COVERSHEET

THE UNIVERSITY OF WESTERN AUSTRALIA

Faculty of Engineering and Mathematical Sciences

Assignment, Report & Laboratory Coversheet for Individual & Group Assignment

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SEE OVER FOR INFORMATION ON REFERENCING & PLAGIARISM

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“The appropriation or imitation of another’s ideas and manner of expressing them to be passed off as one’s own”.

(The Macquarie Dictionary, 1981)

Synonyms:

Piracy, copying, forgery, lifting, expropriation, appropriation

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GENG 5505 The Project Management and Engineering Practice

Northern Goldfields Solar Project

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Executive Summary

The Northern Goldfields Solar Project has been designed by Southern Cross Energy (TransAlta) to introduce renewable energy into TransAlta's SCEN network and to facilitate BHP Nickel West's transition to incorporating renewable based energy in the operations under power purchase agreement (PPA) between BHP Nickel West and TransAlta. This Project includes a 27.4 MW solar farm at Mt Keith, and a 10.7 MW solar farm with a 10.1 MW battery storage system (BESS) at Leinster and HV transmission lines that will be connected to the existing TransAlta owned and operated power infrastructure at BHP Nickel West's Leinster and Mount Keith operations. With first 10 years of operation, this project will cut down 540,000 tonnes of CO2 (carbon dioxide equivalent) from Leinster and Mount Keith nickel mines to achieve BHP's scope 2 electricity greenhouse gas emissions.

The project has identified the scopes and defined the project components. The project has progressed well during its development, installation, and commissioning phase. There were some challenges. For example, the site accommodation was a significant unidentified risk, which impacted the project from many aspects like scheduling, financial and management processes. Conversely, the EPC contractor's performance affected the project as they didn't interpret the quality document and engineering design well.

The recommendation will be to reassess the EPC contractor, involve more internal resources to blend the resources, better planning like site accommodation.

Overall, it was a successful project delivering green energy to the BHP mine site by maintaining the safety and producing environment and social benefit to the region. This project will encourage more mining companies to go green as this project will not only save fuel for BHP but also contribute to clean energy.

1. Section A: Case Study Writing Overview

1.1 Stakeholder Identification

The stakeholder identification process is essential to the project, as individual expectations and project objectives can be managed throughout the project life cycle. Knowing the project stakeholders properly and the deliverables to them in a way that keeps them satisfied is efficient and reduces risk to the project. There were both external and internal stakeholders for this project.

Main Stakeholders	Transalta Australia
	BHP Nickel West
Other Stakeholders	Local Aboriginal Community
	Juwi (EPS contractor)
	Stantec (Project Management Contractor)
Internal Stakeholders	Operations Team
	Maintenance Team
	Engineering Team
	NGSP Team
	RCC (Regional Control Centre) Team
	Commercial Team
	Integration Team

Table 1: List of the stakeholders involved in NGSP.

1.2 Risk Assessment

The project identified risks during its development and created a risk register. There are many notable risks, such as heritage artefacts, regulatory changes and policy uncertainty, infrastructure and logistical challenges, fluctuations in construction costs and supply chain disruptions, unexpected site conditions, inadequate system performance, etc.

AH.4401 Northern Gold Solar Project

					Risk Identification	Risk Response Planning, Monitoring & Control						
Risk ID	Originator	Date Initiated	Date Revised	Risk Name	Risk Description (Root Cause)	Response Action	Mitigation Cost ($)	By Who	Due Date	Comp. (Yes/No)	Last Update	Comment Notes
				Latent Conditions								
R.001	Team	3-Jun-21		Heritage Artefacts	Additional heritage sites may be discovered during land clearing.	Detailed heritage survey undertaken with BHP NiW prior to site mobilisation. Heritage clause in EPC Contract to address this risk and process to be followed	$ -	TM	15-Apr-21	No		
R.002	Team	3-Jun-21		Buried/UG Services data verification / up to date	Unknown underground services found during construction. (Only affecting Leinster power station BESS)	Contractor to make allowance for known underground services.	$ -	TM & RW	15-Apr-21	No		
R.003	Team	3-Jun-21		Leinster Switchyard Condition Recommendations	Further testing or commissioning results in Transformer not servicable	Condition assessment completed and identified further works required.	$ -					
R.004	Team	3-Jun-21		Leinster Compound BESS space	Owner removal / relocation costs have not been allowed for.	Clarify and estimate cost of works and make allowance in project budget	$ 100,000					
R.005	Team	3-Jun-21		Unexpected Site Conditions	Unexpected Site Conditions cause delay or additional cost. (Geotech Risk)		$ -					
R.006	Team	3-Jun-21		Contamination	Delay or additional cost due to Contamination, being contamination which occurred prior to the Execution Date, and: •which shares any or all of the characteristics of Pollution; •a legal obligation exists for the Contractor or SCE to remedy or mitigate its effects; and •which SCE determines qualifies as Contamination under the EPC Contract and directs the Contractor to deal with such Contamination. (up to 1 month delay plus clean-up cost)		$ -					
R.007	Team	3-Jun-21		Extensions of Time and Additional Costs	Time and/or cost risk in relation to: •any find of valuable minerals, fossils, articles or objects of antiquity or of anthropological or archaeological interest, treasure trove, coins and articles of value;		$ -					
				COVID								
R.008	Team	3-Jun-21		Commercial Impacts Caused by COVID	COVID -19 Federal and State decisions regarding movement of people	Delay and Cost to COD to be transferred to BHP NiW	$ -	RW	19-Apr-21	No		
R.009	Team	3-Jun-21		FM - Site shut down	COVID infection on site	Delay and Cost to COD to be transferred to BHP NiW	$ -	RW	19-Apr-21	No		
R.010	Team	3-Jun-21		FM - Lack of resources	COVID travel restrictions - post contract NTP	Delay and Cost to COD to be transferred to BHP NiW	$ -	RW	19-Apr-21	No		
				Customer								
R.011	Team	3-Jun-21		Client delays or halts project	Falling nickel price	Payment of ALL COSTS in the event of Termination for convenience by NiW to be covered in the PPA.	$ -	RW	19-Apr-21	No		
R.012	Team	3-Jun-21	######	Customer intrusion	BHP HSEC compliance may not be applicable to TA site; Onerous worksite inspections	Site Safety Management Plan to be agreed with BHP. Confirmmg that BHP will rely on TransAlta to provide any information that BHP may require.	$ -	HG	19-Apr-21	No		
R.013	Team	3-Jun-21		SCE supplied items	Delay or additional cost for a failure by SCE to supply consumables, utilities and items described in Schedule 9 of the EPC Contract.		$ -					
R.014	Team	3-Jun-21		Responsibility Matrix	Obligations that will rest on SCE under the Responsibility Matrix [***Note to NiW:*** *these obligationshisks are not yet known and can be input on completion of the Responsibility Matrix*]							
				Local Community								

Fig1: Project Risk Register (NGSP Project supplied,2021)

1.3 Project Scope

This document defines the SOW for the services, equipment, documentation, training and associated works to be provided by Contractor which includes two high penetration Solar PV systems, a Battery Energy Storage System (BESS) and associated transmission lines. The project scope included but was not limited to the definition of works, principal (Transalta) supply, contractors' scope of supply, regulatory approvals, interface

connection points, and supply limits. The project contractor will deliver the contract on an EPC and turnkey basis. In addition, the contractor shall provide project management, engineering management and safety management for the works. The project management plan includes quality, environment, traffic, and commissioning. The technical requirements like civil, electrical, and testing have been described in the document as a guideline for the EPC contractor. The main scope was 27.4 MW solar farm at Mt Keith, and a 10.7 MW solar farm with a 10.1 MW battery storage system (BESS) at Leinster. The principal has also defined the design requirement, including the control system scope for the solar farm and BESS. In addition, the principal will obtain any regulatory and environmental approval. Another important definition is the battery limits, which specify the work boundaries between the existing plant and the new solar farm project activities. The project appendix also mentioned the refence documents like Australian standard and regulatory requirements.

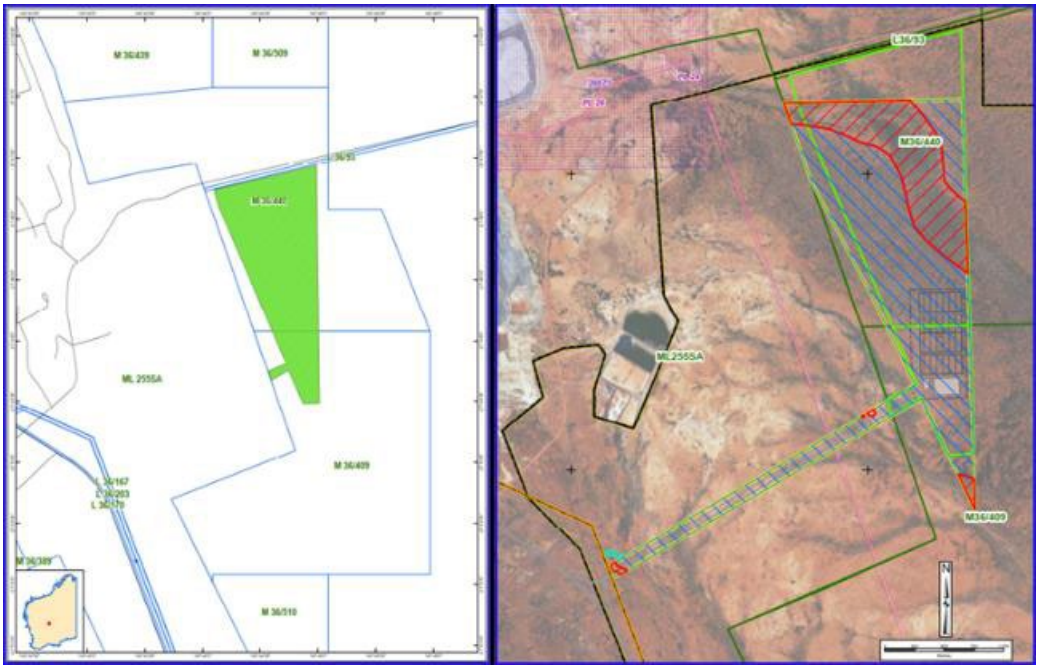

Fig2: Leinster solar firm site location (NGSP Project supplied,2022)

1.4 Project Timeline

The (Northern Goldfield Solar Farm) first solar power in the Perth region was estimated to be completed by the end of 2022. But it was extended, and the practical completion is by September 2023. This project includes different time management tools and techniques, including WBS and Gantt charts. WBS (Work Breakdown Structure) is an activity list of what work has to be performed throughout the project. This project starts with activities such as FID/AFE approval, Issue of LNTP, Design, and milestones such as All permits and approval received, Design Review, and many more. After identification of all the activities, the next step is to estimate the activity duration or work period required to complete the activities. Design activity is estimated to be completed in 182 days, as indicated in the Gantt chart of the project. The Chart monitors the start-and-finish relationship between the activities and the completion percentage.

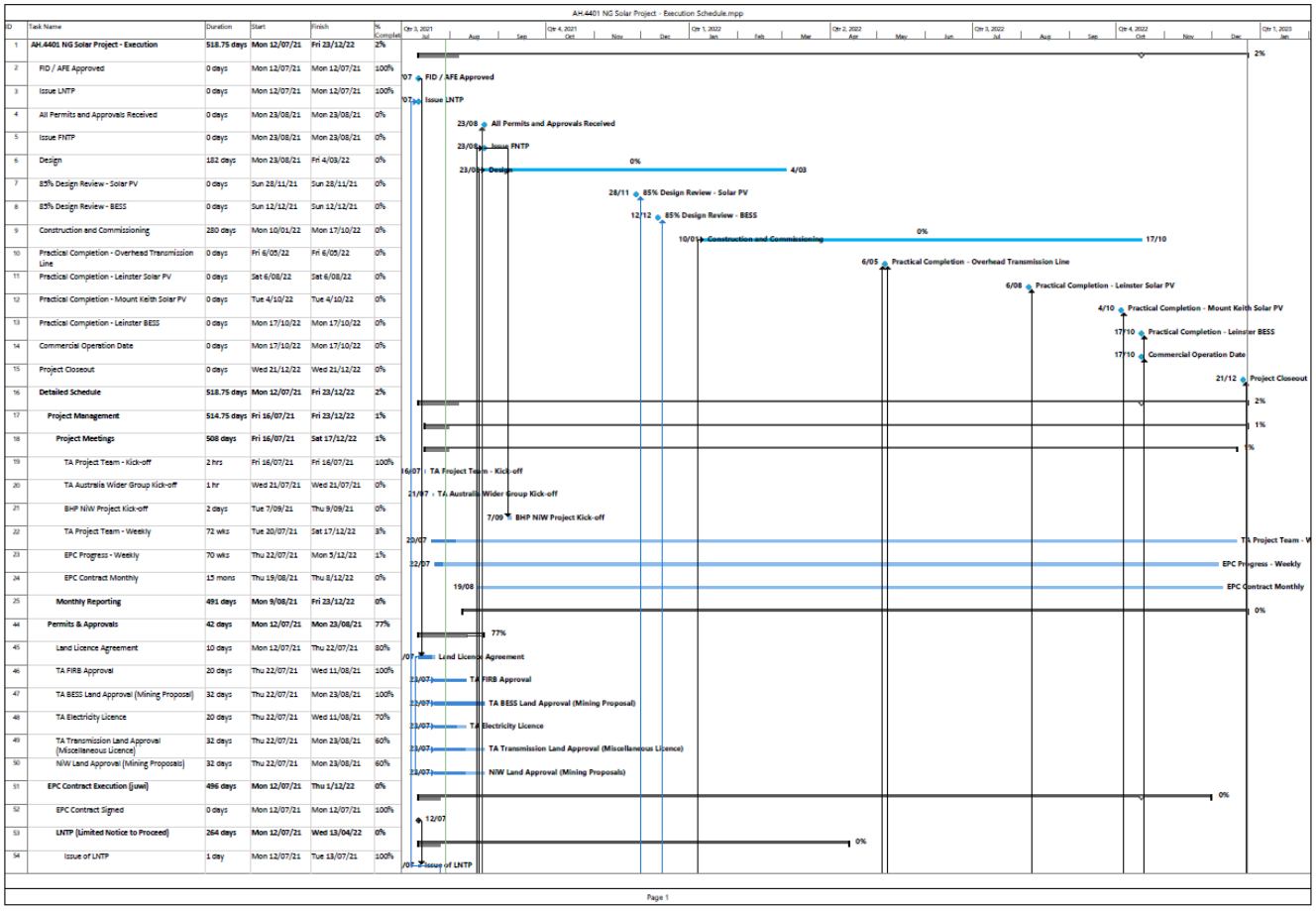

Fig3: Project Gantt chart (NGSP Project supplied,2022)

1.5 Project Cost

The project cost forecast has been created and updated occasionally to keep the record. The Estimated cost of the Northern Goldfields Solar Project is $73 million, and the Actual Value (AV) of the project is confidential. It will comprise a 38.1 MW solar farm and 10.1 MW/5.4 MWh battery energy storage system at Leinster. Solar Choice has live quote pricing data for 1MW systems across all states of Australia. As an indicative guide, 1MW solar power systems can start as cheap as $1,100,000. The project's estimated cost is based on current market conditions and historical trends; the budget also includes future salary increases, new equipment purchases, and other charges that still need to be confirmed. If there are any changes in the purchase order, a recommendation for change approval shall be prepared by the Project Area Lead initiating the change request, and the project manager will approve it after following the project cost control process.

Change Orders	1st Approval / Initiator	2nd Approval	3rd Approval	4th Approval
Budgeted Item	Project Engineer/Site Manager	Project Manager	Project Director	
Non-Budgeted Item	Project Engineer/Site Manager	Project Manager	Project Director	Steering Committee

Table2: Project change of management approval stages (NGSP Project supplied,2021)

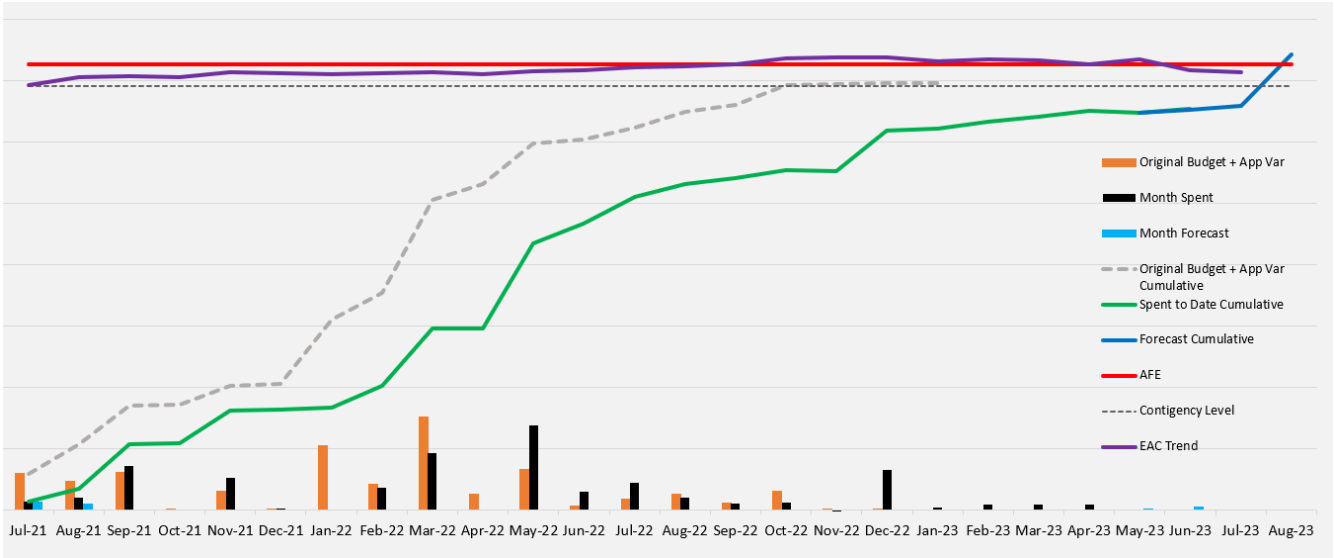

Fig4: Cost graph (Sensitive information has been removed and left blank,NGSP,2021)

1.6 Procurement and resources

Procurement Management includes conducting procurement planning activities that result in a contract being awarded. The horizon of work and specifications comes under the project principal Engineer and Manager with the assistance of the owner's engineer. The Engineering, Procurement and Construction Contractor (EPC) supplies the equipment for work and materials. The supplies provided by the contractor are to be approved from a 'Manufacturers list of Potential Suppliers'. There is an agreement that contains all the things a contractor can supply according to the project and EPC contractor scope. The project committee always has the upper hand over all procurement activities, cost allowance and specifications. In this project, HR refers to the department responsible for developing and maintaining individual and team performance. In addition, HR plays a vital part in ensuring that the project's human capital is successfully managed, motivated, and engaged to contribute to the Northern Solar Goldfield project. This includes finding and hiring qualified people to fill positions on the project team, from engineers and technicians to administrators. Moreover, it helps to make good employee relations by handling issues, resolving disputes, and promoting a positive work environment to keep employees motivated and productive.

1.7 Communication

A comprehensive communication plan aims to engage stakeholders, build trust, and ensure transparency throughout the project lifecycle. Communications management includes the processes required to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. The project team has developed a communication plan between the internal and external stakeholders. There are two separate communication matrixes developed. One is between the project team and the EPC (Engineering, Procurement and Construction) contractor, and the second is between the project team and the BHP NiW. The communication matrix shows the project role, responsibility, contacts, and email addresses for effective and efficient communication.

Energising the future. Date: December 2022 Doc ID:	Project No.:	Document Submittal	PQ / TQ	Reporting	Schedule	Commercial / Contractual Correspondence	Variation Orders	HSE	HR	Indigenous Affairs	Mobilisation Requests	NORTHERN SOLAR GOLDFIELDS PROJECT STAGE 4 - EXECUTION NiW COMMUNICATION MATRIX	
Role	**Project Personnel**											**Email**	**Mobile No.**
Group Manager of Projects		x	x	x	x	Cc	Cc	Cc	Cc	Cc	x		
Project Manager		Cc	Cc	To	To	To	To	To	To	To	Cc		
Engineering & Technical Governance		Cc	Cc	Cc	x	x	x	x	x	x	x		
Engineering Manager		Cc	Cc	Cc	Cc	x	x	Cc	x	x	x		
Senior Project Engineer/Controller		Cc	To	Cc	To	Cc	Cc	Cc	x	To	Cc		
Project Engineer		Cc	Cc	Cc	Cc	Cc	Cc	Cc		Cc	Cc		
Senior Contract Administrator		x	x	Cc	Cc	Cc	Cc	x	x	x	x		
Project Administrator/Document Controller		To	Cc	Cc	Cc	Cc	x	x	Cc	Cc	Cc		
Site Administrator		Cc	Cc	Cc	Cc	x	x	x	Cc	x	To		
HSE Manager		x	x	x	x	x	x	Cc	x	x	x		
HSE Adivsor		x	x	Cc	x	x	x	To	x	x	x		
Site Manager		x	x	Cc	To	x	Cc	To	Cc	Cc	Cc		
Senior Electrical Supervisor		x	x	x	Cc	x	Cc	Cc	x	x	x		
Senior Site Supervisor		x	x	x	Cc	x	Cc	Cc	x	x	x		
Senior Electrical Supervisor		x	x	x	Cc	x	Cc	Cc	x	x	x		
Senior Electrical Supervisor		x	x	x	Cc	x	Cc	Cc	x	x	x		
Integration Manager		x	x	Cc	Cc	x	x	x	x	x	x		
Integration Coordinator		x	x	Cc	Cc	x	x	x	x	x	x		
Project Accountant		x	x	x	x	x	x	x	x	x	x		
Accounts		x	x	x	x	x	x	x	x	x	x		
Project Email		x	Cc	Cc	Cc	Cc	Cc	Cc	x	Cc	x		
Role	**NiW Personnel**											**Email**	**Mobile No.**
NOPS Project Representative		To	Cc	To	To	Cc	To	To	To	To	To		
Lead Principal Energy & Utilities		x	x	To	Cc	To	To	Cc	Cc	x	x		
Energy Specialist		x	x	Cc	Cc	Cc	Cc	x	x	x	x		
NES HV Electrical Engineer		x	To	Cc	Cc	x	x	Cc	x	x	x		
NOPS Specialist Project Delivery		x	To	Cc	Cc	x	x	Cc	x	x	Cc		
NOPS Integration Engineer		x	To	Cc	To	x	x	Cc	x	x	Cc		
		x	x	x	x	x	x	x	x	x	x		

Fig5: Project communication matrix (Sensitive information has been removed and left blank, NGSP, 2021)

The project team also created a RACI (Responsible, Accountable, Consulted and informed) Matrix. A RACI chart is a matrix of all the activities or decision-making authorities undertaken in an organisation set against all the people or roles.

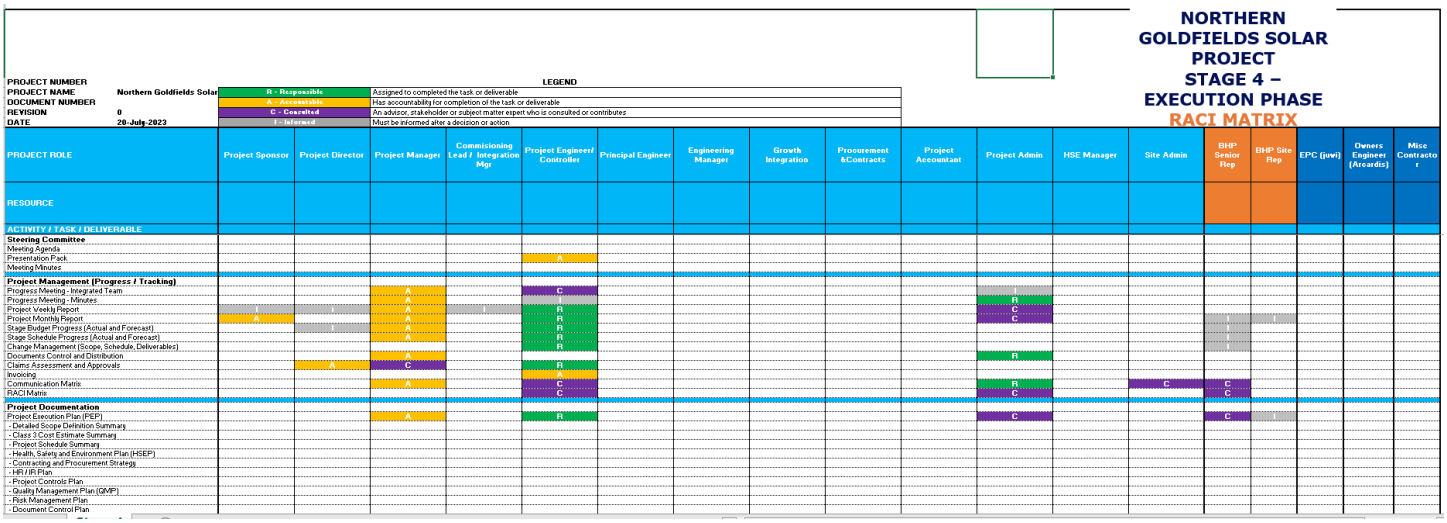

Fig6: RACI Matrix (Sensitive information has been removed and left blank, NGSP,2021)

1.8 Integration

Integration management includes the processes required to integrate and balance the project management knowledge areas—scope, time, cost, quality, communications, human resources, risk, procurement and stakeholders— throughout the project. It's an essential component of project management to ensure that all project parts interact in a symbiotic and seamlessly. Project managers must identify and address potential conflicts, gaps, or overlaps between project components to effectively manage project integration. That involves creating a project charter, designing a project management strategy, and continuously monitoring activities throughout the project's lifecycle. Moreover, it includes tracking progress, managing changes, resolving issues, and ensuring deliverables meet required standards. The final step is project closure, which involves organising activities, conducting a last review, and documenting lessons learned. These steps ensure all project components are concluded and any remaining tasks or documentation are handed over to stakeholders.

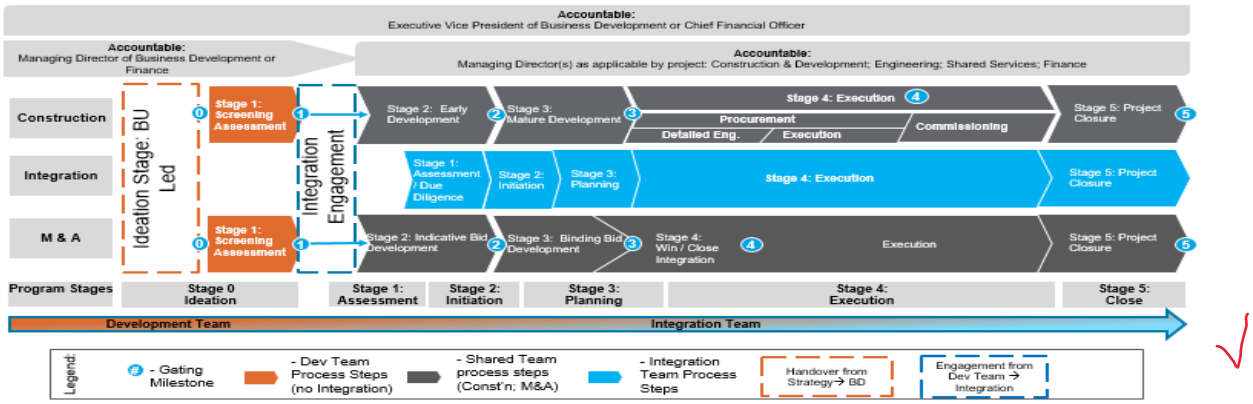

Fig7: Execution Plan (NGSP Project supplied,2021)

The Integration Manager supports the completion of the actions within the Integration Management Plan through consultation, coordination of resources and actions at weekly meetings and reports progress the Project Manager.

2. Section B: Case Study Analysis

2.1 Introduction

The case study analysis section identifies and analyses primary project management competencies applicable to the NGPS. Any early detection of the project management issues assists with rectifying the loopholes and protecting the project from severe consequences. This analysis not only involves the project's drawbacks but also expresses the positive manner of project management. This helps to understand the factors contributing to a successful project.

The case study has been completed based on the information provided by the NGSP project team and from the snapshot of an interview provided by the project director. In addition, the project management theories also supported the firm's performance analysis, blending project management reality and the underlying theories. The key areas discussed are scope management, stakeholder management, procurement, time management, cost management, risk management, quality control and management, communication management, environmental, economic, and social. The primary goal of this case study exercise is to learn about suitable project management methods and practices to implement in real-life scenarios.

2.3 Scope Management

As this is an EPC contracted Project, the scope management depended on the performance of the EPC contractor Juwi and the scope of work defined by Transalta. The principal has well-defined the scope of work and imposed a performance guarantee for both the design and installation of the Solar PV and BESS components of the scope and the general performance of the EPC Contractor. The principle has also introduced management of change (MOC) to establish the process tools that will be used to identify and manage changes in the Project forecasted scope during the execution of the Project. The project scope has mostly stayed the same over the project's life cycle as the SOW has been well defined, including design, technical specification, critical path, site location, and other essential criteria required for this Project.

In some cases, the EPC contractor couldn't interpret the scope of work and required additional explanation, answering TQ (Technical queries), and supporting documents to prevent any variation from SOW. In addition, some of the clauses and material specifications needed to be more balanced and attract unnecessary expense for the Project. The project team has negotiated with the EPC contractor to mitigate those issues.

2.4 Stakeholder management

Stakeholder management is a crucial part of the project. Northern Goldfield Solar Project has different stakeholders. The primary stakeholder of this project is BHP and Transalta Australia, and the other stakeholder is the local Aboriginal community, Stantec and more internal stakeholder. The stakeholders were informed about the project milestones, timelines, changes, completion percentages, variations, and issues in daily meetings with internal stakeholders and weekly meetings with other stakeholders. Stakeholder needs and priorities can change quickly, so daily meetings enable project teams to adapt their strategies in response to evolving stakeholder requirements, ensuring continued satisfaction and keeping track of any changes in the project. They engaged BHP and the customer site team with the project updates. The project team created a RACI (Responsible, Accountable, Consulted, and Informed) Matrix. The RACI model is commonly used to clarify decision-making roles within a project or process to prevent confusion. They also keep good relations with the Aboriginal community to address their concerns, implement measures to minimize negative impacts and promote sustainability, which helps keep their habitat safe. Effective stakeholder management contributes to the overall success and sustainability of the Northern Goldfields Solar Project.

2.4 Procurement Management

Juwi is a renewable energy company specialising in developing and implementing projects related to solar, wind, and hybrid energy systems. The EPC of the Northern Goldfield Solar project is assigned to Juwi. The EPC (Engineering Procurement Construction) refers to the full range of services involved in designing, procuring materials, and constructing a project. The scope of this project is well-defined. The main agreement is between TransAlta and BHP Nickel West for this project, as this renewable energy will be mainly used for mining. TransAlta has partnered with Stantec to provide consultancy for managing the Northern Goldfield Solar Project. Juwi has carefully managed to get everything needed for the Northern Goldfields Solar Project. They planned things well, picked suitable suppliers, ensured contracts were appropriately handled, and maintained communication going because this project was a success. communication going because this project was a success.

2.6 Time Management

Effective time management is a crucial part of any project. It involves allocating time for tasks and deliverables to meet deadlines efficiently by scheduling and monitoring project stages. Prioritizing tasks, setting realistic timelines, and adapting them as needed are

critical strategies for successful time management. The Northern Goldfield Solar Project was due to be completed by the end of 2022, but since that couldn't be achieved, the timeframe got adjusted to finish by September 2023. As the project was being developed under an Engineering, procurement, and construction (EPC) contract, Juwi (EPC contractor) was responsible for the project's schedule. An EPC contract requires a contractor to provide an entire facility to the developer within a set period and cost to the company while maintaining specific criteria.

The major delays occurred when the contractors exceeded the time limit for examining engineering drawings and creating quality standards documentation. The contractor didn't realize the requirement for quality documents and didn't have enough quality engineering resources to complete the milestone in time, creating significant delays in the project. In addition, the principal did not consider the accommodation facility during the project's early stage, which restricted the number of workers who could work at a time. The project was being developed remotely; the contractors had difficulty lodging on-site construction employees. It required to rationale the contractor worker to manage the accommodation issues to be within the limit. The factor also impacted the delay of the overall project schedule.

2.7 Cost Management

Cost management is a critical facet of project management. Estimating, planning, monitoring, and controlling expenditures to ensure they stay within authorized budgets are all part of a productive project. It entails project cost estimation, budget creation, and expenditure management. Project teams improve financial efficiency, avoid overspending, and assure project completion by precisely monitoring expenses.

Although the actual value (AV) of the Northern Goldfields Solar Project is confidential, the estimated cost is around $73.4 million. The management team performed a commendable job with the cost estimating because the projected cost was seldom revised during the project. The predicted cost considered current market conditions, historical patterns, potential pay increases, and new equipment acquisitions. Suppose there were any modifications to the purchase order. In that case, the Project Area Lead initiating the change request would create a recommendation for change approval, which the project manager would approve after following the project cost control process. The project's cost reporting was extremely well defined, and the procedure included precise methods to guarantee that the budget was not exceeded. A few variations were absorbed by the NGSP team, which were within the tolerable range for a large-scale project and were managed

by the structured management of change (MOC) process. In addition, there was a budget execution forecast document that was reviewed promptly, well-tracked and reported to the leadership team.

2.8 Risk Management

Risk management in Transalta's Northern Goldfield project includes identifying, assessing, mitigating, and monitoring potential risks that could impact the project's success. They created a document called a risk register to identify and manage risks. Within the project, fatality risks are governed by mandatory minimum performance requirements for risk management. TransAlta has a dedicated EHS team has helped in various ways in this project to protect their employees from potential harm. They conduct meetings every week to discuss and track potential risks. The management keeps a close watch over their weekly meetings, ensuring that they evaluate any potential project risks and how they face or come across those risks. Constantly monitoring and tracking the influence of risks is their responsibility. They aim to increase the effectiveness of risk management. They came together to find and understand the potential dangers. They created a list of possible hazards and risks after evaluating the situation. The risk management plan helped the NGSP to resolve many potential issues in the early stages of the project like opposition by local community and stakeholders, COVID, regulatory requirements, resources, industrial relation, EPC price and so on.

One major problem the project was the on-site accommodation issues, which affected many parts of the project. The risk presented in the limitation of accommodation space went unnoticed during the early stage of the project. They realized the risks involved in advanced stages of the project and the risk management activities.

2.9 Quality Control & Monitoring

Quality management plays a vital role in this project, mainly to ensure the successful implementation and operation of the project. Quality management in the Northern Goldfields project includes project planning and objectives, compliance, documentation, reports, inspection, continuous performance monitoring, and stakeholder engagement. Transalta, the leading company, had to use an engineering, procurement, and construction (EPC) contract in this project. They kept important documents of good quality, such as ITP (inspection and test plan), SAT (site acceptance test), and FAT (factory acceptance test). Furthermore, they hired a team for the site activities to monitor the EPC contractor work and associated quality. There are requirements to submit material certificates to

ensure these meet the site specification Australian standards and contain high quality. The main problem they had during quality control was that the EPC contractor needed to clearly understand the scope of work to execute as per the site requirement. This caused project delays but didn't significantly impact the project quality.

2.10 Resource Management

The project team well defined the resources while producing the scope of work documentation. The project encountered losing project resources like people leaving the project as most of the project resources were short term contractual. In addition, the principal company outsourced majority of the project resources.

2.11 Communication Management

Communications Management is required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring and ultimate disposition of project promotion. Communication processes create a bridge across which each stakeholder packs their car with different backgrounds, expectations, expertise, perspectives and interests and travels back and forth, interacting with project objectives delivery and ultimate success. The emphasis is clearly on the project manager communicating with team members and other project stakeholders. The primary forms of communication are Verbal and Non-verbal communication, which consists of writing, reading, listening, and speaking.

The project primarily focused on the communication matrix. It is a document that summarizes the communication management plan for the project. This type of plan helps different teams to stay on the same page of the project and get updated regularly regarding any changes in project scope, stakeholder expectations, timelines and cost. The communications mainly are done in the form of Weekly Meetings, follow-ups, Emails, Presentations, Site Inspections, Statements of Work, and Progress Reports according to the order in the matrix. Public Disclosures are carefully managed and only done by authorized spokespeople through interviews, speeches, media, and articles.

2.12 Environmental

While initiating a project, NGSP assessed and acknowledged the impacts that might have on the environment. The project team took care of any loss harmful effects on the ecosystem and local people. The NGSP has pre-planned the project's concept stage, along with authorized environmentalists, government officials, and locals who can give their

insights on how the project affects the environment. The project team had secured clearance from the local government environment department.

Moreover, Western Australian government guidelines were followed while clearing native vegetation for construction purposes. The northern goldfields solar project, which will replace power currently supplied by diesel and gas, will help BHP Nickel West to reduce Scope 2 greenhouse gas emissions at its Mt Keith and Leinster operations by 12 per cent, resulting in an estimated reduction of 54,000 tonnes CO2-e per annum over the first ten years of operation.

2.13 Economic

The Northern Goldfields solar project is expected to benefit the region in several ways. There will be an increase in employment opportunities due to the construction and operation phases of the project. The project's construction, design and maintenance requirements will be made necessary by qualified staff, technicians, engineers and labourers. This employment boost has a positive impact on the region's economic activity, providing stable income to communities and strengthening them. Local economies may be stimulated by the investment of project funds in their resources, materials and services. The supply chain engagement of the project results in increased revenue for local enterprises, which supports growth and resilience, from procuring solar panels and other equipment to hiring local suppliers. The reputation of this region could be enhanced by the Northern Goldfields Solar Project's ecological friendliness, and it might attract Eco-conscious tourists. In turn, this influx of visitors could positively contribute to the continued diversification of the economic landscape with respect to hospitality, retail and entertainment. Its economic benefits include creating jobs, stimulating local economies, reducing energy costs, improving regional image and attracting sustainable investments. It must be borne in mind that, due to the various factors such as project size, location, financing arrangements, municipalities' regulations and broader economic context, the actual economic benefit of each particular Solar Project depends on various factors.

2.14 Social

The promise of several significant social benefits for the local community can be seen in the Northern Goldfields Solar Project. The project could reduce unemployment and raise household incomes by generating employment opportunities during the construction, operation, and maintenance. It can provide community members with valuable expertise in renewable energy technologies, increase their employability and foster a sense of

empowerment through skill development initiatives. The local economy can be strengthened by the project's involvement with local suppliers and businesses, resulting in increased revenue and development within the community. In addition, the initiative's emphasis on renewable energy education can raise awareness of sustainable practices, inspire environmental behaviour and encourage a greener lifestyle in the community. This project may contribute to the overall well-being of the public as it promotes healthy lifestyles through reduced emissions and improved air quality. Moreover, as a platform for mutual engagement and dialogue on energy transition and the environment's responsibility, the project will be able to develop more solid social links and a shared sense of purpose within the community. The Northern Goldfields Solar Project has the potential to deliver a series of positive societal implications, such as supporting business stability, promoting Community empowerment, protecting the environment and a shared commitment towards sustainable development.

3. Section C: Recommendations

3.1 Scope Management

As they are facing difficulties in interpreting the SOW, we recommend they enhance clear and open communication channels between TransAlta and the EPC (Engineering Procurement Construction) contractor. Regular meetings can minimize misunderstandings and reduce the need for more clarifications. The Northern Goldfield Solar Project has a tightly defined scope which sets clear boundaries and expectations for what the project will deliver, which is crucial for its success. But it should not be overly restrictive. Further refine the scope of work documentation, including all the material specifications, to make sure of clarity and balance. The WBS Dictionary serves as a crucial complement to the Work Breakdown Structure (WBS) Within it, you'll find detailed descriptions of each work breakdown activity, offering insights into the specific scope of work, the resources required for execution of the task, responsibilities assigned to team members, and any dependencies with other project elements. This document significantly enhances clarity by providing a comprehensive reference, ensuring that all EPC, including project teams and sponsors, have a precise understanding of the scope of the project. A well-defined scope reduces the potential for misinterpretation and excessive expenses. These recommendations will help to maintain a well-defined scope, reduce potential disputes, and ensure smoother project execution.

3.2 Procurement Management

Value-adding function that focuses on the efficient attainment of goods, services, or results that deliver a number of very specific and measured benefits to the project. Given Juwi's specialization in renewable energy, prioritizing sustainable procurement practices by considering eco-friendly materials is recommended. By emphasizing the use of environmentally friendly materials in their projects, Juwi can further reduce their carbon footprint and enhance the overall sustainability of their operations. This approach involves sourcing materials that have a minimal environmental impact, such as those with lower carbon emissions during production or longer lifespans, contributing to the longevity and eco-friendliness of renewable energy systems. Sustainable procurement not only demonstrates a commitment to environmental responsibility but also ensures that Juwi's projects remain in harmony with their core mission of promoting clean and sustainable energy solutions for a greener future.

Additionally, prioritizing sustainable procurement practices by considering eco-friendly materials can also have positive economic and reputational effects for Juwi. By utilizing materials with reduced environmental impact, they may benefit from potential cost savings in the long run, as eco-friendly materials often have lower operational and maintenance costs. Moreover, embracing sustainability in procurement can enhance Juwi's reputation as an environmentally responsible company, attracting environmentally conscious clients and investors. It can also position Juwi as a leader in the renewable energy sector, setting a standard for responsible and sustainable business practices. In summary, this recommendation not only aligns with Juwi's core values but also offers the potential for financial and reputational advantages.

3.2 Time Management

Using project management software such as Microsoft Project or Asana which include functionality for work scheduling, resource allocation, and tracking progress. They could have been used to develop extensive project plans, allocate jobs to contractors, and track their progress in real-time. Improving project time management would include resolving a few important challenges. First, a solid project schedule with realistic dates and milestones should have been in place. Anticipating delays and allocating buffer time for unforeseen events is critical. Collaboration planning frameworks such as Google Workspace or Microsoft Teams might have improved collaboration, particularly during the Engineering phase. These systems enable contractors and project stakeholders to communicate and share documents in real-time. Delays in document review and approval can be avoided with effective communication channels.

The delay caused by Juwi's inability to recognize the need for quality documentation and a plan for worker accommodations emphasizes the significance of competent contractor selection and management. Contractors should be selected based on their track record and ability to meet project deadlines. It is also critical to successfully engage stakeholders. Ensuring that the principal has some control over the project's timetable would have allowed for better time management.

To measure variables such as completion rates, job quality, and timetable adherence, project-specific key performance indicators (KPIs) might have been utilised. Google Analytics or customised project management dashboards might be handy. More comprehensive contract talks and more clearly specified contractual duties might have reduced the loss of control over the timeframe.

3.3 Risk Management

The principal task the project should do is to enhance the risk register by regularly reviewing and updating the current risk records. Make sure to write down all risks, including risks related to accommodation, clearly, with their potential outcomes and how likely they are to happen. The purpose of this report is to provide recommendations aimed at enhancing BHP's risk management approach for the Northern Goldfields project. Specifically, to help them deal with the problems they have found in identifying, evaluating, and reducing risks, majorly when it comes to accommodation issues. They need to establish a separate risk assessment team that especially focuses on accommodation-related risks. This team needs to collaborate with the EHS team and other relevant departments to find and lessen risks associated with accommodations. Moreover, they should create a strong incident-reporting system that helps to ensure that incidents are properly reported, and investigated, and any necessary actions are taken to prevent similar incidents from happening in the future which motivates employees to quickly report any problems with accommodations or safety concerns. By following these recommendations, BHP can make its risk management practices even better, especially when it comes to dealing with accommodation-related problems. This will improve the safety and success of the Northern Solar Goldfield project.

3.5 Cost Management

Resource accommodation planning should be considered. The project encountered inefficiencies due to the lack of onsite worker accommodation planning. To optimize resources and reduce waste, it's crucial to consider accommodation facilities. Cost

management of the project was very well executed from the conception till the realization of the project. What little deviations there were handled by the NGSP team and were controlled using the structured management of change (MOC) procedure since they were within the acceptable range for a large-scale project. A budget execution projection document was also there, and it was swiftly evaluated, carefully monitored, and reported to the leadership team. However, there is always potential for improvement.

Implement a Just-In-Time (JIT) approach to housing workers, reducing the need for costly FIFO (Fly-In-Fly-Out) arrangements. Earned Value Management (EVM) can add weight in the process. The project can continue to use EVM methodologies to assess project performance. The EVM framework guarantees effective resource allocation and assists in proactively resolving any budget overruns. Moreover, cost contingency can be adopted by allocating a portion of the budget to contingency reserves for unexpected expenses. This will provide flexibility in addressing unforeseen costs without impacting the project's financial health. There are some other ways the cost can be controlled like contributing different amounts of funding, measuring costs differently, reporting costs in different ways, and controlling costs at different times.

3.6 Quality & Control Management

Clear project objectives and quality standards can be established and make sure that all the stakeholders have a common understanding of the quality and control management of the project. In addition, a quality management strategy can be deployed to outline the processes, procedures, and the responsibility throughout the project lifecycle. The project can adopt the quality road map like quality planning, quality assurance, quality control, and continuous improvement. Quality planning can include reviewing scope document, detailed product descriptions, and technical specification. In addition, the project can align with the current business quality policy and supporting processes.

The quality assurance can add business rules and operational definitions, appropriate internal systems, processes to eliminate waste, variation and excess, regular meeting of the quality team members, scheduled and/or random quality audits, ISO standards (i.e. Quality management practices (9000), Environmental management (14000), Social responsibility (26000 series) in conjunction to the Australian standards (GENG5505 lecture).

The quality control can be achieved by peer reviews, physical inspection, control charts, scatter diagrams, checklists, pareto diagrams, statistical sampling, flowcharts, cause and effect diagram and, trend analysis.

The continuous monitoring can be obtained by regular performance reporting, meetings and debriefs, decision gates and approval processes, walkthroughs and peer reviews, scenario analysis, evaluation reports, suggestion boxes, and user feedback.

3.7 Communication Management

Establish regular communication channels to keep them informed of project updates, milestones and potential impacts and maintain a high level of transparency throughout the project. Detailed project information, including environmental assessments, and schedules can be shared to build trust and credibility with stakeholders. The Northern Goldfield Solar Project is a major undertaking with unique communications management requirements. Identify and involve all relevant stakeholders. Develop a community engagement plan that includes meetings and information sessions. Make security a priority by implementing clear communication protocols. Regularly update stakeholders on security measures and incident reporting. Publish regular progress reports to inform stakeholders of project milestones, timelines and plan changes. Create a project website or social media channels to easily access project updates, documents and contact information. Communication primarily takes the form of weekly meetings, follow-ups, emails, presentations, site reviews and progress reports. Monitor and respond to online discussions and concerns. Create feedback mechanisms. Encourage stakeholders to provide feedback and actively listen to their concerns and suggestions.

3.8 Stakeholder Management

By effectively managing conflicts, project teams can maintain harmony, minimize disruptions, and keep the project on track, ensuring stakeholders' concerns are appropriately addressed. The stakeholder management plan must be documented in a suitable format that can be readily disseminated, tracked, and updated, as the project progresses, to all who need it. These are some stakeholder management techniques they can utilize for the Northern Goldfields Solar Project.

The stakeholder management of the Northern Goldfield Solar Pct is properly executed with RACI matrix and good transparent communication by doing regular meetings with

the stakeholders. We specifically recommend implementing a formal feedback system to gather input and concerns from stakeholders regularly. This can be done through surveys, feedback forms or any other methods. They can use this feedback to adapt project strategies as needed. Building trust with stakeholders is essential for a successful project. It involves consistently delivering on promises, maintaining transparency about project challenges, and demonstrating a genuine commitment to their interests.
In addition, a well-defined conflict resolution plan is critical. It provides a structured approach for addressing disputes or disagreements that may arise among stakeholders. This plan should outline clear processes for conflict identification, resolution steps, and escalation procedures for unresolved issues.

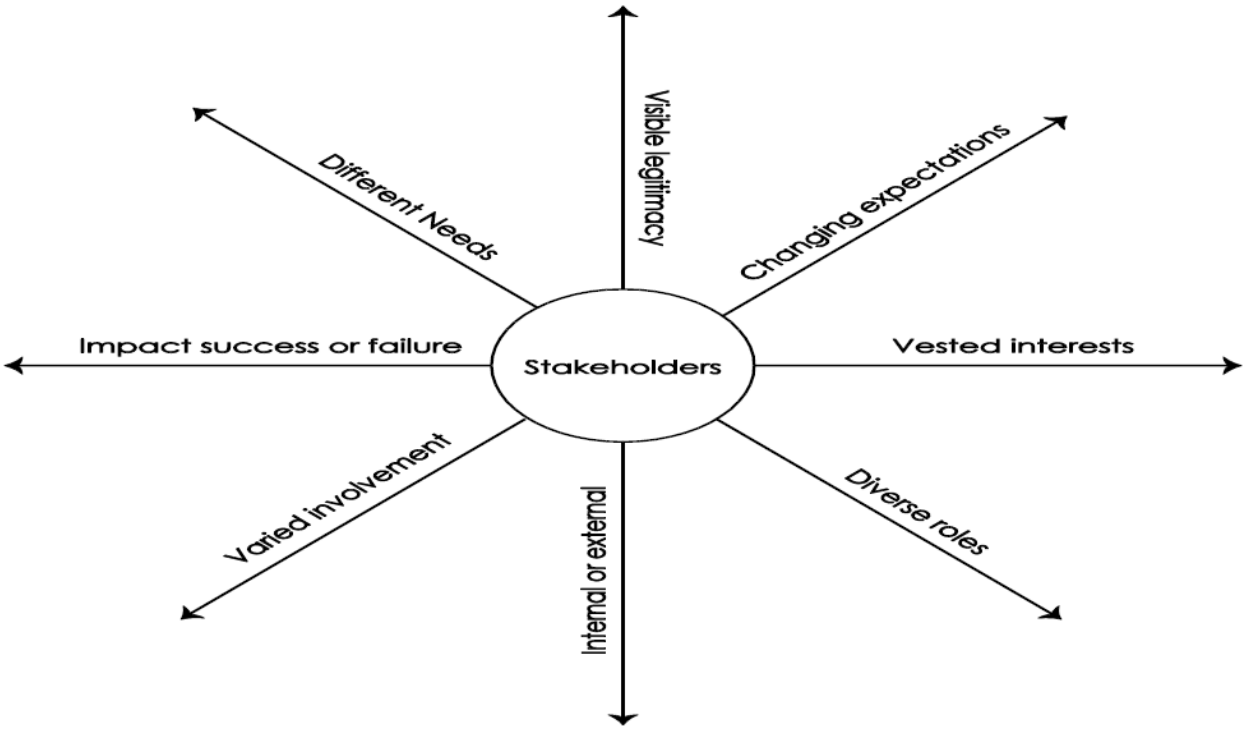

Fig8: The challenges of stakeholder management (GENG5505 lecture)

4. Conclusion

The NGSP project is a major renewable project for BHP to go green and reduce the carbon emission. The project had a kick start with a good project management plan specially scope of work and the risk assessment. In terms of quality, safety and scope, the project team dealt effectively. It was well defined the roles and responsibilities of all project

stakeholders and to determine the decision-making structure for the project. But being an EPC contracted project, the project schedule was controlled by the EPC contractor rather than the principal company. There was a delay in the project because of the onsite accommodation limitation and the EPC contractor performance. The accommodation issue significantly impacted the project in all aspects. The EPC contractor could be assessed more closely before awarding the project. The principal company heavily relied on external resources and contracted positions for project management and project execution which limited the schedule control over the project. Although, there are some hiccups in schedule, it was a successful project considering a large-scale renewable project in a mining industry. The project will assist BHP to save on the fuel and maintenance costs in parallel to the environmental benefits.

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Appendices

Appendix A Stages of team development

Forming	1.Introduction to the team members. 2.Understanding each other. 3.Select the project topic after the discussion within the team member. 4.Creating the team ground rules. 5.Prepare the team strategies and recording the MOM. 6.Preparing the Gantt chart to keep record of the project progress.
Storming	1.Team members were not attending the meeting. 2.Team members were not understanding the project and were not spending enough time on the project. 3.The project issues were not provided by the project management.
Norming	1.The team members had realised the importance of the project work. 2.The project information was received as expected. 3.An exclusive interview had been given by the NGSP project director.
Preforming	1.The members started to attend the meetings regularly. 2.The week meetings were conducted in time. 3.Every member contributed as per the work distributed. 4.Every member wrote their part of the report.
Adjourning	The final review has been done after the completion of the project report writing to ensure the report has been done following the marking rubric.

Appendix B Agenda and Minutes

WEEKLY MEETINGS 1			
Meeting Date & Time	2-aug-2023, 6:00pm-7:00pm	Meeting Location	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	Meeting Type	Conference
Minutes Drafted Date	3-Aug-23	Meeting Title	GENG5505 Project Management

Attendees	Apologies
Kawsar Ahmad	Vinayak Gupta
Amit Bhudiya	Geeta Arora
Kanishk	
Malina Jayswal	

Agenda
Selection of one project out of the ones submitted by each team member.

Summary of the Discussion
All Team member has submiited there projects and we have selected one as the Main project and will submit the summary on The Northern Goldfields Solar Project.

Meeting Conclusion
The project report to be done on The Northern Goldfields Solar Project(Southern Cross Energy Partnership)

WEEKLY MEETINGS 2			
Meeting Date & Time	7-aug-2023, 6:00pm-7:00pm	**Meeting**	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	**Meeting**	Conference
Minutes Drafted Date	3-Aug-23	**Meeting**	GENG5505 Project Management

Attendees	Apologies
Kawsar Ahmad	Vinayak Gupta
Amit Bhudiya	Geeta Arora
Kanishk	
Malina Jayswal	

Agenda
Selection of one project out of the ones submitted by each team member.

Summary of the Discussion
The project topic has been discussed and the strategies have been defined.

Meeting Conclusion
The discussion will be on The Northern Goldfields Solar Project(Southern Cross Energy Partnership)

WEEKLY MEETINGS 3			
Meeting Date & Time	14-aug-2023, 5:30pm-6:30pm	Meeting Location	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	Meeting Type	Conference
Minutes Drafted Date	14-Aug-23	Meeting Title	GENG5505 Group C project meeting

Attendees	Apologies
Kawsar Ahmad	
Amit Bhudiya	
Vinayak Gupta	
Malina Jayswal	
Geeta Arora	
Kanishk	

Agenda
To discuss the project report Ghant chart
To dicuss the report first section case study
Dividing the report's first section topic in team members

Summary of the Discussion
Made the ghant chart of the meetings conducted
Divided the topic to each member and they have to write around 150 word
Next week will draft the report first section that is case study

WEEKLY MEETINGS 4			
Meeting Date & Time	21-aug-2023, 5:30pm-6:30pm	**Meeting Location**	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	**Meeting Type**	Conference
Minutes Drafted Date	22-Aug-23	**Meeting Title**	GENG5505 Group C project meeting

Attendees	Apologies
Kawsar Ahmad	
Amit Bhudiya	
Vinayak Gupta	
Malina Jayswal	
Geeta Arora	
Kanishk	

Agenda
To draft a project report
To collect everyone's part in section A and draft case study
Dividing the report's second section topic in team members

Summary of the Discussion
Started drafting project report
Divided the topic to each member and they have to write around 180-200 word
Next week will draft the report second section that is case study analyse

WEEKLY MEETINGS 5			
Meeting Date & Time	29-aug-2023, 5:30pm-6:30pm	Meeting Location	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	Meeting Type	Conference
Minutes Drafted Date	29-Aug-23	Meeting Title	GENG5505 Group C project meeting

Attendees	Apologies
Kawsar Ahmad	Geeta Arora
Amit Bhudiya	Kanishk
Vinayak Gupta	
Malina Jayswal	

Agenda
To merge and discuss about section B Case study Analysis
To draft report further
To discuss how to proceed with Section C Recommandation of the report
To divide the Section c between the team members

Summary of the Discussion

WEEKLY MEETINGS 6			
Meeting Date & Time	29-aug-2023, 5:30pm-6:30pm	**Meeting Location**	Microsoft Teams
Meeting Organizer	Kawsar Ahmad	**Meeting Type**	Conference
Minutes Drafted Date	29-Aug-23	**Meeting Title**	GENG5505 Group C project meeting

Attendees	Apologies
Kawsar Ahmad	
Amit Bhudiya	
Vinayak Gupta	
Malina Jayswal	
Geeta Arora	
Kanishk	

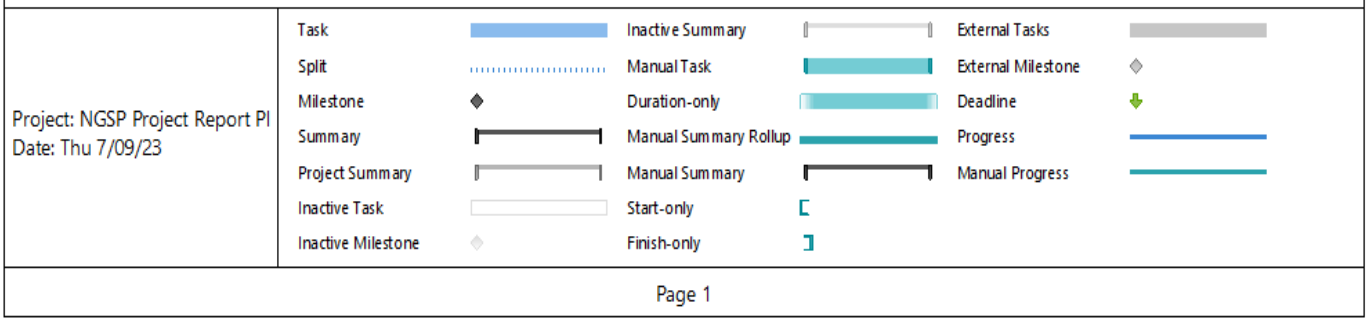
Agenda
To merge and discuss about section C Recommendation
To draft report further
To discuss how to proceed with Presentation of the report
To divide the Presentation between the team members

Summary of the Discussion
Submit all the Presentation slides to Vinayak he will merge the ppt file.
Submit all the presentation recorded clip to Amit he will merge the edit and merge the clip.
Prepare 4 min of video on the presentation.

Appendix C Additional Diagrams and Figures

C.1 Project Gantt Chart

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
0		**NGSP Project Report Plan**	**35 days?**	**Mon 24/07/23**	**Thu 7/09/23**		
1		**Week 1**	**6 days?**	**Mon 24/07/23**	**Sun 30/07/2:**		
4		**Week 2**	**6 days**	**Mon 31/07/23**	**Sun 6/08/23**		
11		**Week 3**	**6 days**	**Mon 7/08/23**	**Sun 13/08/2:**		
16		**Week 4 Case study**	**6 days**	**Mon 14/08/23**	**Sun 20/08/2:**		
17		Stakeholders	48 hrs	**Mon 14/08/23**	**Sun 20/08/2:**		Kawsar
18		Scope	6 days	**Mon 14/08/23**	**Sun 20/08/2:**		Kawsar
19		Time	6 days	Mon 14/08/23	**Sun 20/08/2:**		Amit
20		Cost	6 days	Mon 14/08/23	**Sun 20/08/2:**		Amit
21		Qaulity	6 days	Mon 14/08/23	**Sun 20/08/2:**		Malina
22		HR	48 hrs	**Mon 14/08/23**	**Sun 20/08/2:**		Malina
23		Procurement & contracts	6 days	Mon 14/08/23	**Sun 20/08/23**		Vinayak
24		Risk	6 days	Mon 14/08/23	**Sun 20/08/2:**		Geeta
25		Communication	6 days	Mon 14/08/23	**Sun 20/08/2:**		Geeta
26		Integration	6 days	Mon 14/08/23	**Sun 20/08/2:**		Kanisk
27		**Week 5 Case Study Analysing**	**6 days?**	**Mon 21/08/23**	**Sun 27/08/23**		
28		Introduction	5 days	Mon 21/08/23	**Sun 27/08/2:**	18,23	Kawsar
29		Scope managem	5 days	Mon 21/08/23	**Sun 27/08/2:**	18,23	Kawsar
30		Stakeholder Management	5 days	Mon 21/08/23	**Sun 27/08/23**	18,23	Amit
31		Procurement	5 days	Mon 21/08/23	**Sun 27/08/2:**	18,23	Amit



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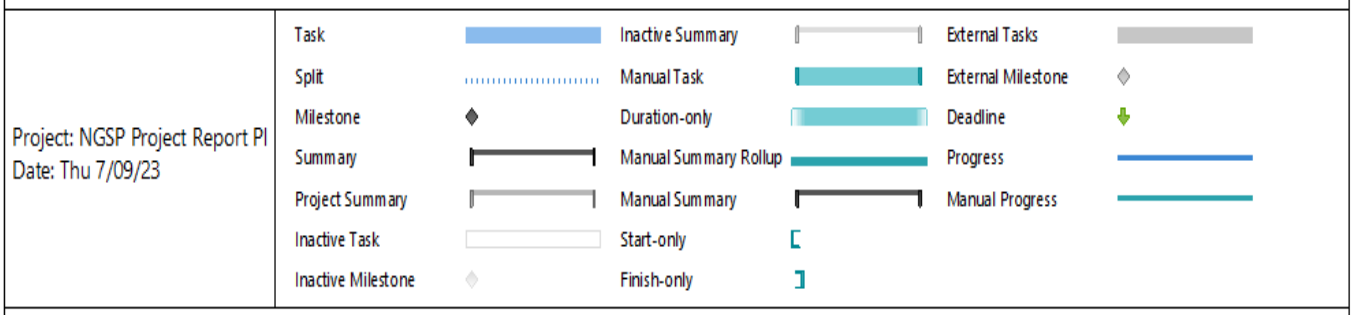
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names	2014	2019	2024 2024
32		Time Manageme	5 days?	Mon 21/08/23	**Sun 27/08/2**		Kanisk			**Kanisk**
33		Cost manageme	5 days?	Mon 21/08/23	**Sun 27/08/2**		Kanisk			**Kanisk**
34		Risk Managemer	5 days?	Mon 21/08/23	**Sun 27/08/2**		Malina			**Malina**
35		Quality control management	5 days?	Mon 21/08/23	**Sun 27/08/23**		Malina			**Malina**
36		Communication Management	5 days?	Mon 21/08/23	**Sun 27/08/23**		Vinayak			**Vinayak**
37		Environmental	5 days?	Mon 21/08/23	**Sun 27/08/2**		Vinayak			**Vinayak**
38		Economic	5 days?	Mon 21/08/23	**Sun 27/08/2**		Geeta			**Geeta**
39		Social	5 days?	Mon 21/08/23	**Sun 27/08/2**		Geeta			**Geeta**
40		**Week 6 Recommendation**	**7 days**	Sun 27/08/23	**Sun 3/09/23**					
45		Scope Managemer	5 days?	Mon 28/08/23	**Sun 3/09/23**		Amit			**Amit**
46		Procurement Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Vinayak			**Vinayak**
47		Time Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Kanisk			**Kanisk**
48		Risk Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Malina			**Malina**
49		Cost Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Kanisk			**Kanisk**
50		Quality & Control Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Kawsar			**Kawsar**
51		Communication Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Geeta			**Geeta**
52		Stakeholder Management	5 days?	Mon 28/08/23	**Sun 3/09/23**		Amit			**Amit**
53		Conclusion	5 days?	Mon 28/08/23	**Sun 3/09/23**		Kawsar			**Kawsar**



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ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
54		**Week 7**	**5 days?**	**Sun 3/09/23**	**Thu 7/09/23**		
58		Review the draft report	4 days?	**Mon 4/09/23**	**Thu 7/09/23**		
59		Lesson learning	4 days?	**Mon 4/09/23**	**Thu 7/09/23**		
60		Project completion	4 days?	**Mon 4/09/23**	**Thu 7/09/23**		

2014 2019 2024 2024

Project: NGSP Project Report Pl
Date: Thu 7/09/23

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	

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