrial or residential contexts [13]. Site workers and any contractors will also be essential for the smooth operation of the solar farm construction and maintenance.

A summary of this stakeholder information along with the expected frequency of contact can be found detailed below in table 2.

Table 2: Stakeholder Summary

Stakeholder	Details	Expected Frequency of Contact
DCCEEW	The federal body in charge of providing and approving relevant grants and investments.	Only as required for grants or applications. Likely a few times a year.
DEECA	The state level organisation who manages approvals and permits for construction. Particularly important during the site selection process to connect to local level stakeholders.	More frequent contact than the government level and important in the preliminary stage for approvals.
Local Councils	Important to communicate with to ensure on a high level that the local citizens, businesses, and organisations are kept up to date. Also a good point of contact to better identify local stakeholders and contact streams.	Regular contact is expected to ensure that locals are kept up to date on current project progress while providing an official stream for queries.
Local Residents	Engagement with these stakeholders will be important to make sure no issues come up in terms of public image specifically.	Regular communication throughout the project lifecycle to ensure that the general public
Local Aboriginal Communities	A critical stakeholder especially since areas of interest might be cultural or heritage sites. Ensuring consultation and participation in the project is vital for respectful development especially during the planning phase.	Heavy communication at the beginning of the project and occasional communication during milestones.
Local Farm Owners	As farmers could be affected by construction and land usage, their participation and feedback are essential for minimising impact on farming operations.	Occasional contact throughout the planning phases to address concerns about land use, water access, and compensation while ensuring there are no unexpected impacts during construction.
Households and Businesses Receiving Electricity	The end consumer who will benefit from the solar farm whose electricity usage is a big factor in determining electricity prices in the spot market. Surveying on expected electricity usage and projections might thus be useful.	Once off surveying at the beginning of the project along with communication towards the end of the project as connection to these stakeholders begins.

Local Businesses	These stakeholders will likely benefit from increased business due to a higher number of worker residents during project construction.	Little to no communication will be needed and any concerns from this stakeholder will likely arise through alternative channels such as the council.
Local Irrigation Authorities	Irrigation authorities are especially important to consult during the planning phase to confirm that construction plans do not disrupt existing irrigation infrastructure.	Detailed two-way communication during the planning phase, with regular communication throughout construction during any excavation phases.
NSPs (AusNet)	Network service providers responsible for delivering the electricity to local or industrial areas.	Ongoing collaboration throughout the project lifecycle, particularly during the planning, grid connection, and operational phases.
AEMO	The Australian Energy Market Operator who manages the grid and ensures energy reliability, along with grid connection.	Frequent contact to ensure compliance with energy market regulations, grid integration, and system reliability.
Site Workers and Contractors	Responsible for the physical construction and maintenance of the project.	Daily or near-daily communication during the construction phase to ensure smooth operations, address issues, and maintain safety standards.
Local Environmental Groups	Local environmental groups are important to ensure the project adheres to environmental regulations and minimises harm.	Frequent engagement during the planning and construction phases to address concerns and ensure adherence to environmental standards.
Climate Change Activists	Important to consider while aligning with public sentiment. Their interest in the project's environmental impact will be the main area of interest.	Engagement as needed, particularly in the planning and early construction phases, to align on sustainability goals and ensure transparency in environmental impact reporting.
Surrounding Solar Farms	Neighbouring energy projects will be important to look to for potential pitfalls while also posing as potential competitors.	Occasional communication to explore partnerships, shared resources, or collective actions that could benefit all projects in the area.

A power interest grid for these stakeholders along with their expected communication frequency is provided below in figure 1.

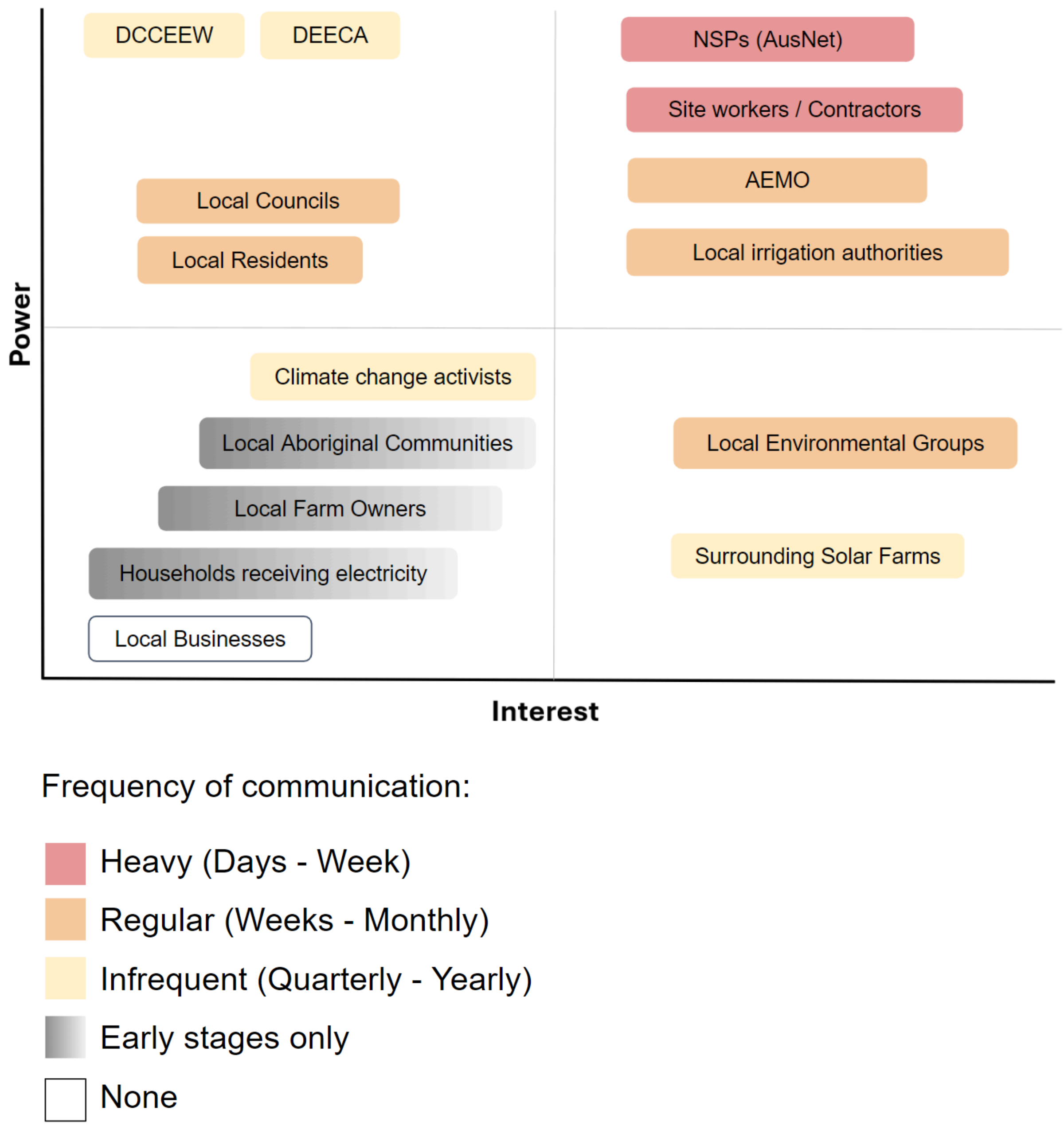

Figure 1: Stakeholder Power Interest Grid

2. Time estimates

2.1 Network Diagram & Critical Path

The network diagram outlines any inter-reliance between tasks and provides a rough blueprint of the order in which tasks should be completed. The critical path outlines the sequence of tasks that must be completed on schedule to ensure the project is finished on time. For the Network Diagram and Critical Path, please refer to Section 11.2 Appendix B and Section 11.3 Appendix C.

2.2 Estimates of activity durations

2.2.1 Preliminary Assessment

The Preliminary Assessment phase of the Kerang solar farm project and battery project includes important early-stage tasks such as site selection, feasibility studies, and market research. This phase ensures that the project is strategically planned with thorough analysis of site suitability, technical viability, and market dynamics, setting a solid foundation for subsequent development stages.

Table 3: Preliminary Assessment Activities and Estimated Durations [18]

Phase	Activity (ID)	Description	Estimated Duration
Site Selection	Land Procurement (A1.1)	Acquire suitable land for the solar farm project through purchase or lease agreements	12 weeks
	Surveying (A1.2)	Conduct detailed site surveys to determine boundaries, topography, and site characteristics	5 weeks
Feasibility Study	Technical Analysis (A2.1)	Evaluate technical parameters like solar irradiance, accessibility, and infrastructure compatibility	8 weeks
	Environmental Impact (A2.2)	Assess the potential environmental effects of the solar farm to ensure compliance with environmental standards and regulations	6 weeks
	Infrastructure Assessment (A2.3)	Analyse existing local infrastructure's ability to support the solar farm, including roads, utilities, etc	2 weeks
Market Research	Risk Assessment (A3.1)	Identify and evaluate potential risks associated with the project, including financial, environmental, and operational risks	2 weeks
	Preliminary project report (A3.2)	Compile findings from the feasibility study and market research into a preliminary report that outlines project viability and strategy	6 weeks
	Demand Analysis (A3.3)	Analyse market demand for solar energy in the region	2 weeks

2.2.2 Permits and Approvals

The Permits and Approvals phase involves navigating various governmental levels to secure the required permits and comply with regulations. This includes obtaining all local, state, and federal approvals besides addressing specific environmental and commercial requirements needed for the project progression.

Table 4: Permits and Approvals Activities with Estimated Durations (from Assumptions) [19]

Phase	Activity (ID)	Descriptions	Estimated Duration
Government	Local level (B1.1)	Engage with local councils for planning permits and gaining approval for land use ensuring the project aligns with local zoning laws and minimising disruptions to the community	18 weeks
	State level (B1.2)	Engage with departments like DECCA, ensuring project compliance. Key aspects include obtaining planning permits and environmental clearance, with approval from the Minister of Planning for solar farms exceeding 1 MW capacity	20 weeks
	Federal level (B1.3)	Ensure compliance with national regulations related to renewable energy development, including applications for grants and ensure that the project meets federal environmental standards	22 weeks
Environmental	Environmental Effects Statement (B2.1)	Conduct Environmental Impact Assessment to address the potential ecological impacts of the project	8 weeks
Commercial	Grid Connection Agreement (B3.1)	Outline the terms for connecting the solar farm to the electrical grid. Close coordination with AEMO to ensure grid stability and energy dispatch	8 weeks
	Power Purchase Agreement (B3.2)	Establish PPA with a utility or private entity to secure long-term revenue streams by selling the electricity generated by the solar farm	4 weeks

2.2.3 Design and Engineering

The Design and Engineering phase targets the meticulous planning and structuring of the solar farm's and battery's components and layout. This phase includes the detailed design of electrical systems, the mechanical configurations, and the overall site layout to ensure optimal infrastructure integration and access routing. Each element is designed to ensure both technical and operational efficiency, building up to achieve the design approval before construction begins.

Table 5: Design and Engineering Activities with Estimated Durations [18]

Phase	Activities (ID)	Task Descriptions	Estimated Duration
Components	Electrical (C1.1)	Design the electrical systems for the solar farm, ensuring compatibility with the grid and efficient energy flow	10 weeks
	Mechanical (C1.2)	Design the mechanical structures, including the solar panel mounting systems and battery enclosures	7 weeks
Site Layout	Panel layout (C2.1)	Determine the optimal arrangement of solar panels for maximum sunlight exposure	2 weeks
	Infrastructure layout (C2.2)	Plan the layout for access roads, buildings, other site infrastructure, and etc	3 weeks
	Access routing (C2.3)	Design routes for maintenance access, ensuring easy and safe movement on-site	3 weeks
Electrical Design	Power analysis (C3.1)	Assess the power generation capacity and ensure the system meets energy demand	2 weeks
	Electrical wiring and connections (C3.2)	Design the electrical wiring and connections to link the solar panels, batteries, and grid	4 weeks
Design Approval	None (C4)	Submit the final designs for approval before construction begins	2 weeks

2.2.4 Financing and Procurement

The Financing and Procurement phase is pivotal as it ensures the project is financially supported and well-equipped. It covers securing loans, equity, and grants, alongside managing the acquisition of the required tools and materials through the procurement processes.

Table 6: Financing and Procurement Activities with Estimated Durations [18]

Phase	Activity (ID)	Descriptions	Estimated Duration
Financing	Bank loans (D1.1)	Secure loans to cover project costs, focusing on favourable terms for repayment	4 weeks
	Equity financing (D1.2)	Raise capital by engaging investors in exchange for project ownership shares	6 weeks
	Government Incentives & Grants (D1.3)	Apply for available renewable energy grants and incentives to reduce financial burdens	16 weeks
Procurement Process	Tendering (D2.1)	Request competitive bids from local contractors to provide their goods and services during the construction phase	10 weeks
	Purchase agreements (D2.3)	Enter into purchasing agreements with successful contractors	5 weeks
	Supplier assessment (D2.2)	Evaluate suppliers for quality, reliability, and environmental compliance	6 weeks
Budgeting	Hardware (D3.1)	Estimate the costs of solar panels, batteries, infrastructure, and etc	3 weeks
	Installation (D3.2)	Plan for installation expenses, including labour, materials, and etc	3 weeks
	Soft costs (D3.3)	Account for project management, legal fees, permits, and other non-construction expenses	3 weeks

2.2.5 Construction

The Construction phase focuses on building the infrastructure for the solar farm and battery, involving workforce mobilisation, site preparation, and the installation of essential hardware and electrical systems.

Table 7: Construction Activities and Estimated Durations [18] [20]

Phase	Activity (ID)	Descriptions	Estimated Duration
Build Project Workforce	Site managers (E1.1)	Appoint and hire suitable project managers to oversee the project construction	6 weeks
	Contractors (E1.3)	Contract successfully tendered contractors to provide relevant goods and services for the construction of the project	8 weeks
	Labourers (E1.2)	Appoint and hire project labourers to provide assistance to contractors on site	10 weeks
	Training (E1.4)	Provide relevant job training to all members of the project workforce, including but not limited to health, safety, sustainability and legal matters	2 weeks
Machinery and Equipment	Worker facilities (E2.1)	Install temporary worker facilities on site, including break rooms, offices and bathroom facilities	1 week
	Machines (E2.2)	Transport all the required machinery to site ready for construction commencement	1 week
Construction	Site preparation (E3.1)	Prepare land for construction works through landscaping, access and drainage works	10 weeks
	Hardware installation (E3.2)	Install solar panel hardware and battery on site	18 weeks
	Electrical installation (E3.3)	Install electrical wiring to solar panel hardware and battery and provide grid connections	26 weeks

2.2.6 Validation

The Validation phase ensures that all aspects of the solar farm meet rigorous standards through compliance inspections, safety checks, and performance testing. This phase culminates with a thorough handover that includes ongoing monitoring to guarantee operational reliability.

Table 8: Validation Activities and Estimated Durations [21] [22]

Phase	Activity	Descriptions	Estimated Duration
Compliance and Inspections	Specification checks (F1.1)	Verify that all components meet design specifications and project standards	3 weeks
	Safety checks (F1.2)	Conduct safety inspections to ensure the site complies with safety regulations and standards	5 weeks
Testing	Load testing (F2.1)	Test the system under operational conditions to confirm that it can handle the expected energy load	7 weeks
	Integration testing (F2.2)	Ensure the seamless integration of the solar farm, battery system, and grid connection	5 weeks
Handover	Monitoring (F3.1)	Perform continuous monitoring to ensure the system operates efficiently and reliably after commissioning	24 weeks

2.3 Time to completion

Upon identifying the critical path, the total time required to complete the project is the sum of the durations of all tasks along the critical path.

Table 9: Time to complete the project

Task Category	Activities	Duration(in weeks)	Total Time Elapsed
Preliminary Assessment	Technical Analysis	8	8
	Land Procurement	12	20
	Preliminary Project Report	6	26
Permits and Approvals	Federal	22	48
Design and Engineering	Electrical Components	10	58
	Electrical Wiring and Connections	4	62
	Design Approval	2	64
Construction	Machines	1	65
	Worker Facilities (concurrent with Machines)	1	65
	Site Preparation	10	75
	Electrical Installation	26	101
Validation	Safety Checks	5	106
	Load Testing	7	113
	Monitoring	24	137

Therefore, the total amount of time required to complete the project is approximately 137 weeks.

For calculations related to Time to Completion and for a detailed visualisation of the project's schedule, please refer to Section 11.5 Appendix E and Section 11.4 Appendix D.

2.4 Total Floats for non-critical-path activities

The visualisation of the total float for non-critical-path activities can be found in the full critical path diagram, please refer to Section 11.3 Appendix C. For detailed calculations of the float values for all tasks, please refer to Section 11.5 Appendix E.

2.5 Critical Path Activities

The activities associated with the critical path are as follows. These activities are also indicated in the full critical path diagram.

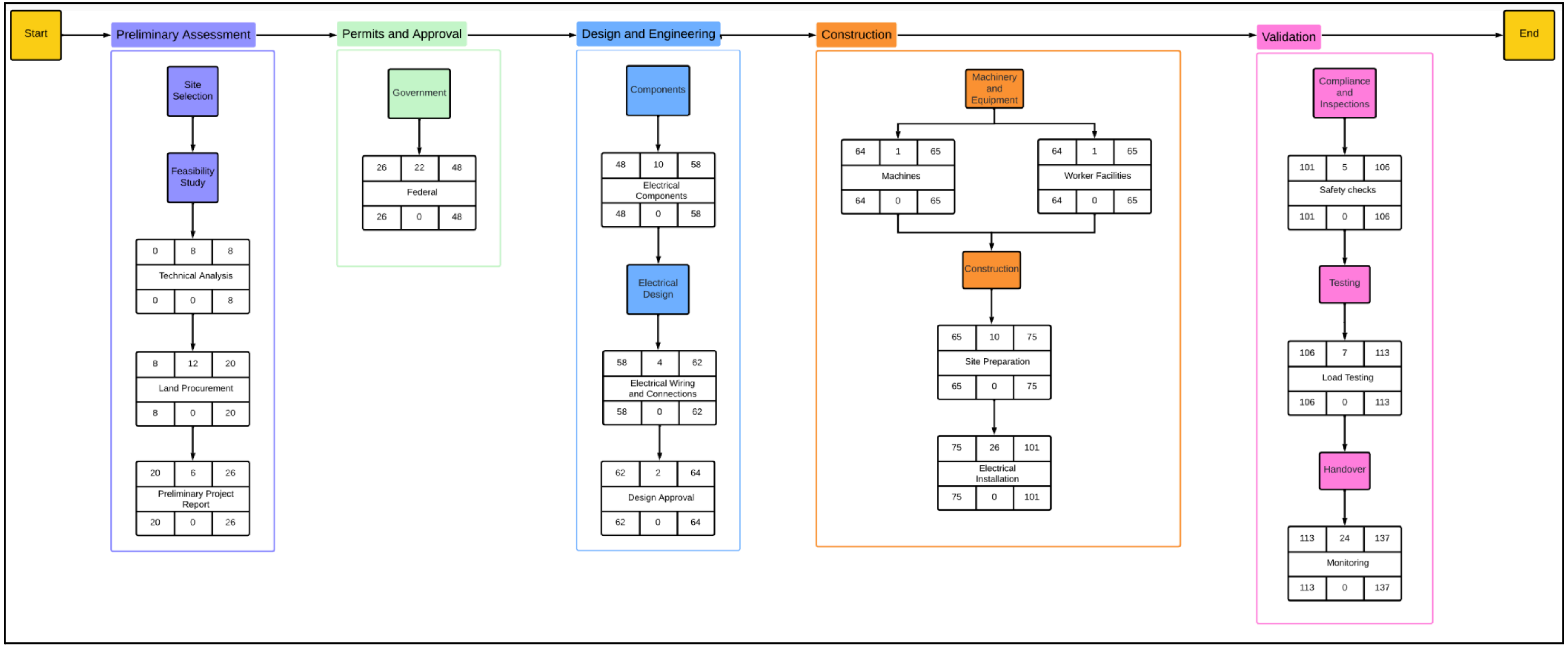

Figure 2: Simplified diagram of critical path activities

2.6 Resource Planning (Human Resource)

Human resource allocation for the project before and after Resource Levelling is visualised in Figure 3 and 4. For detailed calculations of the resource planning, please refer to Section 11.5 Appendix E.

Due to the categorical nature of tasks and their durations, the data is shown in a bar chart rather than a histogram. [18] [19] [23] [24] [25] [26]

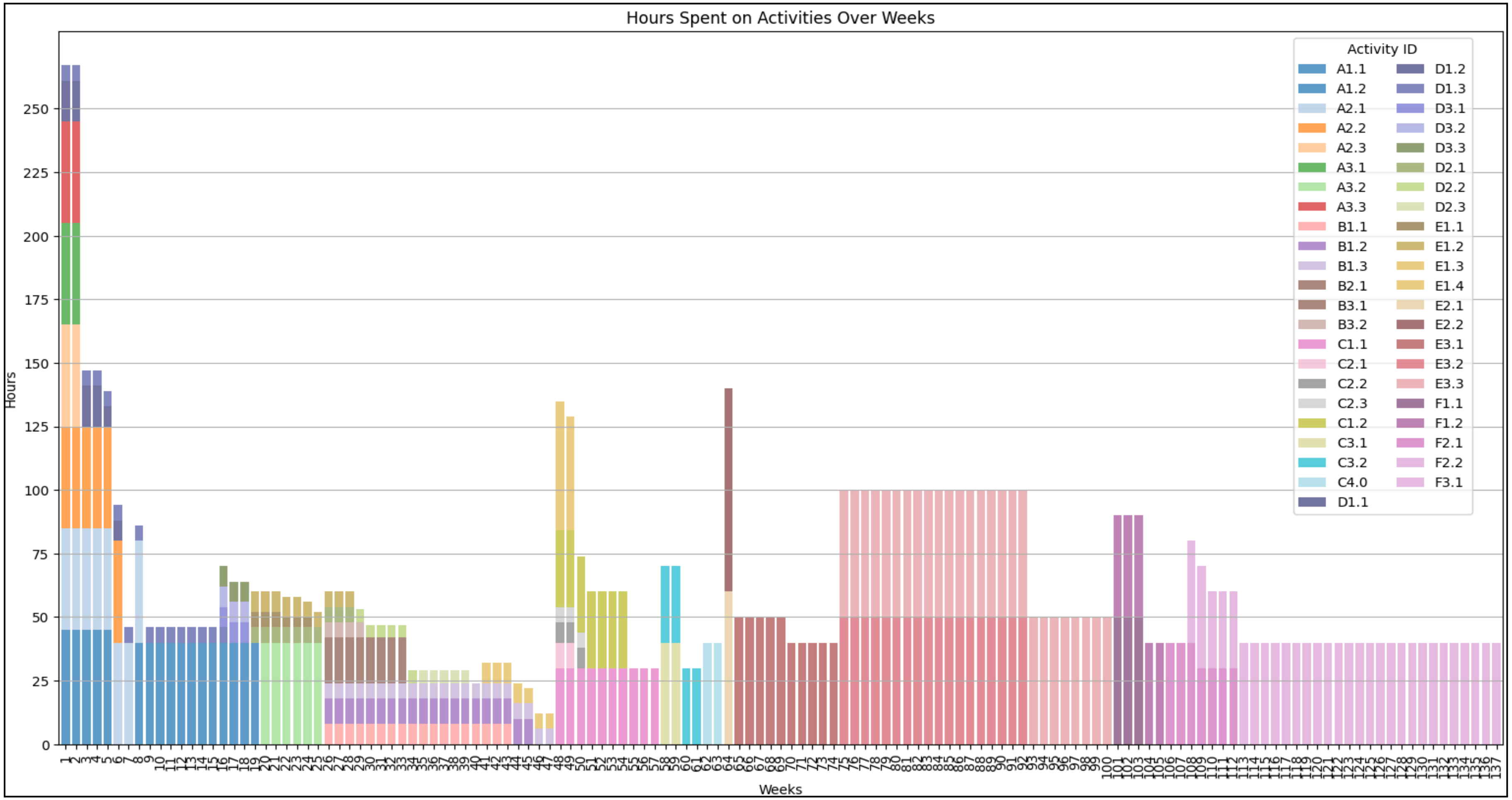

Figure 3: Human Resource Allocation before Resource Levelling

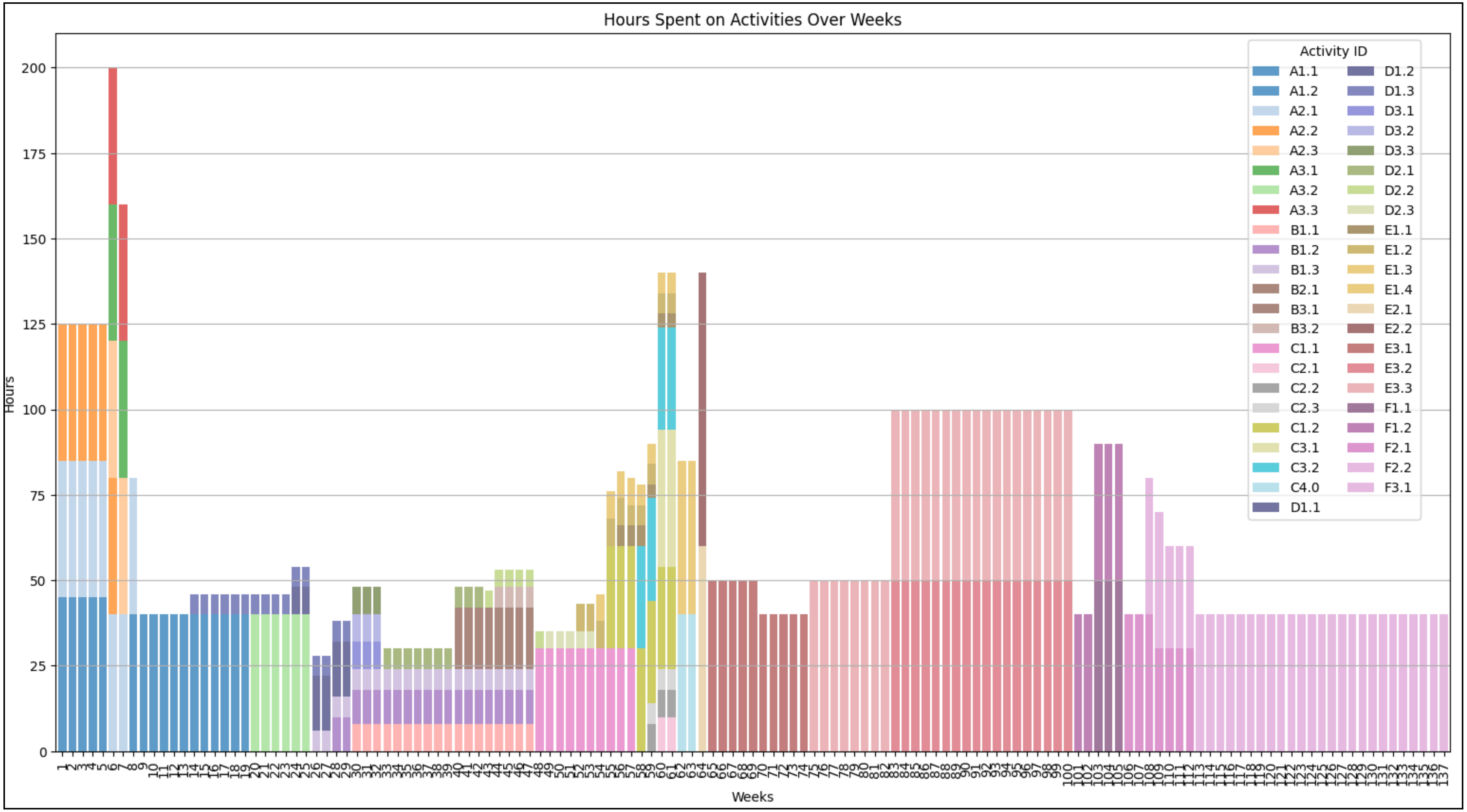

Figure 4: Human Resource Allocation after Resource Levelling

Acknowledging the importance of effective resource allocation to the successful completion of the project, we have evaluated the current resource allocation and identified some slight imbalance in the distribution of working hours across project tasks. To address this, we have switched from an As Soon As Possible (ASAP) scheduling heuristic to an As Late As Possible (ALAP) heuristic, optimising human resource use without affecting the critical path.

Human Resource Allocation before Resource Levelling:

Figure 3 illustrates the current distribution of human resource hours allocated to various tasks, highlighting several high peaks that suggest over-utilisation during certain weeks. This over-allocation is primarily due to the use of the ASAP heuristic, where tasks are scheduled to begin at the earliest opportunity. As a result, multiple tasks overlap unnecessarily, placing undue strain on the human resources. For instance, the overlap between the Preliminary Assessment phase and the Financing and Procurement phase in the early weeks significantly increased the demand for human resources.

Human Resource Allocation after Resource Levelling:

In Figure 4, the ALAP heuristic has been implemented to achieve a more balanced distribution of human resource hours. Compared to Figure 3, where peak human resource hours exceeded 250 hours per week, the ALAP approach has reduced this peak to 200 hours per week. Additionally, the resource allocation is now more evenly distributed across the project timeline. By shifting non-critical tasks to later stages, the ALAP method has effectively spread resource demands, reducing the strain observed in Figure 3. This adjustment has not only alleviated resource over-utilisation but also maintained the project schedule without causing delays to critical path activities. The result is a more balanced workload distribution, minimising the risk of overburdening human resources.

Resource Analysis (after Resource Levelling)

On average, we expect to require approximately 50 to 75 hours of labour per week throughout the project. During the early stages, particularly Weeks 1 to 8, the demand for human resources will be higher as we aim to complete the Preliminary Assessment efficiently and ahead of schedule, allowing for the smooth progression of the subsequent phases of the project. In Weeks 55 to 64, the Financing and Procurement phase will occur concurrently with the Design and Engineering phase. However, these tasks will be handled by different teams, ensuring that both phases progress smoothly without resource conflicts.

However, certain phases, particularly during Weeks 83 to 100 (Construction phase), will require significantly more labour than average due to the compressed timeline for the installation of electrical and hardware components. To address this without extending the overall project duration, we plan to engage additional contractors and labourers, particularly those with expertise in solar installations. While this approach may slightly increase costs, it is both practical and effective given the availability of skilled labour in the region. By increasing the workforce during these high-demand weeks, we can maintain resource flexibility and ensure that project deadlines are met without overburdening our in-house teams.

3. Cost estimates

3.1 Top-down cost estimate for project

Whilst initial project budgets for this solar project were around $140,000,000, a worldwide oversupply of solar panels has seen the estimated cost of the project drop, with the price of solar panels roughly halving over the last ten years. [27]

Table 10: Top-Down Cost Estimate by Phase

Section	Cost
Preliminary assessment	$800,000 - $1,000,000
Permits & Approvals	$400,000 - $500,000
Design & Engineering	$80,000,000 - $100,000,000
Financing & Procurement	$50,000 - $100,000
Construction	$15,000,000 - $20,000,000
Validation	$4,000,000 - $6,000,000
TOTAL	$100,000,000 - $127,500,000

The revised cost for this project using the top-down method sees this project cost estimate fall between $100,000,000 and $127,500,000. This amount is consistent with quoted amounts for solar farms in Australia with prices generally ranging between $1 million to $1.5 million per megawatt (MW) of installed capacity. [28] As this is a large-scale project, we would benefit from economies of scale as we are able to order many of our components for this project in bulk.

3.2 Bottom-up cost estimates for tasks, sub-projects/milestones and total project

For the bottom-up costing of this project, the individual price estimates for tasks can be found in the excel sheet submitted alongside this report. We expect the price associated with each main phase of the project to be as follows:

Table 11: Bottom-Up Cost Estimate by Phase

Section	Cost	Notes
Preliminary assessment	\$855,100	The most expensive purchase of the preliminary assessment will be the acquisition of land (\$552,600). Other tasks include surveying (\$57,500), feasibility study (\$100,000) and market research (\$145,000).
Permits & Approvals	\$446,948	Includes a variety of permits and approvals, with state permits making the majority of this cost (\$305,000).
Design & Engineering	\$86,393,435	This being the most expensive section, it includes the costs of the acquisition of the components of the solar farm, including the battery (\$36,753,435), the panels (\$32,400,000), the sun tracking system (\$9,000,000) and the inverters (\$7,200,000). The designs for the site layout (\$80,000) and the electrical design (\$160,000) are also covered in this section.
Financing & Procurement	\$70,000	Covers the procurement process, including tendering (\$20,000), purchase agreements (\$20,000), and supplier assessment (\$30,000).
Construction	\$16,234,144	The costs involved with hiring and training the workforce for the construction phase of this project make up the majority of the costs in this section (\$14,820,000). Also included worker facility costs (\$64,144) and machinery purchase and hire (\$500,000).
Validation	\$4,700,000	A generous budget has been allocated to this section to ensure that the project is working properly before handover. Includes compliance and inspections (\$1,500,000), testing (\$3,000,000), and handover and monitoring (\$200,000).
TOTAL	\$108,699,627.30	-

For detailed calculations on the top-down and bottom-up cost estimates, please refer to Section 11.6 Appendix 6.

3.3 Cash flow analysis

In the cash flow analysis, we look beyond the project's construction to determine how it will function financially. The main difficulty in developing these estimations comes from the fluctuating power price. In Australia, the eastern and south-eastern states are managed by AEMO as part of the national electricity market (NEM). NEM aims to provide Australians with an affordable and reliable energy source. The price of electricity is updated every 5 minutes based on demand and supply. The ability of different technologies to meet these demands strongly influences their profitability. Using this market model, pure solar systems are limited as they can only produce energy during sunlight hours. Over recent years, there has been a considerable introduction of rooftop and utility solar. This means there are many competitors to fulfil energy demands during sunlight, lowering the wholesale price.

Hybrid solar projects, such as our own, can help remedy this issue by adding a battery storage system. This allows hybrid projects to store and sell energy when other PV farms cannot. The average solar sale price is at an all-time low, with some months reporting negative prices. Given this, the revenue of our farm is calculated by maximising the amount of solar energy that is stored and sold later throughout the day. At present, battery power demands very high prices, allowing our project to deliver good revenue once operation begins. Our full calculations can be found in the attached Excel file, and the result of our cash flow over a 10-year operating period is detailed in Figure 5.

Over the 10 years we have evaluated, we are able to recover the project costs during the 10th year of operation. However, recovering the net present value (NPV) is a slower process. We are working with a discount rate of 6%, which is lower than for other renewable energy projects such as wind, but still hinders our ability to be considered a profitable project for investors [29]. Extrapolations of our NPV data show that we should produce a positive NPV value around 15 years of operation. However, this does not consider the cost of winding up the project. This will occur around 25 years which is the operational life of most of our electrical components including solar panels, inverters and batteries. While we do not expect this to produce a negative NPV, it will be significantly reduced, affecting the desirability of our project. The results of our NPV analysis are shown in Figure 6. For detailed calculations, please refer to Section 11.6 Appendix 6.

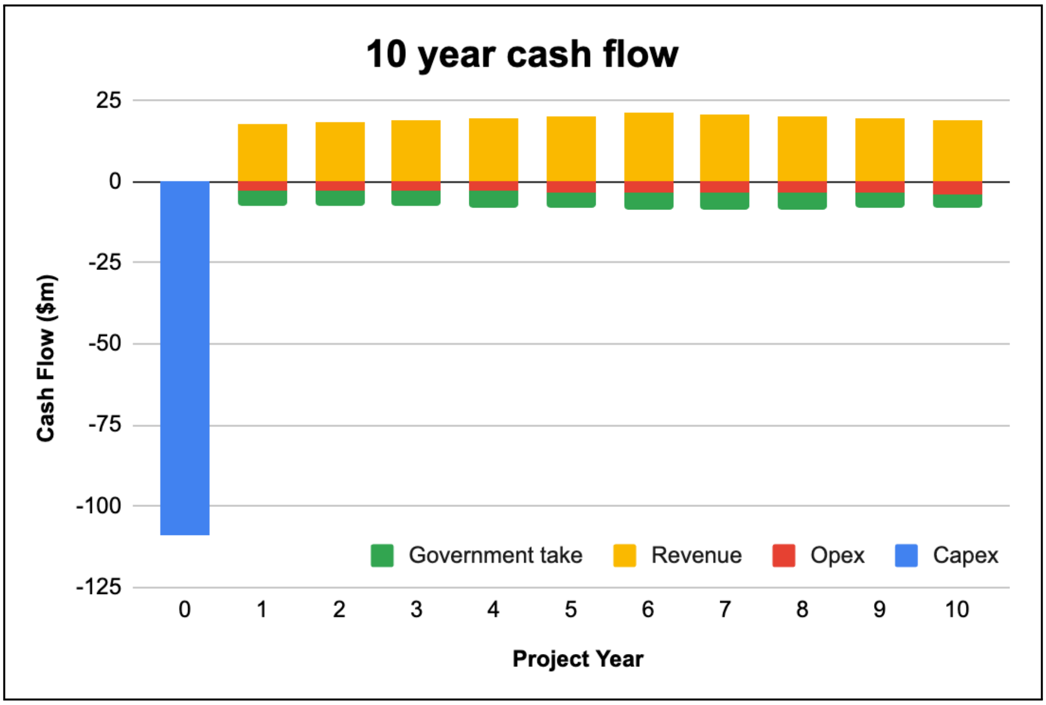

Figure 5: Project cash flow over 10-year period

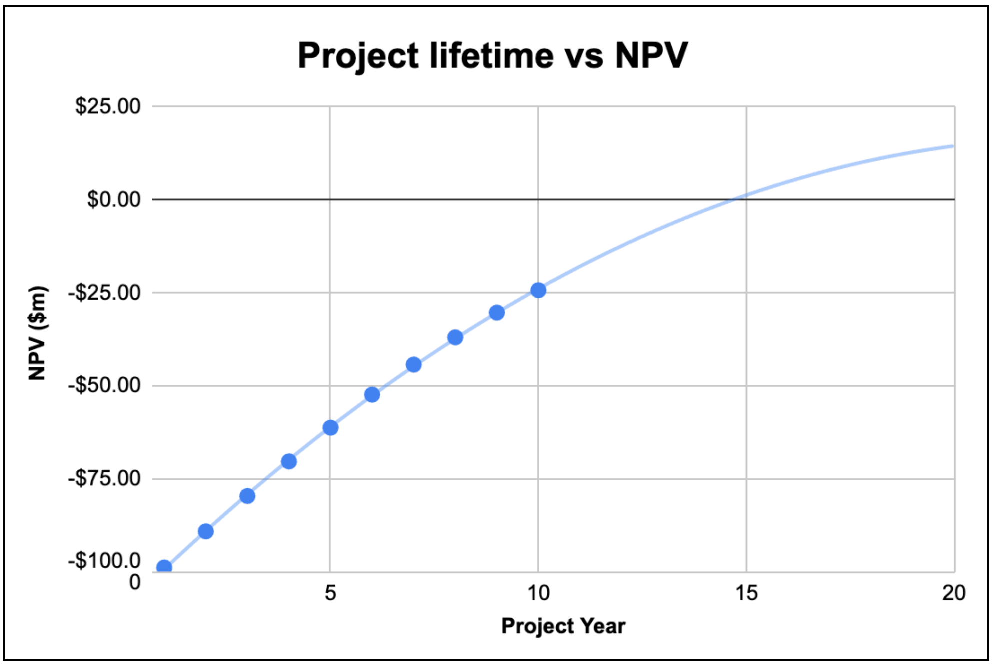

Figure 6: Project Net Present Value analysis

To help uphold the reliability of our concussions, we have conducted a sensitivity analysis of the project's profitability. This analysis looks at the factors that affect our opex,capex and revenue the most. The two most crucial factors are the wholesale price of solar and battery discharge. In our calculations, we scale the average values for each month, looking at both increases and decreases of 20%. Our project assumes high utilisation of stored energy, making our profit very sensitive to the wholesale price of battery energy but significantly less for the price of solar. The sale price of our battery energy is make or break for the project, with a reduction of 5%, leading to negative NCF after 10 years. As discussed in the NPV, we cannot afford to see this level of reduction if the project is to be viable. Conversely, a 10% increase in the price of wholesale battery discharge majorly improves our project's cash flow. The sensitivity of our capex factors, such as the solar panel and battery costs, are relatively low and unlikely to adversely affect the project's NPV.

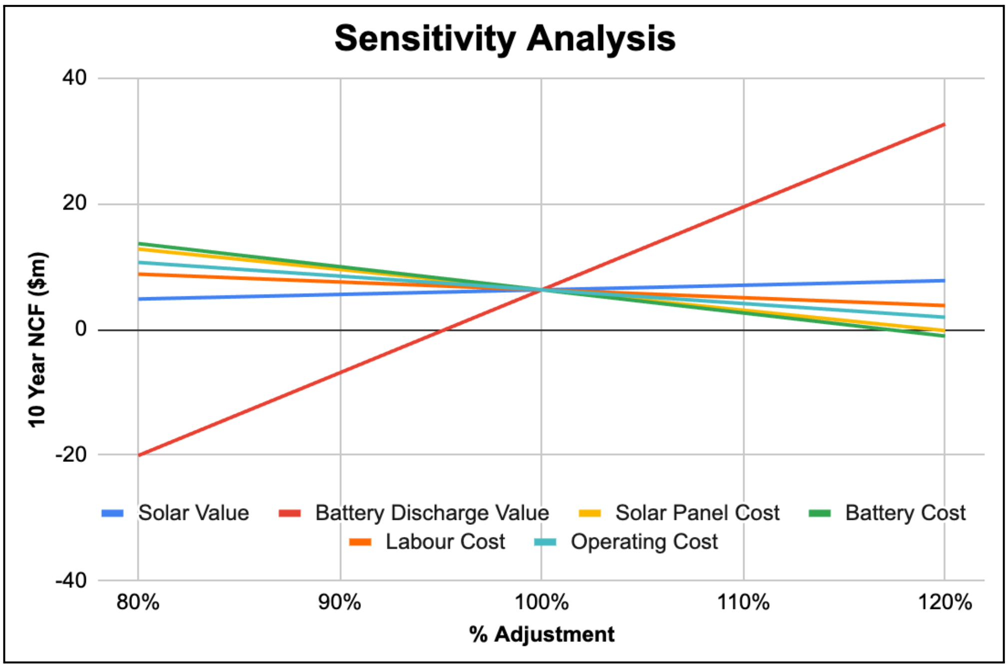

Figure 7: Project sensitivity analysis

4. ESG Report

In the execution of this project along with others, our organisation, Acciona, is committed to ethical and sustainable principles for social action and environmental preservation. We are dedicated to the promotion of the 17 Sustainable Development Goals (SDGs) developed by the United Nations (UN) and we achieve this by using the UN's Global Compact for environment, labour, human rights and anti-corruption to guide our policies. As of 2009, we have developed a Sustainability Committee to ensure adherence to these policies [30]. It is therefore required that the life cycle analysis of this project comply with the standards ISO 14040 (Principles and framework) and ISO 14044 (Requirements and guidelines) [31]. The specific environmental, social and governance concerns for this project are outlined below.

Solar farms require significant land, which can lead to habitat loss of native species [32]. To mitigate this, thorough environmental impact assessments will be conducted before construction to ensure the chosen location will cause minimal habitat disruption. Additionally, the layout of the solar farm will be designed to ensure that it does not interfere with wildlife corridors that enable ecosystem connectivity. Ongoing monitoring and mitigation of environmental impacts will be ensured by adherence to ISO 14001 (Environmental management systems) [31].

The production and maintenance of solar panels can consume significant amounts of water [32]. Implementing water-efficient cleaning techniques, like dry cleaning methods or recycled water, can mitigate this. ISO 14064, which focuses on greenhouse gas accounting and verification, includes considerations for water use efficiency, ensuring a comprehensive approach to sustainability [31].

Construction activities can lead to soil erosion and runoff [32]. Using erosion control measures, revegetating disturbed areas quickly, and designing the site to manage stormwater effectively can help. The Victorian Solar Energy Facilities Design and Development Guidelines will be followed and it provides practical advice on managing soil erosion and maintaining environmental standards during construction [33].

The manufacturing process of solar panels involves hazardous chemicals [34]. Developing stringent protocols for the safe handling, storage, and disposal of these chemicals is crucial. ISO 14001 provides a framework for managing environmental responsibilities, including the safe use and disposal of hazardous materials [31]. Used solar panels can also contribute to electronic waste if not properly recycled [34]. Establishing robust recycling programs can ensure they are properly disposed of.

The sourcing of raw materials for solar panels can involve geopolitical tensions and ethical concerns. Sourcing materials from ethical and sustainable suppliers, promoting transparency in the supply chain, and investing in recycled materials where possible can address this.

Additionally, bringing in external contractors to develop large-scale solar projects can lead to elevated rent and accommodation prices resulting in community displacement. Engaging with local communities early in the planning process to understand their needs and concerns and hiring locally as much as possible is essential. Additionally, training and hiring locally will likely lead to greater job creation, up-skilling and increased local spending, causing numerous positive economic impacts. ISO 26000 provides guidance on social responsibility, ensuring transparent and ethical interactions with affected communities [35].

Solar farms can also compete with agricultural land, leading to land use conflicts. Selecting non-arable land and consulting with local farmers can mitigate this. Additionally, consultation with local Indigenous communities will be important to ensure that the land selected does not hold significant historical or cultural value. These goals tie in with ISO 26000 and ISO 14001 to ensure that communities are respected and land use is managed sustainably.

Finally, some people may find solar farms visually unappealing. Using landscape design techniques to integrate solar farms into the natural environment and planting vegetation around the perimeter can help obscure the view.

5. Chain of Command and Responsibility Matrix

Acciona will employ a project director as the main project lead, backed up by a project administration team, responsible largely for the overall project management, contracts administration and overseeing the project's progression. Acciona's design team will appoint a design manager and supporting team members to take charge of the design aspects of the project, and similarly with our engineering team. The engineering team will be made up of electrical, mechanical and environmental engineers. Upon commencement of on-site activities, the project administration team will be responsible for hiring a site manager and site labourers, whose duties will involve managing the project site and all on-site personnel, including subcontractors. Finally, the monitoring and commissioning phase will largely be carried out by external consultants, with general supervision from the project leadership. Refer to Figures 8 and 9 for the full responsibility matrix.

Legend:	1 Primary responsibility	2 General supervision
	3 Must be consulted	4 Must be notified

	Company Director	Project Director	Design Manager	Site Manager	HSE Coordinator	Project administration team	Engineering team	Design team	Site team	Accounts and finance team	Subcontractors	Consultants
Preliminary Assessment												
Surveying		2					3	4				1
Techincal Analysis		2					3	4				1
Feasabilty study		2					3	4		3		1
Demand Analysis												1
Land procurement	3	2				1				2		
Preliminary Project Report	4	2	2			1	3	3		3		
Permits and Approvals												
Local government permits		2	2			1	3					
State government permits		2	2			1	3					
Federal government permits		2	2			1	3					
Environmental effects statement					3	2						1
Grid connection agreement	4	2				1						
Power purchase agreement	4	2				1						
Design and Engineering												
Electrical components design		4	2			4	1	2				
Mechanical components design		4	2			4	1	2				
Panel layout design		4	2			4	2	1				
Infrastructure layout design		4	2			4	2	1				
Access routing design		4	2			4	2	1				
Power analysis		4	2			4	1	2				
Electrical wiring and connections		4	2			4	1	2				

Figure 8: Responsibility Matrix

Design approvals	4	3	1			4						
Financing and procurement												
Bank loans	4	4								1		
Equity financing	4	4								1		
Government incentives and grants	4	4								1		
Tendering		2				1			4	3		
Purchase agreements		1				2						
Supplier assessment		1				2						
Hardware budgeting		4				4				1		
Installation budgeting		4				4				1		
Soft costs budgeting		4				4				1		
Construction												
Site managers	3	1										
Contractors		1				2						
Labourers		2		1								
Staff training		2		1	1				2			
Worker facilities				2	2				2		1	
Machinery				2	3				2		1	
Site preparation	4	4	3	2	3	4	3	3	1		1	
Hardware installation	4	4	3	2	3	4	3	3	1		1	
Electrical installation	4	4	3	2	3	4	3	3	1		1	
Validation												
Specification checks		3		3	2	2						1
Safety checks		3		3	2	2						1
Load testing		3		3	2	2						1
Integration testing		3		3	2	2						1
Monitoring		3		3	2	2						1

Figure 9: Responsibility Matrix, cont.

6. Planned Value Graph

To measure the Earned Value over the course of the project, specific weighted milestones were created. These milestones largely reflect the major tasks of the Work Breakdown Structure, however, some smaller tasks have been combined so that milestone sizes are more equal. The percentage weighting for each milestone was determined based on the labour (in weeks) required to complete the task. This percentage was then multiplied by the overall cost of the relevant project stage seen in Table 12, in order to determine the weighing of the task as a monetary value. The contribution to the the Planned Value ($/Week) was then calculated by dividing the monetary weighting of the task over the start to end dates of the task, as outlined in the precedence diagram. More details of these calculations can be found in the PV Graph Calculations spreadsheet and the findings are summarised in Table 13. Using this information, the Planned Value Graph was plotted, as seen in Figure 10.

Table 12: Bottom Up Costing of Each Project Stage

Project Stages	Cost
Preliminary Assessment	$855,100.00
Permits & Approvals	$446,948.30
Design & Engineering	$86,393,435.00
Financing & Procurement	$70,000.00
Construction	$16,234,144.00
Validation	$4,700,000.00
Total Costs (Bottom Up)	$108,699,627.30

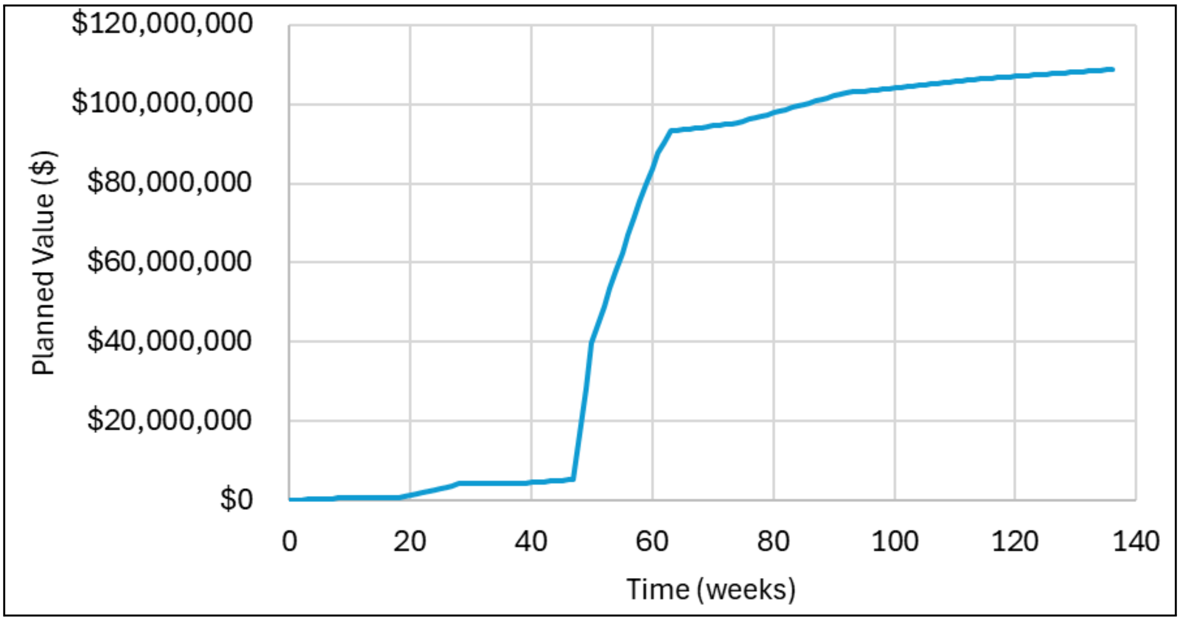

Figure 10. Planned Value Graph for Kerang Solar Farm

Table 13. Planned Value Calculations

Milestones	Description	Labour Required (Weeks)	Milestone Weighting (%)	Milestone Weighting ($)	Contribution to PV ($/Week)
Site Selection	Surveying and Land Procurement	17	39.53%	$338,062.79	$16,903.14
Feasibility Study	-	16	37.21%	$318,176.74	$39,772.09
Market Research	Risk Assessment, Demand Analysis and Preliminary Project Report	10	23.26%	$198,860.47	$7,648.48
Government - Local	-	18	22.50%	$100,563.37	$5,586.85
Government - State	-	20	25.00%	$111,737.08	$5,586.85
Government - Federal	-	22	27.50%	$122,910.78	$5,586.85
Environmental	-	8	10.00%	$44,694.83	$5,586.85
Commercial	-	12	15.00%	$67,042.25	$8,380.28
Components	-	17	51.52%	$44,505,708.94	$4,450,570.89
Site Layout	-	8	24.24%	$20,943,863.03	$6,981,287.68
Electrical Design	-	6	18.18%	$15,707,897.27	$3,926,974.32
Design Approval	-	2	6.06%	$5,235,965.76	$2,617,982.88
Financing	-	26	47.27%	$33,090.91	$2,068.18
Procurement	-	20	36.36%	$25,454.55	$1,212.12
Budgeting	-	9	16.36%	$11,454.55	$3,818.18
Build workforce part 1	Source labourers and site managers	16	19.51%	$3,167,637.85	$316,763.79
Build workforce part 2	Contractors, training, machinery and equipment	12	14.63%	$2,375,728.39	$95,029.14
Site preparation	-	10	12.20%	$1,979,773.66	$197,977.37
Electrical Installation	-	26	31.71%	$5,147,411.51	$285,967.31
Hardware Installation	-	18	21.95%	$3,563,592.59	$137,061.25
Compliance & Inspections	-	8	18.18%	$854,545.45	$170,909.09
Testing	-	12	27.27%	$1,281,818.18	$183,116.88
Handover	-	24	54.55%	$2,563,636.36	$106,818.18
Total				$108,699,627.30	

7. Risk Assessments/Risk Profiles

Table 14: Consequence Definitions

Consequence	Definition
Insignificant	A minor inconvenience which will not result in delay to the project timeline.
Minor	Independent and isolated impact, with potential delays for a maximum of a few days.
Significant	Has the potential to impact other tasks with total delays of up to several weeks. Active rerouting on the project management level might also be required.
Major	Significant delays to the entire project up to a year. Extensive re-planning needed to cope with changes and additional direct costs needed to address the issue.
Severe	Extreme delays of a few years, with potential for the project to be made redundant.

Table 15: Risk Likelihoods

Likelihood	Definition
Rare	Exceptional circumstances, with most projects undergoing their entire lifetime without any of these issues. Less than a 1% chance.
Unlikely	Has the potential to happen but is still more usual to see a lack of occurrence. A 1% to 25% chance.
Possible	Occurs at about an even rate as not occurring across similar projects. A 26% to 55% chance.
Likely	Typically occurs and should be expected to occur at sometime during the project lifetime. A 56% to 85% chance.
Highly Likely	Almost always occurs and will almost definitely happen sometime during the project. Greater than an 86% chance.

Table 16: Risk Level Matrix

	Insignificant	Minor	Significant	Major	Severe
Rare	Very Low	Low	Low	Medium	High
Unlikely	Very Low	Low	Medium	Medium	Very High
Possible	Low	Medium	Medium	High	Extreme
Likely	Low	Medium	High	Very High	Extreme
Highly Likely	Medium	Medium	High	Extreme	Extreme

Table 17: Risk Assessment

Project Hazard	Risk	Likelihood	Consequence	Risk level	Mitigation	Residual Risk
Battery system	Thermal runaway in battery	Rare	Major	Medium	Implement regular checks and maintenance	A hidden or sudden fault could still arise.
Land forming	Unexpected land characteristics	Unlikely	Major	Medium	Do feasibility studies before construction.	Unexpected or unique land issues might remain.
Construction	Pollution or weather affecting the amount of sun you get	Rare	Major	Medium	Consultation of specialists and considerations of existing projects to be built around the area.	Global issues such as global warming and climate change still exist.
Solar panels	Supply shortage	Unlikely	Major	Medium	Extensive research on suppliers beforehand and the formulation of a contingency plan.	Unexpected logistical issues or global pandemics could still pose a risk.
Large land size	Theft of equipment	Unlikely	Minor	Low	Preventative measures	Theft on a smaller

					such as security personnel and barriers.	scale and lower frequency might still occur.
Social responsibility	Protests against the farm	Unlikely	Significant	Medium	Connect with local stakeholders early on to ensure support.	A misstep during the constructio n process or a change of interest in residents might occur.
High-voltage equipment	Electrocuti on	Unlikely	Major	Medium	Implements safety checks and procedures which all workers have to be trained on and enforce to one another.	Failure in safety compliance or unexpected equipment malfunction could still electrocute workers.
Heavy machinery	Injury by heavy equipment	Unlikely	Major	Medium	Implements safety checks and protocols to follow when operating heavy machinery.	Failure in safety compliance or unexpected situations might still arise and injure workers.

8. Assumptions and agreements

The required legal and licensing agreements for this project are listed below in table 18. These will be necessary to obtain and the project will not be able to go ahead without obtaining these approvals. Additionally, understood agreements of legal requirements to follow are also outlined.

Table 18: Project Agreements

Agreement	Details
Planning Permit [36]	For renewable projects with a capacity over 1 MW, Victoria’s minister of planning will be in charge of assessment and approvals. This falls under the planning and environment act (1987), and is required for all renewable plants.
Flora Removal Permit [37]	A permit should be obtained from the local council to ensure that the vegetation removal and its damage mitigation plans have been approved by a local council or other relevant authority.
Native Vegetation Removal Regulations [37]	When removing flora during the construction phase, it is important to ensure that this is done in accordance with the native vegetation removal regulations. The 3-step approach of avoid, minimise, and offset should also be followed.
Bushfire Management Overlay (BMO) [38]	Given that there is a possibility of bushfires within the region of Kerang, it is advised a BMO also be developed as part of this project. This will need a permit for approval if the selected and approved site is deemed at high risk of bushfires.
Noise compliance [39]	This entails ensuring that noise is limited to the zoning and land use noise limits set out by the Environmental Protection Act. The regular monitoring, assessment, and development of mitigation strategies should all be included.
Contamination and Sediment Controls [40]	Controls should be implemented to prevent the contamination of land, air, and water during the construction, lifetime, and decommissioning of the plant. Noise, dust and sediment run offs should also be minimised. This again falls under the Environmental Protection Act.

The assumptions for this project are then listed below in table 19. While these assumptions are still crucial to the plant’s smooth operation, workarounds might still be plausible if any of these assumptions prove to be erroneous within reason.

Table 19: Project Assumptions

Assumption	Details
Energy Prices	The project assumes that average energy prices will remain relatively stable and consistent at $60/MWh throughout the solar farm's lifetime [14]. This stability is critical for ensuring predictable revenue streams and return on investment.
Project Financing	Stable and adequate funding of 100-127.5 million AUD will be provided throughout the project by Acciona, ensuring all development and construction phases are fully financed. Additionally, it is assumed that government incentives, such as grants or tax benefits, will be available to support renewable energy initiatives. Interest free or low-interest loans are also available as an alternative funding source [15].
Grid Capacity	It is assumed that the existing electrical grid has sufficient capacity and stability to accommodate the additional load from the solar farm. This includes the capability to handle both the generation and dispatch of energy from the new infrastructure.
Availability of Workers and Resources	The project assumes that there will be an adequate supply of skilled labour, as well as access to necessary construction materials and equipment, for timely completion.
Proposal Approval	Approvals for the project, including planning and environmental permits, are expected to proceed smoothly, with anticipated timelines for regulatory approval by relevant authorities, including the Australian Energy Market Operator (AEMO), ranging from 3 to 6 months [16].
Design Consistency	No major design changes are anticipated to the plant as any changes to the design would necessitate re-engagement with AEMO and could delay the project.
Solar Irradiance	The project assumes that the chosen location will have high and consistent solar irradiance levels, critical for optimising energy production. While this has been historically true for the chosen area, this assumption extends to any potential changes from atmospheric conditions due to climate change.
Land Suitability	The selected land is assumed to be suitable in land makeup and properties. No toxic chemicals or unexpected erosions are expected, and the project is expected to proceed without major adjustments from land related issues.
Dispatch Energy	The proposal assumes a high frequency of dispatch of energy from the plant as determined by AEMO, contributing to consistent operational efficiency and profitability.

Infrastructure Planning and Land Selection	The solar farm infrastructure is already planned, and the land has been pre-selected. This minimises risks associated with site selection and ensures alignment with both regulatory and operational requirements.
Network Service Provider (NSP) Agreement	AusNet, as the NSP, is assumed to be willing to accept the connection and facilitate grid integration without significant objections or delays [17].
Regulatory Compliance	The project will work closely with AEMO as the regulatory body, assuming a straightforward approval process with minimal additional commissions or regulatory hurdles.

9. Recommendations

Following the review of this proposal, the recommended next steps will be centred around investigating the validity of the project across a myriad of areas.

Firstly, site selection and stakeholder will also play a critical role in the success of this project. Hence, the first recommended course of action will be to contact DEECA to discuss the feasibility of the proposed site. DEECA will provide feedback relating to wildlife management, local regulations, along with guidelines for the project’s development. Additionally, DEECA will connect the company with local stakeholders such as irrigation authorities and local councils. These stakeholders will also play an integral role in the approval of this project and early engagement with these stakeholders will ensure smooth operations.

A feasibility study in terms of land makeup will also be essential to reduce risks and prevent unexpected issues during the construction phase. Investigating the soil makeup and surrounding infrastructure will be of particular importance in establishing the feasibility of the proposed site for such a large-scale project. Consultation with geological and civil engineering experts is also expected as part of this process.

Lastly, considering the financial aspect of this project, it is expected that the entire project cost will stand at 1.3 million AUD for preliminary assessments and approvals, 86 million AUD for design and engineering stages, and 16 million AUD for construction. These costs are given based on the assumption that this project will take no longer than 22.5 months to complete. Based on the current electricity spot market, the solar farm and BESS are expected to generate sizable revenue to allow for efficient recuperations of costs in 5 to 10 years. This makes the proposed solar farm and BESS feasible in terms of profitability, while also offering Acciona the chance to further expand its renewable energy portfolio within Australia. Hence, considering the above, it is recommended that funding, grants, and interest free loans be analysed for their validity and potential risks.

Notwithstanding, with the rise of renewable energy plants, the consistency of energy prices within the electricity market stands as a salient assumption. To counter the potential financial risks from increased electricity surplus, it is also recommended that alternative ways to utilise the projects’ resources be explored. One example of this would be the use of the BESS to stabilise the transmission grid. The intuitive use of the BESS to store surplus electricity before releasing it back into the grid during shortages is the first method of stabilisation. However, additional capabilities such as frequency regularisation for power grids also offer additional streams of revenue which are not at direct risk from the assumption of consistent electricity prices. Thus, investigation into these additional capabilities should also be added to the project scope to lower the risk level of this project.

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11. Appendices

11.1 Appendix A: Work Breakdown Structure (WBS)

The WBS shows the project's key deliverables and tasks breakdown. Refer to the attached PDF – Work Breakdown Structure (WBS) for details.

11.2 Appendix B: Network Diagram

The network diagram displays task dependencies and sequence. See attached PDF – Network Diagram for the complete diagram.

11.3 Appendix C: Critical Path Diagram

The critical path highlights critical tasks affecting project completion. Refer to the attached PDF – Critical Path for details.

11.4 Appendix D: Gantt Chart Diagram

The gantt chart provides a timeline of the project's activities. For full visualisation, refer to the attached PDF – Gantt chart.

11.5 Appendix E: Time Estimates Spreadsheet

The time estimates spreadsheet includes detailed project information, such as the Time to Completion, which calculates the total time required to complete the project based on the durations of critical path activities. It also contains Float Calculations, which identify the float for each task, allowing for flexibility in the schedule. Additionally, the Resource Planning section provides an overview of resource allocation using both ASAP (As Soon As Possible) and ALAP (As Late As Possible) heuristics to optimise resource usage throughout the project. For detailed calculations, refer to the attached Excel sheet – Time Estimates.

11.6 Appendix F: Cost Breakdown Spreadsheet

The Cost Breakdown spreadsheet includes the calculations for the Bottom-up pricing estimate, the sensitivity analysis, cash flow and NPV diagrams, and other technical calculations relating to the requirements of the project. This spreadsheet can be found attached under the excel file – Cost Breakdown.