UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

A PROJECT MANAGEMENT PLAN FOR THE CONSTRUCTION OF A SOLAR POWER PLANT FOR THE SURINAAMSE BROUWERIJ TO ACHIEVE A NET-ZERO ENERGY CONSUMPTION

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DEDICATION

I dedicate this work to my wife, Amrapali, who has supported me during the past months with all the time and patience required to create this project management plan, and to my two pets, Rocky† and Sara, for all the love and warmth during my struggling days.

Finally, I would like to dedicate this work to my next generation (upcoming children), and I hope they will also follow the path of university-level education.

Thank you.

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ABSTRACT

The objective of this document is to develop a project management plan for the construction of a solar power plant for Surinaamse Brouwerij N.V. to achieve net zero energy consumption in order to become independent of the local energy supply and, most importantly, towards sustainable and regenerative brewing practices. The current brewery depends on the local energy supply, and during blackouts, a financial loss of $200.000 occurs on a daily basis. Heineken (the mother company) has also set goals for all her breweries to work toward net-zero CO_2 production by 2030 and to achieve many sustainable development goals.

The final product of this project consists of a project management plan for the construction of a new solar power plant. This study is made up of the final deliverables of the project that correspond to the management plans for integration, scope, schedule, cost, quality, resource, communication, risk, procurement, stakeholders, and validation of the project from a sustainable/regenerative development perspective.

The communication and stakeholder management plan will assist the project team in keeping stakeholders interested, informed, and satisfied during the project life cycle. The schedule, scope, resource, and cost management plan define the what, who, and when of the deliverables while integrating the costs of the project. The procurement management plan describes the methods to attain resources, goods, and services for the project. The risk and quality management plan ensures the project team has the tools to ensure the deliverable meets the requirements and how it deals with risks associated with the project. This project management plan serves as a template for future projects.

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ABBREVIATIONS AND ACRONYMS

€: euros

$: US$ dollars

AC: Actual Costs

CARICOM: Caribbean Community

CMP: cost management plan

CMP: Cost management Plan/Cost management plan

CO2: Carbon dioxide

COQ: Cost of quality

COTED: Council for Trade and Economic Development

CRF: Change Request Format

CV: Cost Variance

CPI: Cost Performance Index

EAS: Energy Authority Surname

EBS: Energy Companies Suriname

EPA: Environnemental Protection Agency

EIA: Energy Information Administration

ETI: Environmental Transformation Institute

EV: Earned Value

EVA: Earned Value Analysis

EVM: Earned Value Management

FGP: Final Graduation Project

GHG: greenhouse gas emissions

IPCC: Intergovernmental Panel on Climate Change

KPI: Key Performance Indicator

MDG: Millennium Development Goals

MS: Microsoft

NZEB: Net Zero Energy Buildings

PC: Project Charter

PMP: procurement management plan

PM: Project Manager

PV: Planned Value

QC: Quality Control

QMP: Quality Management Plan

RACI: Responsible, Accountable, Consulted and informed

RMP: Resource Management Plan or Risk management plan

RR: Risk Register

SB: Surinaamse Brouwerij N.V

SDG: Sustainable Development Goal

- SDG 3: Good health and well-being
- SDG 7: Affordable and clean energy
- SDG 8: Decent work and economic growth
- SDG 9: Industry, innovation and infrastructure
- SDG 11: sustainable communities and cities

SDG 12: responsible consumption and production

SDG 13: climate action

SDG 15: life on land

SHMP: Schedule management plan

SMP: scope management plan

SPI: Schedule performance index

STMP: Stakeholder management plan

SV: Schedule variance

TBL: Triple bottom line

WBS: Work breakdown structure

EXECUTIVE SUMMARY

SB N.V., part of the Heineken Company, has a track record of producing high-quality beer products and is a vastly growing company in Suriname. The current production highly depends on the local energy supply, and during blackouts, a financial loss of $200.000 occurs on a daily basis. In 2021, Heineken (the mother company) has set the ambitions for this brewery to work towards net-zero CO_2 production by 2030 and to achieve many sustainable development goals.

Currently, SB has no project management plan for the construction of the solar power plant for this brewery. Around mid-November 2024, the board of directors needs to have a clear plan that needs to be presented to the Heineken Brewing Company to get funding. The company also needs to submit this plan before mid-2025 to the current government in order to get subsidies for achieving its sustainable development goals and commitment to achieve net zero carbon emissions by 2030. The aim of this FGP is to create a project management plant for the SB for the construction of a solar power plant that will eventually guide the project execution to maximize its success chances. Given that the company has had unsuccessful project experiences in the past, the creation and use of a project management plan will help better define project objectives, success criteria, resource allocation, and, in general, everything that is needed for the project's success. Also, this project management plan will become an organizational asset for the company and might be used as the basis for future project plans. The project for the construction of the solar power plant is critical for SB and its mother company, Heineken.

The general objective was to create a robust project management plant for the SB for the construction of a solar power plant that will eventually guide the project execution to maximize its success chances. This plan will serve as an organizational asset and a template for future projects. The specific objectives include developing plans for integration, scope, schedule, cost, quality, resources, risk, procurement, stakeholders, sustainability, and regenerative impact-, schedule-, cost-, quality-, resource-, develop-, risk-, procurement-, stakeholder-, sustainability-, and regenerative impact plan.

The specific objectives were: to develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success; to develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully; to develop schedule management plan to manage the timely completion of the project; to develop cost management plan for effective budgeting and financial control throughout the project; to develop quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant; to develop resource management plan for optimal utilization of resources, including manpower and materials; to develop quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant; to develop resource management plan for optimal utilization of resources, including manpower and materials; to develop a communication management plan, ensuring effective and transparent communication among project stakeholders; to develop a risk management plan, identifying, assessing, and mitigating potential risks that may impact the project; to

develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services; to develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle; and to validate the project from a sustainable/regenerative development perspective.

The methodology for this research was analytic, synthetic, and inductive-deductive methods. The analytic synthetic method was used to break down tasks and integrate them into a coherent schedule, while inductive-deductive methods draw from past project analyses to identify success factors and apply them to the current project.

Analysis reveals that the company's current project management practices lack standardization and formality, leading to frequent project failures. Addressing issues such as scope creep, poor planning, communication gaps, stakeholder disengagement, and unclear objectives is crucial for success. The project management plan for the solar power plant construction comprehensively addresses these factors, providing a roadmap for success.

Two relevant conclusions were drawn after creating this project management plan. It is recommended that SB promptly implements the project management plan for the solar power plant construction. This plan is indispensable for project success, facilitating communication, stakeholder engagement, and effective project management and control throughout its lifecycle. It sets a precedent for future projects, ensuring organizational success and sustainability.

1 INTRODUCTION

1.1. Background

Throughout the past few decades, industries have been one of the prime sectors responsible for a large share of energy demand and greenhouse gas (GHG) emissions worldwide (IEA, 2018). For example, in the United States, the residential sector alone accounts for 21.2% of the national primary energy demand (EIA, 2020) and 15.6% of the total GHG emissions (EPA, 2018).

In Suriname, industries account for 48% of the total energy consumption, and renewable energy technologies such as solar account for only 0.4%. Around 40% of the energy produced still comes from fossil fuels used in diesel generators, while the other 59.6% comes from hydropower. Currently, Suriname faces challenges for the future with regard to energy demand: a growing energy demand on the one hand and a relative lower electricity output from the hydropower plant as a result of extreme droughts (ETI, 2020).

Given the fact that there will be an increased demand for electricity in the near future on the one hand and, on the other hand, the effects of climate change will minimize the potential of the current energy system, the country should commit to a fully sustainable energy system. (IPCC, 2023).

SB is the biggest and largest brewery in Suriname and has committed to having net-zero production by 2030 (SURINAAMSE BROUWERIJ, 2022). To achieve this, they have purchased electric delivery trucks (Surinaamse Brouwerij, 2023) and also installed a solar rooftop in their new office building to become the first net-zero building in Suriname. They

have also increased their energy efficiency by using sub-zero coolers and reducing their CO_2 emissions.

1.2. Statement of the problem

Currently, Surinaaamse Brouwerij N.V. has no project management plan for the construction of the solar power plant for this brewery. Around mid-November 2024, the board of directors needs to have a clear plan that needs to be presented to the Heineken Brewing Company to get funding. The company also needs to submit this plan before mid-2025 to the current government in order to get subsidies for achieving its sustainable development goals and commitment to achieve net zero carbon emissions by 2030.

1.3. Purpose

The aim of this FGP is to create a project management plan for the SB for the construction of a solar power plant that will eventually guide project execution to maximize its success chances. Given that the company has had unsuccessful project experiences in the past, the creation and use of a project management plan will help better to define project objectives, success criteria, resource allocation, and, in general, everything that is needed for the project's success. Also, this project management plan will become an organizational asset for the company and might be used as the basis for future project plans. The project for the construction of the solar power plant is critical for the SB and its mother company, Heineken, for the following reasons:

- Currently, there are no industries in Suriname that are using renewable energy sources for production processes, SB-part of the Heineken Company, wants to be the first company to do this and to set an example for other local companies.
- The current brewery of SB depends on local power supply, during a power blackout, the entire production process lays still, and the company deals with a loss of over €200.000 per day.
- Heineken International has set goals for a lot of their breweries to work towards zero CO_2 net production by 2030 and to achieve many sustainable development goals. To achieve this, new breweries need to have renewable energy sources installed to supply enough power for all production and transportation facilities.

The hypothesis behind this final graduation project is: “The successful implementation of a well-structured project management plan for the construction of a solar power plant will lead to the timely completion of the project, efficient resource utilization, reduced costs, and increased energy output, contributing to the overall success and sustainability of the solar power plant."

1.4. General objective

To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

1.5. Specific objectives

1. To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.
2. To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.
3. To develop a schedule management plan to manage the timely completion of the project.
4. To develop a cost management plan for effective budgeting and financial control throughout the project.
5. To develop a quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant.
6. To develop a resource management plan for optimal utilization of resources, including manpower and materials.
7. To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.
8. To develop a risk management plan, identify, assess, and mitigate potential risks that may impact the project.
9. To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.
10. To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.

11. To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.

2 THEORETICAL FRAMEWORK

2.1 Company framework

In this paragraph, the theoretical framework of the company is described. It consists of the company background, project management concepts, and other applicable theories and concepts related to the project topic and context.

Company Background

The SB is a subsidiary of the Heineken Company, engaged in the production of different types of beers for local consumption and export. The company belongs to one of the vastly growing companies in Suriname. The company has a track record of over 65 years in high quality beer production and started in 2015 to move towards different sustainable and regenerative practices. During the last few years, the company has invested in carbon capture and reuse systems, rainwater collection systems, and wastewater treatment plants to work towards different sustainable development goals (SDGs). In 2023, the company decided to build their own solar rooftop power plant to become the first energy neutral company in Suriname and the Caribbean.

Mission and vision statements

Mission statement: SB has set a mission to work towards zero carbon emission production by 2030 and to become totally carbon neutral by 2040 (Weggemans, 2018).

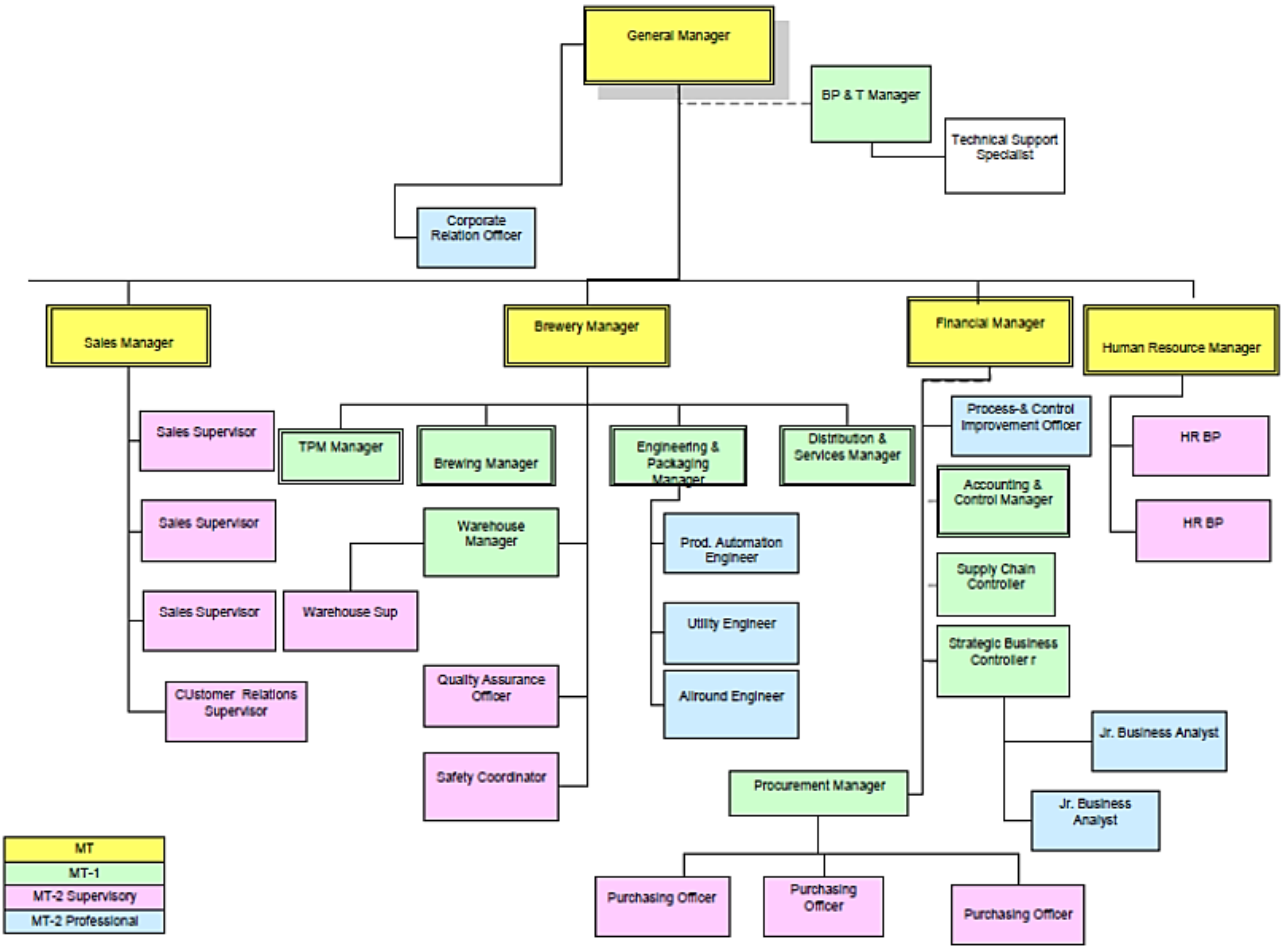
Vision statement: To adapt sustainable and regenerative practices in the brewing and production processes of beer and comply with different SDG's (Weggemans, 2018).

Organizational structure

The organizational structure of the organization can be seen on the next page in figure 1.

Figure 1

Organizational structure of Surinaamse Brouwerij N.V.



Note. In yellow, the primary sources of information are visible from "*Het opzetten van een Process Control, Automation and IT masterplan voor de Surinaamse Brouwerij N.V.",* by S. Isrie, 2014, with authorization from the author.

Products Offered

SB produces different types of beer, beverages, and chiller drinks for the local market and the export market. The brands used are Parbo Bier, Radler, Chiller, and Climax. Recently, they also started producing soda water and Heineken brand beer in cans and glass bottle variants. Currently, all these products are produced using energy obtained from fossil fuels, but the company has set goals to move towards sustainable and regenerative production practices. SB also offers different types of byproducts for free to the Surinamese market:

- Crushed glass bottles are provided for use in dry mix construction, road building, concrete mixing, golf bunker construction, and for making glass lamps.
- Recycled aluminum metal from used beer cans for use in window frames, roofing panels, and aluminum foil wraps.
- CO_2 is offered for sparkling water and soft drinks. During the beer fermentation process, a significant amount of CO_2 is produced. This CO_2 is captured using a CO_2 recapture plant and infused into soft drinks and sparkling water to create fizziness. The recapture and reuse of this CO_2 also reduce carbon emissions.
- Mashed rice and grains are provided for feeding cows and pigs. During the brewing process, mashed rice and grains are considered waste. However, this waste is high in protein and serves as valuable food for cows and pigs. Local cow and pig farmers receive this waste for free to feed their animals. Additionally, some of the mashed rice and grains are used by locals to bake cookies and bread with a lower sugar content, a higher protein content and a finer grain than normal bread flour.

2.2 Project management concepts

In this paragraph, the 12 project management principles are described in order to guide the behaviors and actions of project professionals and other project stakeholders. In figure 2, an overview of these 12 principles is given.

Figure 2

The 12 project management principles

Note. Own work.

1. **Stewardship principle:** Stewards act responsibly to carry out activities with integrity, care, and trustworthiness while maintaining compliance with internal and external guidelines. They demonstrate a broad commitment to the financial, social, and environmental impacts of the projects they support.

    - Stewardship encompasses responsibilities within and external to the organization.
    - Stewardship includes: integrity, care, trustworthiness, and compliance.

- A holistic view of stewardship considers financial, social, technical, and sustainable environmental awareness and the environmental impacts of the projects they support (PMBOK guide 7th edition, 2021, p.24).

2. **Team principle:** project teams are made up of individuals who yield diverse skills, knowledge, and experience. Project teams that work collaboratively can accomplish a shared objective more effectively and efficiently than individuals working on their own.
    - Projects are delivered by project teams.
    - Project teams work within organizational and professional cultures and guidelines, often establishing their own "local" culture.
    - A collaborative project team environment facilitates:
        - Alignment with other organizational cultures and guidelines.
        - Individual and team learning and development, and
        - Optimal contributions to deliver desired outcomes (PMBOK guide 7th edition, 2021, p.28).
3. **Stakeholder principle**: engage stakeholders proactively and to the degree needed to contribute to project success and customer satisfaction.
    - Stakeholders influence projects, performance, and outcomes.
    - Project teams serve other stakeholders by engaging with them.
    - Stakeholder engagement proactively advance value delivery (PMBOK guide 7th edition, 2021, p.31).

4. Value principle: continually evaluate and adjust project alignment to business objectives and intended benefit value.

- Value is the ultimate indicator of project success.
- Value will be realized throughout the project, at the end of the project, or after the project is complete.
- Value, and the benefits that contribute to value, can be defined in quantitative and/or qualitative terms.
- A focus on outcomes allows project teams to support the intended benefits that lead to value creation.
- Project teams evaluate progress and adapt to maximize the expected value (PMBOK guide 7th edition, 2021, p.34).

5. **System thinking principle:** recognize, evaluate, and respond to the dynamic circumstances within and surrounding the project in a holistic way to positively affect project performance.

- A project is a system of interdependent and interacting domains of activity.
- System thinking entails a holistic view of how project parts interact with each other and with external systems.
- Systems are constantly changing, requiring consistent attention to internal and external conditions.
- Being responsive to system interactions allows project teams to leverage positive outcomes (PMBOK guide 7th edition, 2021, p.37).

6. **Leadership principle:** demonstrate and adapt leadership behaviors to support individual and team needs.
    - Effective leadership promotes project success and contributes to positive project outcomes.
    - Any project team member can demonstrate leadership.
    - Leadership is different than authority.
    - Effective leaders adapt their style to the situation.
    - Leaders demonstrate desired behavior in areas of honesty, integrity, and ethical conduct (PMBOK guide 7th edition, 2021, p.40).
7. **Tailoring principle:** Design the project development approach based on the context of the project, its objectives, stakeholders, governance, and the environment, using a "just enough" process to achieve the desired outcome while maximizing value, managing costs and enhancing speed.
    - Each project is unique.
    - Project success is based on adapting to the unique context of the project to determine the most appropriate methods of producing the desired outcomes.
    - Tailoring the approach is iterative, and therefore is a continuous process throughout the project conduct (PMBOK guide 7th edition, 2021, p.44).

8. **Quality principle:** maintain a focus on quality that produces deliverables that meet project objectives and align to the needs, uses, and acceptance requirements set forth by relevant stakeholders.
    - Project quality entails satisfying stakeholder expectations and fulfilling project and product requirements.
    - Quality focuses on meeting acceptance criteria for deliverables.
    - Project quality entails ensuring project processes are appropriate and as effective as possible (PMBOK guide 7th edition, 2021, p.47).
9. **Complexity principle:** continually evaluate and navigate project complexity so that approaches and plans enable the project team to successfully navigate the project life cycle.
    - Complexity is the result of human behavior, system interactions, uncertainty, and ambiguity.
    - Complexity can emerge at any point during the project.
    - Complexity can be introduced by events or conditions that affect values, scopes, communications, stakeholders, risks, and technological innovations.
    - Project teams can stay vigilant in identifying elements of complexity and use a variety of methods to reduce the amount or impact of complexity (PMBOK guide 7th edition, 2021, p.50).
10. **Risk principle:** continually evaluate exposure to risk, both opportunities and threats, to maximize positive impacts and minimize negative impacts on the project and its outcomes.
    - Individual and overall risks can impact projects.

- Risks can be positive (opportunities) or negative (threats).
- Risks are addressed continually throughout the project.
- An organization's risk attitude, appetite, and threshold influence how risk is addressed.
- Risk responses should be: appropriate for the significance of the risk, cost-effective, realistic within the project context, agreed upon by the relevant stakeholders, and owned by a responsible person (PMBOK guide 7th edition, 2021, p.53).

11. **Adaptability and resiliency principle**: build adaptability and resiliency into the organization's and project team's approaches to help the project accommodate change, recover from setbacks, and advance the work of the project.
    - Adaptability is the ability to respond to changing conditions.
    - Resiliency is the ability to absorb impacts and recover quickly from a setback or failure.
    - A focus on outcomes rather than outputs facilitates adaptability (PMBOK guide 7th edition, 2021, p.55).
12. **Change principle:** prepare those impacted for the adaptation and sustainment of new and different behaviors and processes required for the transition from the current state to the intended future state created by the project outcomes.
    - A structured approach to change helps individuals, groups, and organization transition from their current state to their desired future state.

- Change can originate from internal influences or external sources.
- Enabling change can be challenging as not all stakeholders embrace change.
- Attempting too much change in a short time can lead to fatigue and/or resistance.
- Stakeholder engagement and, motivational approaches assist in change adoption (PMBOK guide 7th edition, 2021, p.58).

In summary, the project will utilize all the project management principles during the project's lifecycle. The PM will act as a steward of project resources to manage the project successfully. The team comprises the PM's support network to enable transportation and other related resources. The project's stakeholders include the management team of SB, neighbors living in the area, and EAS, which will benefit from the work performed. The PM uses systems thinking, tailoring, and leadership to overcome project obstacles. Quality, complexity, and risk are applicable principles as the project will be evaluated for quality, and the PM must balance the research's complexity with risk vs. reward criteria. Finally, the adaptability and resilience of the PM will be measured by the project deliverables and stakeholder's feedback. The result is the necessary changes to meet the final project deliverable.

Project management domains

Project performance domains refer to specific areas or aspects of a project where performance is evaluated and managed. These domains provide a framework for understanding and assessing project

progress and success. The PMBOK identifies 8 several key project performance domains. The eight project domains are further clarified in the figures below, along with justification for this FGP.

Figure 3

Project performance domains

Note. Own work.

1. **Stakeholder performance domain**: the stakeholder performance domain addresses activities and functions associated with stakeholders. Effective execution of this performance domain results in the following desired outcomes:
    - A productive working relationship with stakeholders throughout the project.
    - Stakeholder agreement with project objectives.
    - Stakeholders who are project beneficiaries are supportive and satisfied while stakeholders who may oppose the project or its deliverables do

not negatively impact project outcomes (PMBOK guide 7th edition, 2021, p.8).

The management team of Heineken international, the management of SB, neighbors living in the area, and EAS are the main stakeholders in this project.

2. **Team performance domain:** The team performance domain addresses activities and functions associated with the people who are responsible for producing project deliverables that realize business outcomes. Effective execution of these performance domains results in the following desired outcomes:
    - Shared ownership
    - A high performing team
    - Applicable leadership and other interpersonal skills are demonstrated by all team members (PMBOK guide 7th edition, 2021, p.16).

    The PM, electrical, mechanical, and construction engineers are the main personnel responsible for producing project deliverables that will realize business outcomes.
3. **Development approach & life cycle performance domain:** the development approach and life cycle performance domain addresses activities and functions associated with the development approach, cadence, and life cycle phases of the project. Effective execution of these performance domains results in the following desired outcomes:
    - Development approaches that are consistent with project deliverables.

- A project life cycle consisting of phases that connect the delivery of business and stakeholder value from the beginning to the end of the project (PMBOK guide 7th edition, 2021, p.32).

This project will have a predictive lifecycle. The predictive life cycle will be used. The predictive life cycle model is appropriate for this project due to the linear nature of designing a project management plan.

4. **Planning performance domain:** The planning performance domain addresses activities and functions associated with the initial, ongoing, and evolving organization and coordination necessary for delivering project deliverables and outcomes**.** Effective execution of these performance domains results in the following desired outcomes:

    - The project progresses in an organized, coordinated, and deliberate manner.
    - There is a holistic approach to delivering the project outcomes.
    - Evolving information is elaborated to produce the deliverables and outcomes for which the project was undertaken.
    - Time spent planning is appropriate for the situation.
    - Planning information is sufficient to manage stakeholder expectations.
    - There is a process for the adaption of plans throughout the project based on emerging and changing needs or conditions (PMBOK guide 7th edition, 2021, p.51).

In the construction of a solar power plant, the project planning performance domain encompasses the various activities and processes involved in developing comprehensive plans to

guide the project from initiation to completion, such as scope management, schedule development, resource planning, cost estimation and budgeting, risk management planning, procurement planning, communication planning, and quality planning.

5. **Project work performance domain:** the project work performance domain addresses activities and functions associated with establishing project processes, managing physical resources, and fostering a learning environment. Effective execution of these performance domains results in the following desired outcomes:
    - Efficient and effective project performance.
    - Project processes are appropriate for the project and the environment.
    - Appropriate communication with stakeholders.
    - Efficient management of physical resources.
    - Efficient management of procurements. Improvement team capability due to continuous learning and process improvement conditions (PMBOK guide 7th edition, 2021, p.69).

In the construction of a solar power plant, the project work performance domain encompasses various aspects related to the execution and management of construction activities to achieve project objectives efficiently and effectively, such as construction execution, workforce management, materials procurement and management, equipment and machinery deployment, subcontractor coordination, quality control, change management, documentation, and reporting.

6. **Delivery performance domain:** The delivery performance domain addresses activities and functions associated with delivering the scope and quality that the project was undertaken to achieve. Effective execution of these performance domains results in the following desired outcomes:

- Projects contribute to business objectives and the advancement of strategy.
- Projects realize the outcomes they were initiated to deliver.
- Project benefits are realized in the time frame in which they were planned.
- The project team has a clear understanding of the requirements.
- Stakeholders accept and are satisfied with project deliverables (PMBOK guide 7th edition, 2021, p.80).

In the construction of a solar power plant, the delivery performance domain would encompass various aspects related to the timely and efficient completion of the project, such as project schedule adherence, resource allocation, quality assurance, risk management, and stakeholder communication.

7. **Measurement performance domains.** The measurement performance domain addresses activities and functions associated with assessing project performance and taking appropriate actions to maintain acceptable performance. Effective execution of these performance domains results in the following desired outcomes:

    - A reliable understanding of the status of the project
    - Actionable data to facilitate decision making.
    - Timely and appropriate actions are needed to keep project performance on track.
    - Achieving targets and generating business value by making informed and timely decisions based on reliable forecasts and evaluations (PMBOK guide 7th edition, 2021, p.93).

In the construction of a solar power plant, the measurement performance domain involves quantitatively assessing various aspects of the project to track progress, evaluate performance, and identify areas for improvement, such as progress tracing, KPI's, quality metrics, resource utilization, cost performance, and schedule adherence.

8. **Uncertainty performance domain:** the uncertainty performance domain addresses activities and functions associated with risk and uncertainty. Effective execution of these performance domains results in the following desired outcomes:

    - An awareness of the environment in which projects occur, including, but not limited to, the technical, social, political, and economic environments.
    - Proactively exploring and responding to uncertainty.
    - An awareness of the interdependence of multiple variables on the project.
    - The capacity to anticipate threats and opportunities and understand the consequences of issues.
    - Project delivery with little or no negative impact from unforeseen events or conditions.
    - Opportunities are realized to improve project performance and outcomes.
    - Costs and schedule reserves are effectively utilized to maintain alignment with project objectives (PMBOK guide 7th edition, 2021, p.116).

The eight project domains serve as benchmarks for the project to measure its success. All of the desired outcomes from each of the eight performance domains are the goal at project completion. The project will transition through all domains, and the PM is charged with ensuring the desired outcomes to consider the project a success.

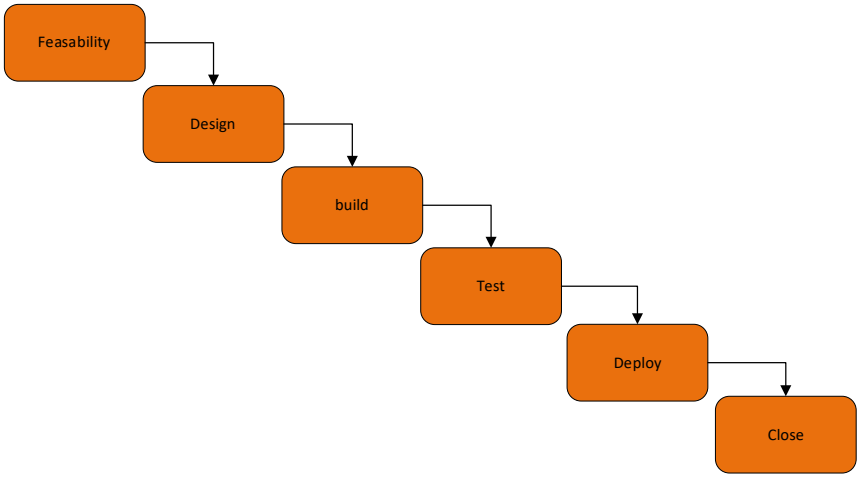
Project life cycle

The PMBOK recognizes various project life cycle approaches, including predictive, iterative/incremental, and adaptive (hybrid/agile). In this section, an overview is given of each of these project life cycles.

1. **The predictive life cycle (also known as a fully plan-driven, or waterfall, life cycle**) follows a sequential progression through defined phases, where each phase relies on the outcomes of the preceding one. It's often dubbed the traditional approach due to its linear nature. The downside is that Waterfall is pretty inflexible when it comes to changes late in the project and therefore leads to significant cost increases when rework is needed. This method is meticulously planned from the outset and is best suited for projects with clearly outlined requirements and minimal ambiguity (PMBOK guide 7th edition, 2021, p.43). In figure 4, an example of a predictive project life cycle is visualized.

Figure 4

Example of a predictive project life cycle



Note. Own work.

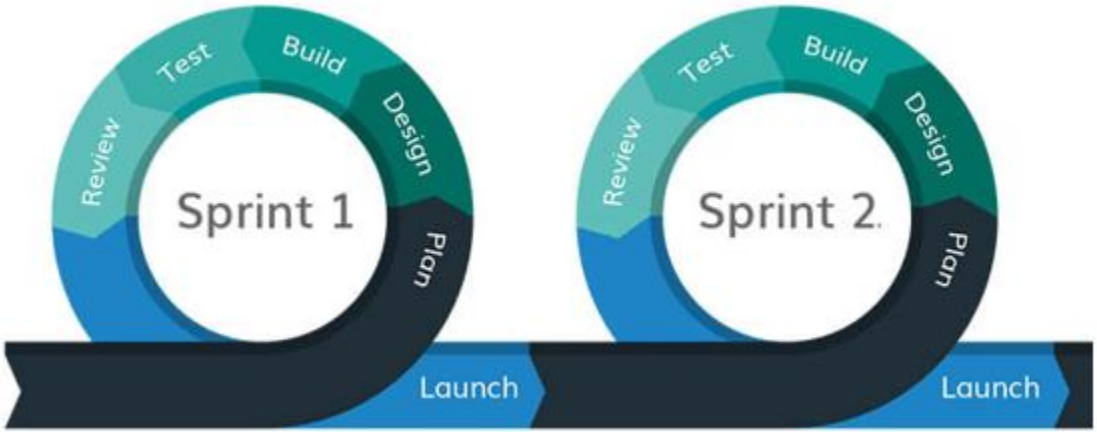
2. The adaptive (or agile) life cycle stands out for its flexibility and iterative nature, accommodating alterations in requirements and scope as the project progresses. This approach was built to handle changes and reduce inherent risk. Agile methodology, a prime example of this approach, prioritizes collaboration, adaptability to change, and the incremental delivery of value. Particularly in projects dealing with emerging technologies or evolving requirements, opting for an adaptive or hybrid life cycle can be advantageous. Adaptive projects are quick and time bound with two critical success factors:

- The customer must be intimately involved in the process and
- You must be able to define incremental requirements at the start of each iteration.

If requirements are not well known, like when you are developing a first of its kind application, the adaptive approach works nicely (PMBOK guide 7th edition, 2021, p.45). In figure 5, an example of an adaptive life cycle is visualized.

Figure 5

Example of an adaptive life cycle

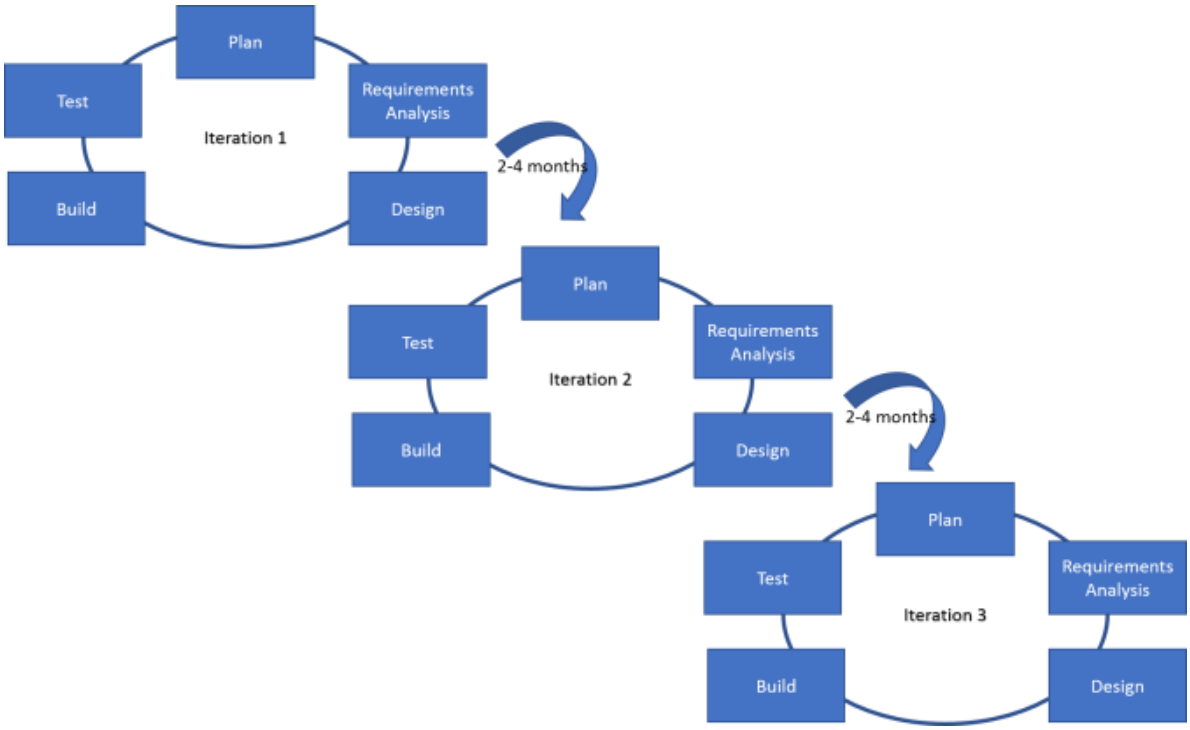


Note. From *Types of project management life cycles*, by M. Ma'ayta, 2020 (https://www.pmclounge.com/types-of-project-management-life-cycle/)

4. **The iterative life cycle** comprises recurring cycles of development, where each cycle enhances and expands upon the accomplishments of prior iterations. The iterative approach is like a bunch of small waterfall cycles, with the customer verifying the work at the end of each cycle. This gives you more flexibility and a better opportunity to address changes and reduce risk. Through this process, a deeper comprehension of project requirements is attained, facilitating necessary adjustments along the way. Iterative life cycles find utility in defense projects, where the continual evolution of capabilities through ongoing feedback and testing is imperative (PMBOK guide 7th edition, 2021, p.37). In figure 6, an example of an iterative life cycle is visualized.

Figure 6

Example of a iterative lifecycle

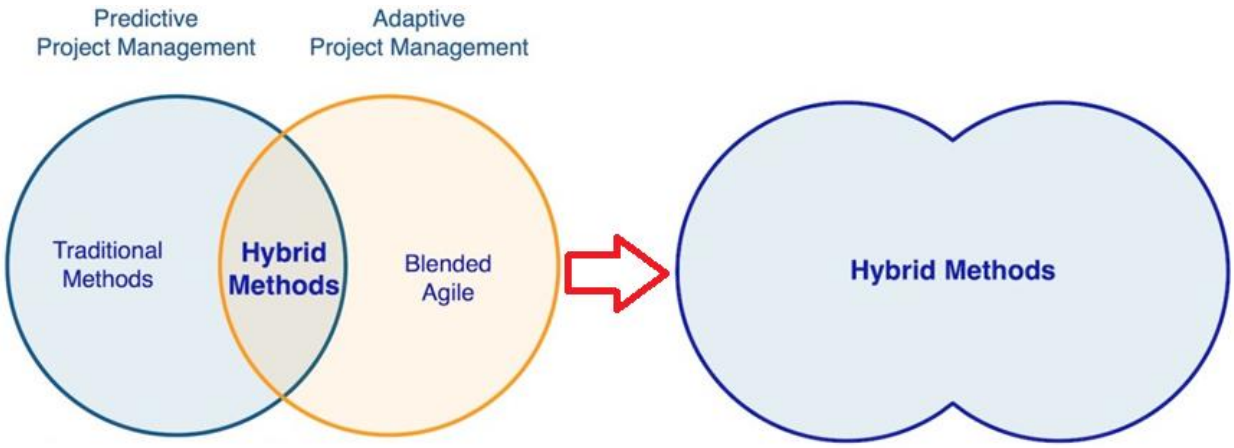


Note. Own work.

5. **Hybrid project lifecycle:** A hybrid project lifecycle is a project management approach that combines elements of different project management methodologies to suit the specific needs and characteristics of a project. It integrates practices from both predictive (waterfall) and iterative (agile) methodologies to create a tailored approach that maximizes flexibility, adaptability, and responsiveness throughout the project lifecycle (PMBOK guide 7th edition, 2021, p.37).

Figure 7

Example of a hybrid lifecycle



Note. Own work.

The construction of the solar power plant will have a predictive lifecycle, since the project scope, schedule, and cost can be accurately predicted and planned in advance. The predictive life cycle model is appropriate for this project due to the linear nature of designing a project management plan. Changes will be discouraged once the project is underway.

Project management process groups

The PMBOK recognizes five process groups that encompass all project management processes. These process groups are sequential and iterative, meaning they are applied throughout the project life cycle. In figure 8 these process groups are visible in the right order.

Figure 8

The 5 process groups of PMBOK

Note. Own work.

Here are the five project management process groups:

1. **Initiating Process Group:** This process group focuses on defining and authorizing the project. Key activities include developing the project charter, identifying stakeholders, and determining high-level project requirements and objectives.
2. **Planning Process Group:** In this process group, detailed planning activities are carried out to establish the project scope, objectives, and approach. Key activities include developing the project management plan, defining the project scope, creating a work breakdown structure (WBS), estimating resources and durations, and establishing schedules and budgets.
3. **Executing Process Group:** During the executing process group, project work is performed to implement the project management plan and achieve project objectives. This involves coordinating people and resources, managing stakeholder communications, and ensuring quality assurance. Key activities include directing and managing project work, managing project resources, executing the procurement plan, and managing stakeholder engagement.
4. **Monitoring and Controlling Process Group:** This process group involves monitoring project performance, identifying variances from the project management plan, and taking corrective actions to keep the project on track. Key activities include monitoring and controlling project work, performing integrated change control, managing project scope, schedule, and cost, and conducting quality assurance.
5. **Closing Process Group:** The closing process group focuses on formally closing out the project or project phase. This includes obtaining final acceptance of project deliverables, transferring project documentation, releasing project resources, and closing out contracts. Key activities include closing projects or phases and closing procurements.

Each project will have to go through all these processes during the project life cycle. Process groups are not identical to the previously defined project phases. The processes flow interactively between the phases. The five groups contain 49 processes, which are spread over the 10 knowledge areas, which are shown in figure 9.

Figure 9

Project Management Process Group and Knowledge Area Mapping

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Monitor Stakeholder Engagement	

Note. From PMBOK guide 6th edition, 20217, p by PMI.org, Part 2. P. 556)

Project management knowledge areas

Project management knowledge areas are “identified areas of project management defined by their knowledge requirements and described in terms of their component processes, practices, inputs, outputs, tools, and techniques” (PMBOK guide 6th edition, p.61). This project will focus on the following knowledge areas:

1. **Integration Management:**
    - *Purpose:* Coordinating and managing various aspects of the project to ensure its progresses in a unified way.
    - *Key Activities:* Developing the project charter, project management plan, and overseeing project execution and closure.
2. **Scope Management:**
    - *Purpose:* defining and controlling what is and isn't included in the project.
    - *Key Activities:* defining the scope of the solar power plant project, creating a work breakdown structure (WBS), and controlling changes to the scope.
3. **Time Management:**
    - *Purpose:* planning and controlling the project timeline to ensure timely completion.
    - *Key Activities:* developing and managing the project schedule, defining activities, sequencing activities, and controlling the project timeline.
4. **Cost Management:**
    - *Purpose:* estimating, budgeting, and controlling costs throughout the project.
    - *Key Activities:* planning cost management, estimating costs, determining the budget, and controlling project costs.

5. **Quality Management:**
    - *Purpose:* ensuring that the project delivers outputs that meet or exceed stakeholders' expectations.
    - *Key Activities:* planning quality management, performing quality assurance, and controlling the quality of project deliverables.
6. **Resource Management:**
    - *Purpose:* managing human resources, equipment, and materials to achieve project goals.
    - *Key Activities:* planning resource management, acquiring project team members, developing the project team, and managing the project team.
7. **Communications Management:**
    - *Purpose:* planning and managing the flow of information within the project.
    - *Key Activities:* planning communications management, managing communications, and controlling project communications.
8. **Risk Management:**
    - *Purpose:* identifying, assessing, and responding to project risks to minimize their impact.
    - *Key Activities:* planning risk management, identifying risks, performing qualitative and quantitative risk analysis, and planning and implementing risk responses.
9. **Procurement Management:**
    - *Purpose:* planning, managing, and controlling the procurement of goods and services from external sources.
    - *Key Activities:* planning procurement management, conducting procurements, and controlling procurements.

10. **Stakeholder Management:**

- *Purpose:* identifying, engaging, and managing stakeholders throughout the project lifecycle.
- *Key Activities:* identifying stakeholders, planning stakeholder engagement, managing stakeholder engagement, and controlling stakeholder engagement.

Company strategy, portfolios, programs, and projects

The SB has a strategy to work towards carbon-neutral beer production, supply chain, and delivery. To achieve this, the company has started many projects since 2014. In 2015, they built a CO_2 recapture system, and in 2016, they started using sub-zero (energy-efficient) beer coolers. In 2017, they created their own rainwater collection system, and in 2024, they are planning to build their own solar power plant, which will help them become energy independent from the unstable electrical supply and also become the first net-zero carbon-emitting industry in Suriname. With this aim, they also hope to be an example for other companies in Suriname. With all these strategies, they are also aiming to achieve many sustainable development goals and to brew beer using sustainable and regenerative practices.

2.3 Other applicable theories/concepts related to the project topic and context

2.3.1 Current situation of the problem or opportunity in the study

Currently, SB has no project plan available for the construction of a solar power plant. In the past, most of the projects were done by in-company engineers without project plans, which resulted in projects being delivered with cost and schedule overruns and without risk management plans to

identify, assess, and mitigate potential risks that may impact the project. Also, they don't have a stakeholder management plan that ensures all stakeholders are satisfied.

In the past, the brewery used a spreadsheet with some budget, resource, and cost planning, but since it was not often updated and the engineers lacked project management knowledge, the projects were often not a success due to several reasons related to cost, time, resources, and risks. Recently, the brewery manager decided to do proper project planning before starting it.

2.3.2 Previous research done for the topic in the study

During the period 2013-2015, a feasibility study (Isrie, 2014) was conducted to construct a solar power plant to become energy independent from the electricity grid, and brew beer in a sustainable and regenerative way.

2.3.3 Other theory related to the topic in the study

2.3.3.1 Energy supply in Suriname

In Suriname, industries account for 48% of the total energy consumption, and renewable energy technologies such as solar account for only 0.4%. Around 40% of the energy produced still comes from fossil fuels used in diesel generators, while the other 59.6% comes from hydropower.

Currently, Suriname faces challenges for the future with regard to energy demand: a growing energy demand on the one hand and a relative lower electricity output from the hydropower plant as a result of extreme droughts. (ETI, 2020). Given the fact that there will be an increased demand for electricity in the near future on the one hand and, on the other hand, the effects of climate change

will minimize the potential of the current energy system, the country should commit to a fully sustainable energy system. (IPCC, 2023).

Moreover, Suriname has committed to the MDG's aim at eight specific targets. Although these MDGs do not directly address energy, it is acknowledged that access to sustainable energy contributes directly to realizing all MDGs (ENERGYPEDIA, 2024). During the 41st Special Meeting of COTED (Council for Trade and Economic Development), where Suriname is part of a member state of the CARICOM (Caribbean Community), the target of realizing 47% renewable power capacity and, at the same time, CO_2 reductions of 36% in the power sector by 2027 was agreed upon (HARRISON, 2018).

2.3.3.2 Energy dependency and financial losses of Surinaamse Brouwerij N.V.

SB produces over 300.000 hectoliters of beer per year, which is around 800 hectoliters per day. SB heavily depends on the local energy supply from N.V. EBS. In the dry period, the energy production from the hydroelectric dams reduces by around 50%, resulting in frequent blackouts lasting for over 8 hours. This results in financial losses of over $100.000 on a daily basis. This power outage also leads to voltage fluctuations and surges when power is restored, which damage electronic devices, appliances, and industrial equipment.

The unreliable power supply to the brewery also causes business interruptions to supply chains, and customer services during power outages, leading to delays, cancellations, and potential loss of revenue. In some situations, a diesel generator is powered, but this causes increased CO_2 emissions, noise pollution in the neighborhood, and health issues for the workers living nearby.

2.3.3.3 Benefits of the Solar Power Plant for SB

This project has the following objectives and expected benefits for the company:

1. **Pioneer in Renewable Energy Use**:
   - **Objective:** To establish SB as the first company in Suriname to use renewable energy for its production processes.
   - **Expected Benefits:**
     - Enhanced corporate image as an environmentally responsible and innovative company.
     - Leadership role in inspiring other local industries to adopt sustainable practices.
2. **Mitigating Power Blackouts:**
   - **Objective:** To reduce dependency on the local power supply and mitigate financial losses during power outages.
   - **Expected Benefits:**
     - Uninterrupted production processes, minimizing downtime and associated losses.
     - Improved operational resilience, ensuring consistent product availability.
3. **Alignment with Heineken's Sustainability Goals:**
   - **Objective:** To contribute to Heineken International's goal of achieving zero CO_2 net production by 2030 and meeting various sustainable development goals.
   - **Expected Benefits:**
     - Fulfillment of corporate responsibility towards sustainability.
     - Meeting global standards and expectations, enhancing the company's market position.
4. **Cost Savings and Financial Efficiency:**

- **Objective:** To achieve long-term cost savings through the use of renewable energy sources.
- **Expected Benefits:**
    - Reduced energy costs over time, contributing to financial sustainability.
    - Potential eligibility for incentives, grants, or tax breaks related to renewable energy adoption.

5. Organizational Learning and Development:

- Objective: To use the project as a learning opportunity for project management and renewable energy implementation within the organization.
- **Expected Benefits:**
    - Enhanced internal capabilities in project execution and management.
    - Creation of a valuable organizational asset in the form of a comprehensive project management plan.

6. **Positive Environmental Impact:**

- **Objective:** To contribute to environmental conservation and reduce the brewery's carbon footprint.
- **Expected Benefits:**
    - Reduction in greenhouse gas emissions associated with energy consumption.
    - Preservation of local ecosystems through sustainable construction and operation practices.

7. **Enhanced Competitiveness:**

- Objective: To gain a competitive edge by adopting sustainable and environmentally friendly practices.

- **Expected Benefits:**
    - Attraction of environmentally conscious consumers.
    - Potential for market differentiation and increased market share.

8. **Long-term Energy Security:**

- **Objective:** To secure a reliable and sustainable energy source for current and future production needs.
- **Expected Benefits:**
    - Reduced vulnerability to fluctuations in traditional energy sources.
    - Long-term stability in energy costs, contributing to financial planning.

3 METHODOLOGICAL FRAMEWORK

In this chapter, the methodological framework is described. The methodological framework consists of the sources, research methods, tools, assumptions, restrictions, and deliverables that will be used to develop the FGP.

3.1 Information sources

3.1.1 Primary sources

In project management, according to PMBOK, primary sources of information typically refer to the original sources of data or information used in project management processes. The primary source of information in this project will be the key stakeholders in this project. This includes engineers, managing directors, Heineken management, and experts from Heineken who also worked on solar power plants and projects to reduce energy dependency and carbon footprints. Also, graduation reports and lessons learned reports of previously contacted solar power plants in Suriname will be considered as primary sources of information. The primary sources of information are visible in Table 1.

3.1.2 Secondary sources

Secondary sources of information in project management, according to the PMBOK, typically refer to sources that are derived from primary sources or other sources. The following sources will be consulted as secondary sources:

- Yearbooks, and Sustainable and Generative Reports of SB from 2018-2022:Weggemans, E. (2018), Ottervanger, R. (2019), Ottervanger, R. (2020), Ottervanger, R. (2021), Ottervanger, R. (2022),

- Internal database of SB with project plans for the next 10 years.
- Financial, quality standards, human and material resources, PR&V communication, previous projects' lessons learned, standard suppliers' relationships, energy consumption, and KPI databases.

Table 1

Information Sources

Objectives	**Information sources**	
	Primary	**Secondary**
To develop an integration management plan	The managing director of SB.	Internal database of SB. with project plans for the next 10 years.
To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.	The people & corporate affairs manager and finance manager of SB.	Internal database of SB with project plans for the next 10 years.
To develop a schedule management plan to manage the timely completion of the project.	The people & corporate affairs manager, finance manager of SB.	Internal database of SB with project plans for the next 10 years.
To develop a cost management plan for effective budgeting and financial control throughout the project.	The finance manager of SB.	Financial database of SB
To develop a quality management plan outlining measures to ensure the delivery of a high-quality solar power plant.	The people & corporate affairs manager of SB.	The quality standards database of SB.
To develop a resource management plan for optimal utilization of resources, including manpower and materials.	The managing director, the people & corporate affairs manager, finance manager of SB.	The human and materials database of SB.
To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.	The people & corporate affairs manager of SB.	The PR&V communication database of SB.
To develop a risk management plan, identify, assess, and mitigate potential risks that may impact the project.	The people & corporate affairs manager of SB.	Previous project lesson learned database of SB.

Objectives	Information sources	
	Primary	Secondary
To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.	The people & corporate affairs manager, finance manager of SB.	Standard suppliers and relationship databases of SB.
To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.	The people & corporate affairs manager of SB.	Standard suppliers and relationship databases of SB.
To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.	The people & corporate affairs manager of SB.	Energy consumption and KPI reports of SB.

3.2 Research methods

This paragraph describes the two methods that will be used to develop the project management plan. The first one is the analytical method described in 3.2.1, and the second one is the inductive method.

3.2.1 Analytical method

For this project management plan, **analytical** scientific research will be used as the first method. In the planning phase, an analytic approach will be used to break down the project into its constituent elements.

Synthetic approach: During the integration management phase, a synthetic approach will be employed to combine various project components, plans, and processes. This will be done to integrate different aspects to create a comprehensive project plan that aligns with overall objectives.

Inductive method: For this project management plan, the inductive research method will be used as the second method. The inductive method will be used to analyze project risks and derive general principles. By examining historical project data, generalizations can be made about potential risks and strategies for risk mitigation.

Deductive reasoning: deductive reasoning will help to break broad project objectives into specific tasks, activities, and requirements. The Work Breakdown Structure (WBS) will be used as a tool that uses deductive reasoning to decompose project deliverables. The summary of research methods 1 and 2 is shown in chart 2 below.

Table 2

Research methods

Objectives	**Research methods**	
	Analytic-synthetic	**Inductive-Deductive**
1. To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.	By applying the analytic-synthetic research method, you can systematically analyze and synthesize information to develop a robust integration management plan that addresses the complexities of coordinating various project aspects and contributes to the overall success of the project.	By applying the inductive-deductive research method, the development of the scope management plan is grounded in specific project observations and data (inductive) but is also guided by general principles and theories that can be applied more broadly (deductive). This approach helps ensure that the project's scope is well-defined, comprehensive, and aligned with overarching principles for successful project completion.
2. To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust scope management plan. The analytic phase involves breaking down information	By applying the inductive-deductive research method, you ensure that the scope management plan is rooted in specific project observations and data (inductive) while being guided by general principles that can be applied

Objectives	Research methods	
	Analytic-synthetic	**Inductive-Deductive**
	to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	broadly (deductive). This approach helps ensure that the project's scope is comprehensive, well-defined, and aligned with both specific project requirements and overarching principles for successful project completion.
3. To develop a schedule management plan to manage the timely completion of the project.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust schedule management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	By applying the inductive-deductive research method, you ensure that the schedule management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the project's schedule is well-defined, realistic, and aligned with both specific project constraints and overarching principles for successful project completion.
4. To develop a cost management plan for effective budgeting and financial control throughout the project.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust cost management plan. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive	By applying the inductive-deductive research method, you ensure that the scope management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the project's scope is comprehensive,

Objectives	Research methods	
	Analytic-synthetic	**Inductive-Deductive**
	understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing financial circumstances.	well-defined, and aligned with both specific project requirements and overarching principles for successful project completion.
5. To develop a quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust quality management plan for the solar power plant. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	By applying the inductive-deductive research method, you ensure that the quality management plan is grounded in specific observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the solar power plant project adheres to high-quality standards and aligns with both specific quality requirements and overarching principles for successful project completion.
6. To develop a resource management plan for optimal utilization of resources, including manpower and materials.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust resource management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the	By applying the inductive-deductive research method, you ensure that the resource management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the project's resources, including manpower and materials, are optimally utilized and aligned with both specific project requirements and

Objectives	Research methods	
	Analytic-synthetic	**Inductive-Deductive**
	approach ensures ongoing refinement and adaptation to changing project circumstances.	overarching principles for successful project completion.
7. To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust communication management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	By applying the inductive-deductive research method, you ensure that the communication management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that communication practices are tailored to the unique needs of the project and aligned with both specific stakeholder preferences and overarching principles for successful project completion.
8. To develop a risk management plan, identifying, assessing, and mitigating potential risks that may impact the project.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust risk management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to	By applying the inductive-deductive research method, you ensure that the risk management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the risk management practices are tailored to the unique needs of the project and aligned with both specific risks and overarching principles for successful project completion.

Objectives	Research methods	
	Analytic-synthetic	**Inductive-Deductive**
	changing project circumstances.	
9. To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust procurement management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	By applying the inductive-deductive research method, you ensure that the procurement management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that procurement practices are tailored to the unique needs of the project and aligned with both specific procurement requirements and overarching principles for successful project completion.
10. To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust stakeholder management plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances.	By applying the inductive-deductive research method, you ensure that the stakeholder management plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that stakeholder management practices are tailored to the unique needs of the project and aligned with both specific stakeholder requirements and overarching principles for successful project completion.

Objectives	Research methods	
	Analytic-synthetic	**Inductive-Deductive**
11. To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.	By applying the analytic-synthetic research method, you systematically analyze and synthesize information to develop a robust sustainability validation plan for the project. The analytic phase involves breaking down information to understand specific details, and the synthetic phase integrates this information to form a comprehensive understanding that guides the development of the plan. The iterative nature of the approach ensures ongoing refinement and adaptation to changing project circumstances while promoting a holistic and regenerative approach to sustainable development.	By applying the inductive-deductive research method, you ensure that the sustainability and regenerative impact validation plan is grounded in specific project observations and data (inductive) while being guided by general principles that can be applied broadly (deductive). This approach helps ensure that the validation practices are tailored to the unique needs of the project and aligned with both specific observed positive impacts and overarching principles for successful validation of sustainability and regenerative impact.

3.3 Tools

The following tools will be used to develop this project management plan:

- **Interviews** are structured conversations between a PM or team member and stakeholders to gather information, insights, or feedback. They are used to elicit detailed information, clarify requirements, and understand stakeholder perspectives.
- **Focus groups** involve a moderated discussion with a group of stakeholders selected to represent a cross-section of the project's audience. The purpose is to gather collective opinions, insights, and feedback in a collaborative setting.

- **Decomposition** is the process of breaking down or subdividing project deliverables into smaller, more manageable components or work packages. It involves breaking the project scope and work into progressively detailed levels, enabling a clearer understanding of the project structure. Decomposition is an essential technique used in various project management processes, particularly in defining the project scope and creating a Work Breakdown Structure (WBS).
- **Expert judgment** is a technique where input and insights are sought from individuals or groups with expertise or specialized knowledge relevant to the project. These experts could be internal or external to the project team and may include subject matter experts, industry specialists, stakeholders, or individuals with specific domain knowledge. Expert judgment is used to enhance decision-making, provide insights, and ensure that the project benefits from the experience and knowledge of those with relevant expertise.
- **Analogous estimating**, also known as top-down estimating or historical estimating, is a technique used to estimate project duration or costs based on historical data from similar projects. This method relies on the assumption that the current project's characteristics and scope are similar to past projects, and the actual performance from those past projects can be used as a basis for estimating.
- **Cost of Quality (COQ**) is a concept that considers the total costs incurred by an organization related to the quality of its products or services. The cost of quality includes both the costs of conformance (prevention and appraisal costs) and the costs of non-conformance (internal and external failure costs). The goal of analyzing the cost of quality is to identify opportunities for reducing defects, improving processes, and ultimately lowering overall project costs.

- **Bottom-Up Estimating** is a detailed estimating technique where the project is broken down into smaller, more manageable components, and estimates are developed for each component. These detailed estimates are then aggregated to provide a total estimate for the entire project. This method is considered more accurate but can be time-consuming, especially for complex projects, as it requires a detailed understanding of each work package.
- **Stakeholder analysis** is a systematic process of identifying, analyzing, and managing the individuals, groups, or organizations that can affect or be affected by a project. The analysis involves understanding stakeholders' interests, expectations, influence, and potential impact on the project. Stakeholder analysis is crucial for effective stakeholder engagement, communication, and the overall success of the project.
- **SWOT analysis** is a strategic planning technique used to assess a project or organization's strengths, weaknesses, opportunities, and threats. It involves identifying internal factors (strengths and weaknesses) and external factors (opportunities and threats) that may impact the project's success. SWOT analysis is valuable for strategic decision-making and risk management, providing a comprehensive understanding of the project environment.
- **Make-or-Buy analysis** is a procurement management technique used to determine whether a particular product or service should be produced in-house (made) or obtained from external sources (bought). The analysis involves evaluating various factors such as cost, time, available expertise, risks, and strategic considerations to make an informed decision on whether to perform the work internally or procure it externally from vendors, suppliers, or subcontractors. The goal is to optimize project resources, control costs, and enhance overall project performance by choosing the most suitable sourcing strategy.

- **The Triple Bottom Line (TBL)** is a sustainability framework that assesses the success of a project or an organization based on three interconnected dimensions: economic, social, and environmental. It emphasizes a holistic approach to project management, considering not only financial performance but also the project's impact on people and the planet.

Table 3

Tools

Objectives	Tools
To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.	Checklists, interviews, document analysis, root cause analysis
To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.	Benchmarking, interviews, and mind maps
To develop a schedule management plan to manage the timely completion of the project.	Alternatives analysis, earn value analysis, and simulation.
To develop a cost management plan for effective budgeting and financial control throughout the project.	Bottom-up estimating and historical information review.
To develop a quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant.	Cost-benefit analysis, process analysis
To develop a resource management plan for optimal utilization of resources, including manpower and materials.	Hierarchy charts and RAM
To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.	Stakeholder engagement assessment matrix
To develop a risk management plan, identify, assess, and mitigate potential risks that may impact the project.	Probability and impact matrix, SWOT analysis, and decision tree
To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.	Market research, proposal evaluation
To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.	Stakeholder analysis, prioritization ranking

Objectives	Tools
To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.	The Triple Bottom Line (TBL) framework (evaluates the project's impact on people, planet, and profit).

3.4 Assumptions and Constraints

Assumptions are "things that we believe to be true and which we therefore build into the project plan" (Abernathy, 2016). Constraints are "things that we know to be true, and which must be accounted for in the plan so that we can work around them" (Abernathy, 2016). The project contains both assumptions and constraints relevant to the parameters of the project background. The table below will discuss these in further detail.

Table 4

Assumptions and constraints

Objectives	Assumptions	Constraints
1. To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.	The project charter will be created before all other subsidiary documents.	There is a limited availability of project stakeholders for the development of the initial project charter. The project charter will require a secondary review during the scope management phase.
2. To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.	Three months is sufficient to complete the project. Information to develop the Project Scope Management Plan will be accessible.	Limited time: (only three months are allocated to the development of the PMP). Limited human resources (only the PM is working on all deliverables).

Objectives	Assumptions	Constraints
	The prices of materials will remain stable for the next four months. The project goal is clear and specific.	
3. To develop a schedule management plan to manage the timely completion of the project.	The PM has all the required skills.	The project will be executed during the dry and rainy seasons. Due to inclement weather and extreme weather events, project work will have to be scheduled ahead of time.
4. To develop a cost management plan for effective budgeting and financial control throughout the project.	The cost management plan is thorough enough to maintain project cost efficiency.	The budget for the project is $1,830,000.
5. To develop a quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant.	A quality management plan will be developed thoroughly, covering the co-constraints of cost and scope.	No universal standard for projects in SB. The stakeholders set the standard of quality.
6. To develop a resource management plan for optimal utilization of resources, including manpower and materials.	The required resources for the project are available. Each resource will have enough time budgeted.	Rainy season weather affects outside work, limiting resource procurement.
7. To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.	Communication goals are clearly defined regarding communication between the project team and project stakeholders. All project stakeholders will understand the communication plan.	Language barrier, lack of English to Dutch translators, reliance on translator applications.

Objectives	Assumptions	Constraints
8. To develop a risk management plan, identifying, assessing, and mitigating potential risks that may impact the project.	The project risks are clearly identified. A risk assessment will be completed to analyze all identified risks. A contingency plan will be created to mitigate project risks. Project risks will be monitored throughout the project lifecycle.	Lack of expertise in the research field regarding solar plant construction. Lack of current examples; solar power storage facilities.
9. To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.	The roles and responsibilities of the procurement management plan are clearly defined. A schedule for operations is created. Procurement criteria and workflow are created. A vendor management process is established.	Shipping and customs charges and timelines for materials outside Suriname create difficulties in solar power plant construction.
10. To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.	Accurate and reliable data, stable economic conditions, stakeholder commitment, accurate scope definition, availability of skilled workers in timely and accurate reporting, adherence to budget constraints, and continuous monitoring and control.	Preparation for the holiday season limits the commitment of stakeholders during the project lifecycle.
11. To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.	Community involvement is adequate for creating the project management plan. Community resources are available to create the project management plan. The need exists for constructing the solar power plant.	Business constraint: high prices of solar panels and materials due to high shipping and handling costs, import charges, and government taxes.

3.5 Deliverables

In the context of PMBOK, deliverables refer to tangible or intangible outputs or results that are produced as part of a project. These deliverables can take various forms, depending on the nature of the project and its objectives. In table 5 the project objectives and the deliverables are described.

Table 5

Deliverables

Objectives	Deliverables
To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.	Creation of a project charter. The Project charter contains the construction of the solar power plant management plan framework.
To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.	Scope Management Plan. Contains the pertinent details for the scope and depth of the construction of the solar power plant.
To develop a schedule management plan to manage the timely completion of the project.	Schedule Management Plan. Contains details concerning the project's schedule.
To develop a cost management plan for effective budgeting and financial control throughout the project.	Cost Management Plan. Contains details concerning the project's related costs.
To develop a quality management plan, outlining measures to ensure the delivery of a high-quality solar power plant.	Quality Management Plan. Contains details concerning the quality of the project.
To develop a resource management plan for optimal utilization of resources, including manpower and materials.	Resource Management Plan. Contains the framework of resources required for the project.
To develop a communication management plan, ensuring effective and transparent communication among project stakeholders.	Build a Communication Plan. Contains the details of the communication network for the project.
To develop a risk management plan, identifying, assessing, and mitigating potential risks that may impact the project.	Risk Management Plan. Contains the details of the associated risks of the project.
To develop a procurement management plan, outlining strategies for the acquisition of necessary resources and services.	Procurement Management Plan. Contains the details of the approaches used to procure resources for the project.

Objectives	Deliverables
To develop a stakeholder management plan, addressing the needs and expectations of key stakeholders throughout the project lifecycle.	Stakeholder Management Plan. Contains information regarding the stakeholders or the project.
To validate the project from a sustainable/regenerative development perspective to validate the project's sustainability and regenerative impact.	Sustainable/regenerative validation plan. The completed deliverable for the project.

4 RESULTS

4.1 Integration Management Plan

Two main activities within the preparation of the project are the development of the project charter and integrated change control.

Project charter

The project charter document contains the following information: business case, objectives, requirements, general description, risks, assumptions, and constraints, schedule summary, budget, deliverables, PM, stakeholder, and project sponsor. The project charter development requires various techniques that facilitate the collection of data and the exchange of ideas, considering meetings as a primary source of information.

SB does not have a specific project charter template or historical information related to the development of projects, nor a formal project management team or a project management office; it was necessary to develop a project charter document that can be used as a guide to further SB projects.

The project's first objective is to create and develop a project charter that the project will utilize to organize and regulate all project activities. To develop this charter, a brainstorming session was held with the members as the primary source of information to define the project objectives. The project charter was finalized and then reviewed with the managing director and finance manager.

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY		**Project Charter**	
Version 1.0		Document ID: 001-SB-PC	03/24/2024
Project Name:		The construction of a solar power plant for Surinaamse brouwerij N.V.	
Company Name:		Surinaamse Brouwerij N.V.	
Date		March 24, 2024	
Application area (Sector / Activity)		Food and Beverage Industry	
Knowledge area	**Process group**		
• Scope management • Schedule management • Cost management • Quality management • Resource management • Communication management • Risk management • Procurement management • Stakeholder management	Initiating Planning Executing Monitoring and Control Closing		
Tentative start date	**Tentative completion date**	**Duration (months)**	
1 august 2025	December 31, 2029	61 months	

Project objectives (general and specific)

General objective:

- To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

Specific objectives:

- Conduct an assessment of the energy needs of the brewery, taking into consideration both current and future requirements.
- Perform a thorough analysis and evaluation of potential locations for the solar plant, considering various factors.

- Carry out a comprehensive cost-benefit analysis to determine the financial feasibility of the solar power plant.
- Define the different phases of the construction process and establish specific deliverables to be achieved after each phase.
- Develop a monitoring and control program that will track the progress and execution of the project at each phase.

Justification or purpose of the project (contribution and expected results)

Suriname currently lacks industries utilizing renewable energy sources for production processes. Surinaamse Brouwery N.V., a subsidiary of Heineken, aims to pioneer this initiative and serve as a model for other local businesses. The brewery currently relies on local power supplies, resulting in production halts and daily losses exceeding $200,000 during power outages. Heineken International has established targets for its breweries to achieve zero CO_2 emissions by 2030 and meet various sustainable development objectives. To reach these goals, new breweries must incorporate renewable energy sources to power all production and transportation operations.

Description of the product or service that the project will generate – Final deliverables of the project

The deliverables of the project are as follows:

In the initiation and planning phase:
A master plan for the implementation of activities over the 5-year period using the principles of integration management, scope management, time management, schedule management, cost analysis, risk and quality analysis, resource management, stakeholder management, and procurement management.

In the execution phase:

- In 2025, the current and future energy usage of the company will be estimated.
- In 2026, the solar power plant will be built by a contracted company.
- In 2027, the modification will be done in the power house of SB to connect the solar power plant and grid energy supply.
- In 2028, adjustments will be made to the solar power plant so that it becomes independent of the local power supply in Suriname. The solar plant, the excess energy of the solar plant will be exported for free to the homes of the workers living nearby.
- In the first quarter of 2029, the generated solar power will be monitored, and the coupling will be done with the different SDGs 7,8,9,11,12, and13. Also, all the staff will be trained to operate the solar system. A monitoring program will be created, and staff will be trained to operate this new system.
- In the last quarter of 2029, the project will be closed and evaluated.

Assumptions

- Access to all the resources (human and material) to complete the project will be available.
- The budget will be completed and approved within the planning stage (management and the board of directors support the development of the project).

- The economic growth of the company remains stable, and the cost of day-to-day operations, and personal costs will not increase.
- Other material and resource costs will remain consistent throughout the project.
- All equipment will work as defined by the supplier throughout the project cycle.
- The required equipment costs will not change.
- The scope of the project will not change throughout the life cycle.

Preliminary risk identification

- Local officials and the government might oppose an increase in beer production (growth company).
- Lack of local knowledge to operate the solar system with our existing systems.
- Lack of local companies that can provide technical support to build the solar power plant.
- Limited information is available on the failure rates of current systems.
- No proper documentation on previous projects.

Restrictions

- Legal restrictions in the country may arise in relation to the regulations for grid-connected solar systems.
- Stakeholders are not available for interviews or teamwork are absent.
- There is no documented experience from previous projects.
- No accurate overview of the delivery dates of equipment and materials from suppliers.

Restrictions

- Legal restrictions in the country may arise in relation to the regulations for grid-connected solar systems.
- Stakeholders are not available for interviews and teamwork (absent).
- There is no documented experience from previous projects.
- There is no accurate overview of the delivery dates of equipment and materials from suppliers.

General resources and budget

Deliverable	**Name of the resource (can be human, equipment, material, supply, infrastructure, or hiring)**	**Quantity**	**Cost (€)**
Solar panels and mounting frame	Solar panels and mounting	6000	1.200.000
Workmanship	Engineering and Installation of solar panels	1	200.000

Roof reinforcement	Roof reconstruction	1	200.000
Adjustments to powerhouse	Hardware and supporting machines	1	100.000
Workmanship	Engineering and Installation Powerhouse	5	100.000
Training	Personnel Training		50.000
Unforeseen expenses	Unforeseen expenses	1	87.500
			1.983.500
Contingency Reserve			198.350
Cost Baseline			2.077.941,7
Management Reserve			198.350
Total Project Budget			2.276.291,7

Milestone schedule

Milestones	Start date	End date
Estimating the current and future energy usage of the brewery	01/08/2025	31/12/2025
Construction of the solar power plant	02/01/2026	31/12/2026
Modifications to the power house	02/01/2027	31/12/2027
Realization of net metering (energy export to the grid)	02/01/2028	31/12/2028
Training of personnel	02/01/2029	31/12/2029
Closing the project		31/12/2029

Relevant historical information

Surinaamse Brouwerij NV-part of the Heineken company, has a track record of producing high-quality beer products and is a vastly growing company in Suriname. The current production highly depends on the local energy supply, and during blackouts, a financial loss of $200.000 occurs on a daily basis. In 2021, Heineken (the mother company) has set the ambitions for this brewery to work towards net-zero CO_2 production by 2030 and to achieve many sustainable development goals.
Currently, Surinaaamse Brouwerij N.V. has no project management plan for the construction of the solar power plant for this brewery. Around mid-November 2024, the board of directors needs to have a clear plan that needs to be presented to the Heineken Brewing Company to get funding. The company also needs to submit this plan before mid-2025 to the current government in order to get subsidies for achieving its sustainable development goals and commitment to achieve net zero carbon emissions by 2030.

Identification of interest groups (involved)

Direct stakeholders	Indirect stakeholders
Project sponsor: Heineken International	Local companies
Board of directors of SB	Beer consumers
Project manager	Local government agencies
Infrastructure engineer	Neighborhood organizations
Electrical engineer	Ministry of Public Works in Suriname
Mechanical engineer	EAS
Construction team members	N.V EBS
Neighbors living in the area	
N.V AMPS	
Project manager:	**Signature:** 
Authorized by:	**Signature:** Surinaamse Brouwerij N.V.

Integrated change control

In the PMBOK framework, the Change Management Process involves a structured approach to managing changes to the project scope, schedule, or budget. Here's an overview of what it typically involves:

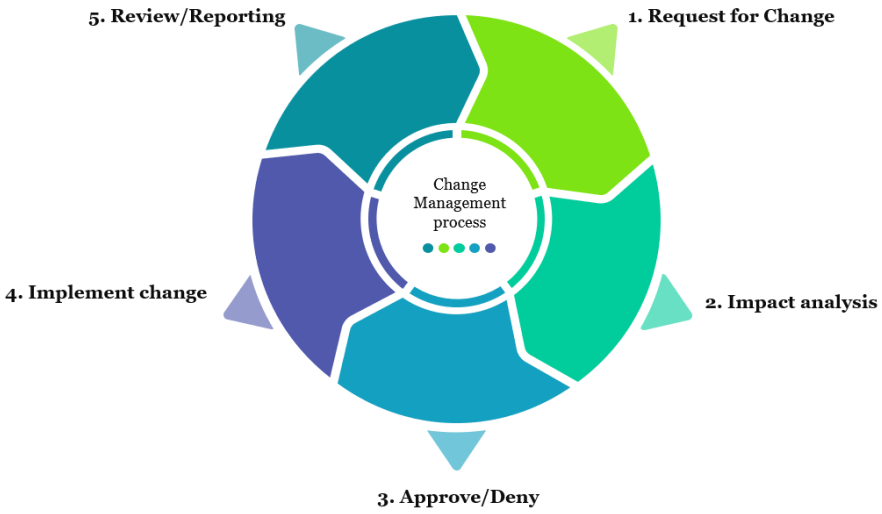
1. **Change Identification**: This step involves identifying potential changes to the project. Changes can come from various sources, such as stakeholders, team members, or external factors. It's crucial to have a systematic process for capturing and documenting proposed changes.
2. **Change Request Documentation**: Once a change is identified, it needs to be formally documented using a change request form. This document includes details such as the nature of the change, its impact on the project scope, schedule, budget, and any other relevant information.
3. **Change Impact Analysis**: The project team assesses the potential impact of the proposed change on various aspects of the project, including scope, schedule, budget, quality, and risks. This analysis helps in understanding the implications of the change before it is approved or rejected.

4. **Change Review and Approval**: The change request is then reviewed by the relevant stakeholders, including the project sponsor, PM, and other key decision-makers. Based on the change impact analysis, they decide whether to approve, reject, or defer the change.
5. **Change Implementation**: if the change is approved, it is implemented according to the agreed-upon plan. This may involve updating project documents, revising the project schedule, allocating additional resources, or making other adjustments as necessary.
6. **Change Control**: throughout the project lifecycle, it's important to monitor and control changes to ensure they are properly managed and do not negatively impact the project objectives. Change control processes help in tracking approved changes, managing change requests, and ensuring that the project stays on track.
7. **Documentation and Communication**: all changes, whether approved or rejected, need to be documented for future reference. Additionally, effective communication is essential to keep stakeholders informed about the status of changes and their impact on the project.

By following a structured change management process, project teams can effectively handle changes while minimizing disruptions and maintaining project success.

Figure 10

Change Management Process



Note. Own work.

Implementation of change management control

The following steps need to be followed for change management control:

1. **Request for Change**: All requests must be made using the change request format.
2. **Impact Analysis**: The requested changes are identified by analyzing the project parameters, to which include time, quality, requirements, cost, scope, issues, resources, deliverables, and customer inputs.
3. **Approve or Deny:** Once the analysis is complete, the project sponsor provides the resolution, either approval or denial. All requests submitted must be documented within the change request format.
4. **Implement Change**: If the changes are approved, the project team implements the approved changes.
5. **Review and Reporting:** Implemented changes must be tracked, and updates or advancements must be reported daily to the PM.

6. **Storage of Information**: Once the change management process is completed, results must be documented within the change request format and saved as a project document.

Appendix 4: Change Request Format contains the format used to document and track changes within the project. The management team of SB will be tasked with the review of all change requests. The review will judge the impact on the triple constraints (time, costs, and scope) of the project.

For this project, there are three levels of approvals.

Level 3:

- This is the lowest level.
- Change requests are reviewed by the management team members of SB and can only be approved if they have a positive impact on the quality, without affecting the contract value, time or scope.
- Changes are logged and communicated with the SCU and project sponsor.

Level 2:

- The management team of SB will review these requests and advise the project sponsor (Heineken management).
- The total costs and time are still within the allocated budget and loan period.
- If the changes require additional time or costs as per the contract clauses, these changes should also be communicated with the management team of Heineken.
- Once the management team of SB gets approval from the management team of Heineken, the changes can be made.
- Scope changes are not allowed at this level.

Level 1:

- If the change request requires a scope change of the project,
- Approval of the Heineken management is needed through the management team of SB.
- The loan agreement needs to be adjusted.
- Additional funding may be required through restructuring the loan agreement.
- After approval from the Heineken international management, the project sponsor can approve the change of scope.

Lesson learned register

A lessons learned template is a tool that helps project teams to document the knowledge obtained from executing a project. That knowledge comprises positive and negative experiences that occurred throughout the project. By systematically capturing and analyzing lessons learned throughout the project, the Lessons Learned Register of the Scope Management Plan can serve as a valuable resource for future projects, enabling continuous improvement and informed decision-making.

Lesson learned register

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Lesson Learned register**	
Version 1.0	Document ID: xxxxx	03/24/2024

Project Name:	The construction of a Solar power plant for Surinaamse brouwerij N.V
Issued by:	
Issue Date:	

Project Name:	Construction of Solar power plant for SB			
Project Manager:	Shiwam Isrie			
Notes:	(add any extra info here)			
WIN or ISSUE	**Describe What Happened**	**What Was the Impact?**	**How Does This Change Future Projects?**	**Action Items**
WIN				
ISSUE				
WIN				

4.2 Scope Management Plan

Project scope management involves a set of procedures focused on outlining, confirming, and regulating the entirety of the tasks essential for the construction of the solar power plant project, while excluding any unnecessary activities. Directed by the Scope Management Plan, the PM and

Project Team delineate the approaches by which the project scope will be defined, validated, and managed.

Document Tracking (*Scope Management Plan*)

General Information

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Scope Management Plan**
Document Id	*003-SB-SMP*
Document Owner	*Shiwam Isrie*
Issue Date	*March 25, 2024*
Last Saved Date	*March 25, 2024*
File Name	*Scope Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*March 25, 2024*	*Release*

Approvals

Role	Name	Signature©	Date
Project Sponsor	*Heineken Management*		
Project Manager	*Shiwam Isrie*		

4.2.1 Scope Management Plan

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Scope Management Plan**	
Version 1.0	Document ID: 003- SB-SCMP	03/25/2024

Scope Statement

The project scope statement defines the work that will be carried out. The statement clarifies what work will and will not be performed to clarify project responsibilities and roles. A clear project scope statement is critical for the scope management plan and the efficient design and execution of the project.

Project Requirements

The requirements for the project are compiled based on the project management needs and the construction requirements. In table 6, the main deliverables of this project with theirs requirements are represented.

Table 6

Requirements table solar power plant construction

Requirements
The project duration should not exceed more than 5 years.
The project budget is a maximum of €1.830.0000.
Monthly progress report submitted.
Change request requires sponsors' approval.
Quarterly presentation due.
Sponsors' approval is required for designs.
Adequate human resources are available.
Adequate materials are available.
The solar power plant should be accessible via local private and public roads during construction.
The solar power plant should be accessible to community services such as police, ambulances, and fire departments.

Requirements
The solar power plant should be constructed near an available water source (a free-flowing river).
The solar power plant should not encounter shadow effects from buildings and trees.
The brewery roof can support 3000 solar panels.
The brewery roof is at least 6000 m^2 in size.
The brewery power house has enough storage for battery storage.
The solar power plant can be configured for off-grid/on-grid electrical connection.
The brewery power consumption will expand 1.5 times during the next year and the solar power plant should be able to supply this amount of energy.
A total power blackout should never occur.

Requirements traceability matrix

The full list of activities, including the construction activities, are listed in the requirements.

Table 7

Requirements traceability matrix

Requirements Traceability Matrix

Project Manager:	Shiwam Isrie	Project ID:	001-SB-PC
Project Sponsor:	Heineken International	Project Title:	The construction of a Solar power plant for Surinaamse Brouwerij N. V.

Requirement Information					Relationship Traceability			
ID	Category	Requirement	Priority	Source	Business Objective	Deliverable(s)	Verification	Validation
REQ-001	Mandatory	The project duration should not exceed more than 5 years	High	PM	Heineken international has set goals for a lot of their breweries to work towards zero CO_2 net productions by 2030 and to achieve many sustainable development goals	Sustainable and regenerative development report.	Verified with SB management team and PM.	Monthly status report meeting.
REQ-002	Mandatory	The project budget is maximum €1.830.0000	Medium	Management team of Heineken	The project sponsor (Heineken) has set a maximum budget of €1.830.0000	Cost management plan.	Verified with SB management team and PM.	Monthly status report meeting.
REQ-003	Mandatory	Monthly progress report submitted	Low	PM	The PM is responsible to submit monthly reports.	Monthly progress report.	Verified by PM.	Monthly status report meeting.
REQ-004	Mandatory	Change request requires sponsors approval	High	Project sponsor	Change requests require the Project Sponsors approval	Change request form	Verified by PM and project sponsor.	Monthly status report meeting.
REQ-005	Mandatory	Quarterly presentation due	Medium	PM	The sponsor requires a Quarterly meeting when applicable, by the PM.	Quarterly presentation using monthly progress report summaries.	Verified by PM and project sponsor.	Monthly status report meeting.
REQ-006	Mandatory	Sponsors' approval is required for designs	High	PM	Solar power plant designs are required to be approved by the project sponsor,	Solar power plant construction layouts.	Verified by PM and project sponsor.	Monthly status report meeting.
REQ-007	Mandatory	Adequate human resources is available	High	PM	The PM is responsible for staffing to ensure project success.	Human Resources Management plan	Verified by PM	Monthly status report meeting.
REQ-008	Mandatory	Adequate materials are available	High	PM	The PM is responsible for buying adequate materials ensure project success.	Materials Management plan.	Verified by PM.	Monthly status report meeting.
REQ-009	Mandatory	The solar power plant should be accessible via local private and public roads during construction.	High	PM	The solar power plant should be accessible for trucks to deliver materials.	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.
REQ-010	Mandatory	The solar power plant should be accessible to community services such as police, ambulance, and fire department.	High	PM	The solar power plant should be accessible for community services in case of accidents	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.
REQ-011	Mandatory	The solar power plant should be constructed near available water source (a free-flowing river).	Medium	PM	The solar power plant should be constructed near available water source for cooling purposes.	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.

Requirements Traceability Matrix

Project Manager:	Shiwam Isrie	Project ID:	001-SB-PC
Project Sponsor:	Heineken International	Project Title:	The construction of a Solar power plant for Surinaamse Brouwerij N.V.

Requirement Information					Relationship Traceability			
ID	Category	Requirement	Priority	Source	Business Objective	Deliverable(s)	Verification	Validation
REQ-012	Mandatory	The solar power plant should not encounter shadow effects from buildings and trees	High	Contractor	To obtain maximum power output the solar power plant should not encounter shadow effects.	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.
REQ-013	Mandatory	The brewery roof can support 3000 solar panels	High	PM	For generating the required amount of power 3000 solar panels need to be installed on the brewery roof.	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.
REQ-014	Mandatory	The brewery roof is at least 6000 m^2 in size	High	PM	The solar panels need at least 6000 m2 to fit.	Construction blueprints.	Verified by PM and construction engineer.	Monthly status report meeting.
REQ-015	Mandatory	The brewery powerhouse has enough storage for battery storage	Medium	PM	Surplus energy need to be stored in the battery first and any excess can be sold to the power grid.	Construction blueprints.	Verified by PM and electrical engineer.	Monthly status report meeting.
REQ-016	Mandatory	The solar power plant can be configured for off-grid/on-grid electrical connection	Medium	Contractor	Surplus energy need to be stored in the battery first and any excess can be sold to the power grid.	Construction blueprints.	Verified by PM and electrical engineer.	Monthly status report meeting.
REQ-017	Mandatory	The brewery power consumption will expand 1.5 times during the next years, the solar power plant should be able to supply this amount of energy.	Medium	PM	The solar power plant needs to supply enough energy for further brewery capacity expansion.	Construction blueprints.	Verified by PM and electrical engineer.	Monthly status report meeting.
REQ-018	Mandatory	A total power blackout should never occur.	High	Contractor	The solar power plant should be able to run the brewery 24*7, even if the power grid fails for a longer time.	Construction blueprints.	Verified by PM and electrical engineer.	Monthly status report meeting.

Define Scope

The PM and the project team meticulously gathered and elaborated on the project scope requirements throughout the scope management process. This involved defining the boundaries of the project and specifying what is to be included or excluded in the construction of the solar power plant for the SB project. This process is of utmost importance in the project development phase since any oversights or errors could potentially have adverse effects or lead to project delays. Considering the inherent uncertainties associated with projects of this nature, proactive measures will be implemented to address changes in the project scope. This includes the handling of change requests that may be submitted by project stakeholders. All proposed changes will undergo thorough documentation and review processes, where they may be accepted, rejected, or returned for further justification or revision before implementation.

Project exclusions

The project's scope is carefully defined, with exclusions pertaining to both design and execution, overseen by the PM and team. Notably, the PM is not affiliated with a specialized Project Management Office (PMO) or governmental body for solar power plant construction; instead, they are directly employed by SB. In managing and researching the project, stakeholders from diverse fields such as electrical engineering, construction, and municipal sectors will be engaged to furnish vital scope details. The construction of the solar power plant holds immense significance for SB's quest for energy independence and sustained growth, particularly amidst the challenging economic landscape of Suriname. The research outlined in this document lays the groundwork for a prospective project

management plan tailored to the construction of SB's solar power plant, ensuring its alignment with strategic objectives and operational realities.

4.2.2 Work breakdown structure

The Work Breakdown Structure (WBS) serves as a visual roadmap, dissecting the construction of the solar power plant into manageable components essential for project success. By breaking down the project into smaller segments, the WBS delineates the deliverables required throughout the project lifecycle.

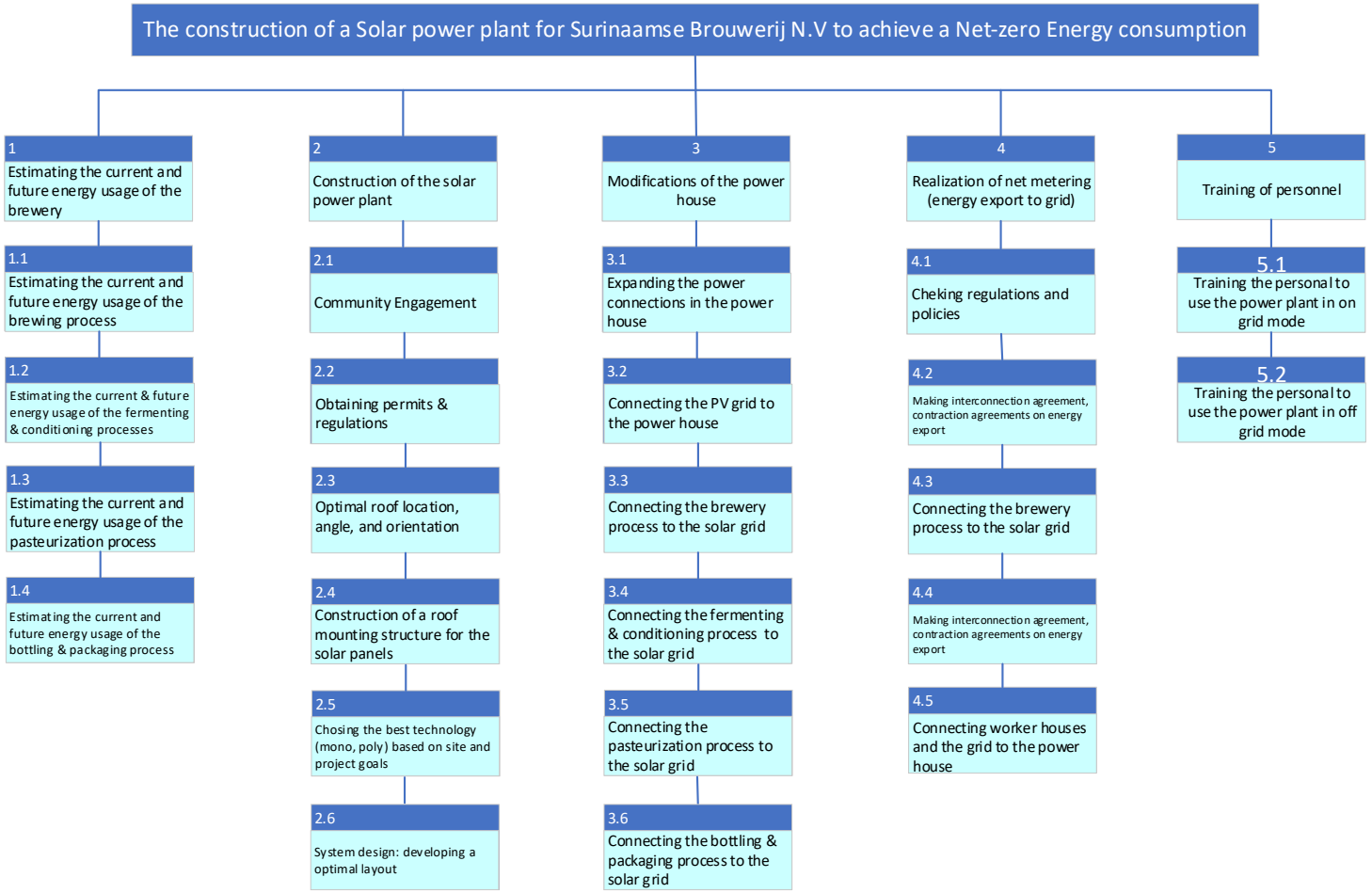
The scope management, the WBS and its accompanying dictionary play pivotal roles. The WBS categorizes project deliverables into hierarchical levels, ensuring comprehensive coverage of all elements. For this project, the 100% rule guided the creation of Level 1, capturing all deliverables. Level 2, known as "Elements," further dissects these deliverables into manageable parts, totaling two elements.

Execution responsibilities are delineated within the WBS. Elements 1.1 through 1.4 are assigned to the SB management team, while elements 2 through 5 will be outsourced to contracted companies. The final step involves creating a WBS dictionary for Levels 1 and 2, detailing each component's scope, requirements, and responsibilities.

The development of the WBS was a collaborative effort, involving a brainstorming session between the SB management team and Mr. Adri Vick, a member of Heineken International based in Amsterdam, The Netherlands. Mr. Vick's expertise, derived from similar projects in the Netherlands and the Caribbean, provided invaluable insights during the WBS development process. This collaboration ensured the creation of a comprehensive and tailored WBS aligned with the project's objectives.

Figure 11

WBS for- the solar power plant construction



Project WBS dictionary

The WBS dictionary provides detailed clarification of the WBS tasks, actions, and deliverables. It is closely tied to the scope and displays project milestones such as deliverables, time, cost, etc.

Table 8

WBS dictionary

WBS ID	Task Name	Description of Work	Deliverables	Resources	Budget
1	Estimating the current and future energy usage of the brewery	Estimating the current and future energy usage with energy usage reports and future capacity expansion plans	Energy usage report	PM, project team, and electrical engineers	€ 10.000
1.1	Estimating the current and future energy usage of the brewing process	Assessing energy consumption in the brewing process	Energy usage report for brewing		
1.2	Estimating the current & future energy usage of the fermenting & conditioning processes	Analyzing energy requirements for fermenting & conditioning processes	Energy usage report for fermenting & conditioning		
1.3	Estimating the current and future energy usage of the pasteurization process	Evaluating energy consumption during pasteurization	Energy usage report for pasteurization		
1.4	Estimating the current and future energy usage of the bottling & packaging processes	Assessing energy needs for bottling & packaging processes	Energy usage report for bottling & packaging		

WBS ID	Task Name	Description of Work	Deliverables	Resources	Budget
2	Construction of the solar power plant	Initiating the construction of the solar power plant	Solar power plant construction plan	PM, project sponsors, stakeholders, and the construction team	€ 1.300.000
2.1	Community Engagement	Informing neighbors about the benefits for the brewery and for them	Community engagement plan		
2.2	Obtaining permits & regulations	Acquiring necessary permits from the Ministry of Public Works	Contruction permit		
2.3	Optimal roof location, angle, and orientation	Determining optimal roof location, angle, and solar irradiation	Installation report		
2.4	Construction of a roof mounting structure for the solar panels	Building a roof mounting structure for solar panels	Roofing plan		
2.5	Chosing the best technology (mono, poly) based on site and project goals	Selecting optimal solar panel technology based on site conditions and project objectives	Technical specifications of solar panels		
2.6	System design: developing an optimal layout	Designing an optimal layout for solar power plant installation	Installation plan		
3	Modifications of the power house	Implementing modifications to the power house for solar grid integration	Installation plan	PM, Project Sponsors, stakeholders, electrical, and	€ 300.000
3.1	Expanding the power connections in the power house	Increasing power connections in the power house for solar grid integration			

WBS ID	Task Name	Description of Work	Deliverables	Resources	Budget
3.2	Connecting the PV grid to the power house	Integrating the PV grid with the power house for solar grid integration		mechanical engineers.	
3.3	Connecting the brewery process to the solar grid	Establishing a connection between the brewery process and solar			
3.4	Connecting the fermenting & conditioning processes to the solar grid	Establishing a connection between the fermenting & conditioning processes and the solar grid			
3.5	Connecting the pasteurization process to the solar grid	Establishing a connection between the pasteurization process and the solar grid			
3.6	Connecting the bottling & packaging processes to the solar grid	Establishing a connection between the bottling & packaging processes and the solar grid			
4	Realization of net metering (energy export to the grid)	Facilitating energy export to the grid through net metering agreements	Net metering-agreements	PM, project sponsors, stakeholders, electrical, infrastructure and mechanical engineers.	€ 200.000
4.1	Checking regulations and policies	Ensuring compliance with regulations and policies for energy export	Regulatory compliance		
4.2	Making interconnection agreements and contraction agreements on energy export	Negotiating and formalizing agreements for energy exports to the grid	Interconnection agreements		
4.3	Connecting the brewery process to the solar grid	Establishing a connection between the brewery process and the solar grid for energy export	The brewery process connected to the solar grid for export		

WBS ID	Task Name	Description of Work	Deliverables	Resources	Budget
4.4	Making interconnection agreements and contraction agreements on energy export	Negotiating and formalizing agreements for energy export to the grid	Interconnection agreements		
4.5	Connecting worker houses and the grid to the power house	Integrating worker houses with the power house for energy export to the grid	Worker houses connected to the solar grid for export		
5	Training of personnel	Providing training to personnel for operating the solar power plant	Trained personnel	PM, project aponsors, and all engineers	€ 20.000
5.1	Training the personnel to use the power plant in on grid mode	Conducting training sessions for operating the solar power plant in on-grid mode	Trained personnel for on-grid mode	PM, project sponsors, and all engineers	
5.2	Training the personnel to use the power plant in off grid mode	Conducting training sessions for operating the solar power plant in off-grid mode	rained personnel for off-grid mode	PM, project sponsors, and all engineers	

Validate Scope

The validation of the project scope will be an ongoing process spanning the entire project lifecycle. Scope validation entails a thorough analysis of project components against predefined criteria. This analysis will involve comparing the work outlined in the Work Breakdown Structure (WBS) with the actual work completed to identify any missed milestones or discrepancies.

Furthermore, a comprehensive review of the requirements list will be conducted to ensure that the completed work aligns with the project's objectives and meets the specified requirements. The findings from these analyses will be compiled into a results list, which will be presented to all project sponsors during monthly meetings.

To ensure the quality and accuracy of the work completed, the project team and stakeholders will conduct site visits after the completion of each phase of the project construction. These site visits will serve to verify the completed work and certify its compliance with project specifications.

Formal acceptance of project milestones will be obtained from key stakeholders and project sponsors through written confirmation. In the event that changes to the scope are necessary, change requests can be submitted. Approved changes will be documented in the issue log and managed through the change control process.

For the project management plan, the following parties are responsible for the validation of the deliverables:

- The management team of SB will validate the deliverables that derive from the contract with the contracting companies.
- The management team will validate the deliverables of SB, KPIs, and the achieved SDGs. The SB management team should report the progress and prepare the final acceptance letter for the Heineken international management team.
- The formal agreement will be signed by the project sponsor (Heineken International Management).

Table 9

Issue Log of the Solar power plant construction for SB.

Issues ID	Date identified	Identified by	Details of issues & effects	Specific actions and resolutions	Agreed owner	Date for completion

Control Scope

Scope control involves continuously monitoring the project and product scope while managing any changes within the established scope baseline. This process involves a thorough examination of project elements and resulting products, highlighting what actions to take to uphold project schedule adherence and meet objectives. Variance and trend analysis comparing planned versus actual progress are utilized by the project team to oversee and regulate project and product advancement, ensuring alignment with the project scope. Recognizing the potential for changes, the PM exercises effective management and control to maintain project momentum. Decisive decision-making ensures that necessary changes are implemented while unnecessary ones are not.

Roles and Responsibilities

Each project management activity contains essential roles and responsibilities for the project lifecycle. Below is a detailed list of the construction of the solar power plant project roles and responsibilities.

Table 10

Roles and responsibilities in Scope Management

Name	Roles	Responsibilities
Shiwam Isrie	Project Manager	a. Measures and verifies the project scope. b. Promotes scope change requests. c. Promotes impact assessments of the scope change requests. d. Organizes and facilitates scheduled change control meetings. e. Communicates outcomes of the scope change requests. f. Updates project documents upon approval of all scope changes.
Heineken International	Project Sponsor	a. Participates in defining change requirements b. Approves or denies scope change requests as required. c. Evaluates the need for scope change requests. d. Accepts completed project deliverables.
Construction team: electrical, mechanical, and infrastructure engineers	Project Team	a. Define and participate in change resolutions. b. Evaluate proposed scope changes and communicate with the PM as required.
Municipality, community agencies, neighbors living in the area, the energy authority of Suriname, and neighborhood organizations.	Stakeholders	a. Authorized to propose scope changes. b. Will abide by and execute change request orders issued by the PM.

Product deliverables and acceptance criteria

The project deliverables and acceptance criteria are the final deliverables, and the project team and stakeholders manage the criteria. A detailed list of the solar power plant construction project acceptance criteria is included below.

Table 11

Project acceptance criteria

Criteria ID	Criteria Categories	Description
Crit. 1	Safety	The solar power plant is located in an area with few environmental dangers (flooding, thunder, heavy winds, and mudslides). The solar power plant should be constructed near an available water source for cooling purposes.
Crit. 2	Solar power plant registry (legal ownership)	The solar power plant is legally registered with the ministry of Public Works and the municipality in Suriname.
Crit. 3	Solar power plant accessibility	The facility is accessible to trucks/commercial vehicles transporting resources and other services such as ambulances, fire brigade, and police.
Crit. 4	Solar power plant size	The brewery roof size should be no smaller than 6000 m2. The roof can support 3000 solar panels. To obtain maximum power output, the solar power plant should not encounter shadow effects.
Crit. 5	Roof construction	The roofing sheets will be a 24-gauge standing seam, finished in PVDF paint, to carry the solar panels.
Crit. 6	Power/Electrical	Surplus energy needs to be stored in the battery first, and any excess can be sold to the power grid. The solar power plant should be able to run the brewery 24×7, even if the power grid fails for a longer time. A total power blackout should never occur. The solar power plant can be configured for off-grid/on-grid electrical connections.
Crit. 7	Capacity expansion	The solar power plant needs to supply enough energy for further brewery capacity expansion.
Crit. 8	Training	All personnel should be trained to operate the solar power plant.

Project constraints

The construction of the solar power plant contains the following constraints: the total project costs should not exceed € 1.830.000, and the total time for project completion should not exceed five years.

- **Budget:** the total project costs should not exceed €1.830.000 for the construction of the solar power plant, which could restrict the choice of materials, technologies, and labor resources available.
- **Time**: the whole time for project completion should not exceed five years.
- **Resources:** the availability of skilled labor, equipment, and materials could be limited, impacting the project's ability to proceed as planned.
- **Regulatory and Permitting Requirement**s: compliance with local regulations, environmental permits, and zoning restrictions may pose constraints on the project's design, location, and timeline.
- **Weather and Climate:** adverse weather conditions such as extreme temperatures, storms, or seasonal variations in sunlight could affect construction progress and productivity.
- **Technological Constraints:** the availability and reliability of solar technologies, equipment, and suppliers could influence the project's design and implementation.
- **Grid Interconnection:** connectivity to the electrical grid and interconnection requirements may present technical and regulatory constraints that need to be addressed.

- **Quality Standards:** Compliance with industry standards, safety regulations, and quality assurance requirements may impose constraints on project implementation and delivery.

Project assumptions

The following assumptions are believed to be true for the project:

- **Project Scope:** The project scope will not change drastically during the project lifecycle.
- **Stakeholder engagement:** stakeholders will be committed to the project, and resources will be available to complete the project successfully.
- **Availability of Skilled Labor:** Assuming that there will be an adequate supply of skilled labor, including engineers, technicians, and construction workers, to complete the project on schedule.
- **Material Availability:** assuming that necessary materials such as solar panels, inverters, mounting structures, and electrical components will be available from suppliers without significant delays or shortages.
- **Weather Conditions:** assuming that weather conditions during construction will be favorable, with minimal disruptions due to extreme weather events such as storms or heavy rainfall.
- **Cost & Financial Support:** the cost of materials will remain throughout the project timeline. Also, assuming that funding for the construction of the solar power plant will be secured as planned, with sufficient budget allocated for project expenses.

- **Community Support:** Assuming that there will be support from the local community and stakeholders for the construction and operation of the solar power plant, with minimal opposition or resistance.
- **Environmental Impact:** Assuming that the environmental impact of the solar power plant construction and operation will be manageable and in compliance with regulatory requirements.

4.3 Project Schedule Management

The project's schedule management, as outlined in the PMBOK framework, encompasses processes aimed at effectively planning, developing, managing, and controlling the project schedule to ensure timely completion of project activities. Microsoft Project will be employed to draft a comprehensive project schedule, encompassing activity durations and a fully developed timeline.

4.3.1 Plan and Schedule Management

Utilizing the Work Breakdown Structure (WBS) outlined in the Scope Management Plan, the project schedule will mirror this structure. Each task will be meticulously managed at the task level. Microsoft Project software will translate the WBS into a detailed project schedule, encompassing all tasks, activities, and their respective durations. The PM will guarantee alignment with the 5-year timeline specified in the Scope Management Plan. This plan provides a comprehensive framework for the utilization of project resources and the monitoring and management of changes by the project team.

4.3.2 Schedule Management Approach

The schedule will be crafted using MS Project, enabling the PM to effectively oversee project activities. Upon consensus among the project sponsor and all stakeholders, the schedule will be deemed official. Any alterations to the schedule will be permitted solely through the change control process, subject to review by all stakeholders.

Document Tracking (*Schedule Management Plan*)

General Information

	**Information**
Document Id	*004- SB-SHMP*
Document Owner	*Shiwam isrie*
Issue Date	*March 27, 2024*
Last Saved Date	*March 27, 2024*
File Name	*Schedule Management Plan*

Change Control

Version	**Issue Date**	**Changes**
1.0	*March 27, 2024*	*Release*

Approvals

Role	**Name**	**Signature©**	**Date**
Project Sponsor	*Heineken international*		
Project Manager	*Shiwam Isrie*		

4.3.3 Schedule management plan

	**Schedule Management Plan**	
Version 1.0	Document ID: *005-SB-CMP*	03/24/2024

Roles and Responsibilities

The project will adhere to the five phases of project schedule management as outlined in the PMBOK Guide 7th edition. Alongside defining and sequencing project activities, the schedule will be created using MS Project, incorporating activity durations and a fully developed project timeline. The roles and responsibilities of the integrated project team are outlined in the table below.

Table 12

Roles and responsibilities

Name	Role	Responsibilities
Heineken International	Project Sponsor	• Participates in defining change requirements. • Approves or denies scope change requests as required. • Evaluates the need for scope change requests. • Accepts completed project deliverables.
Shiwam Isrie	Project Manager	• Measures and verifies the project scope. • Promotes scope change requests. • Promotes impact assessments of the scope change requests. • Organizes and facilitates scheduled change control meetings.

Name	Role	Responsibilities
		• Communicates the outcomes of the scope change requests. • Updates project documents upon approval of all scope changes.
Construction team, electrical, mechanical, and infrastructure engineers.	Project Team	• Define and participate in change resolutions. • Evaluate proposed scope changes and communicate with the PM as required.
Municipality, community agencies, neighbors living in the area, the energy authority of Suriname, neighborhood organizations.	Stakeholders	• Authorized to propose scope changes. • Will abide by and execute change request orders issued by the PM.

Activities Definition, Sequence, and Duration

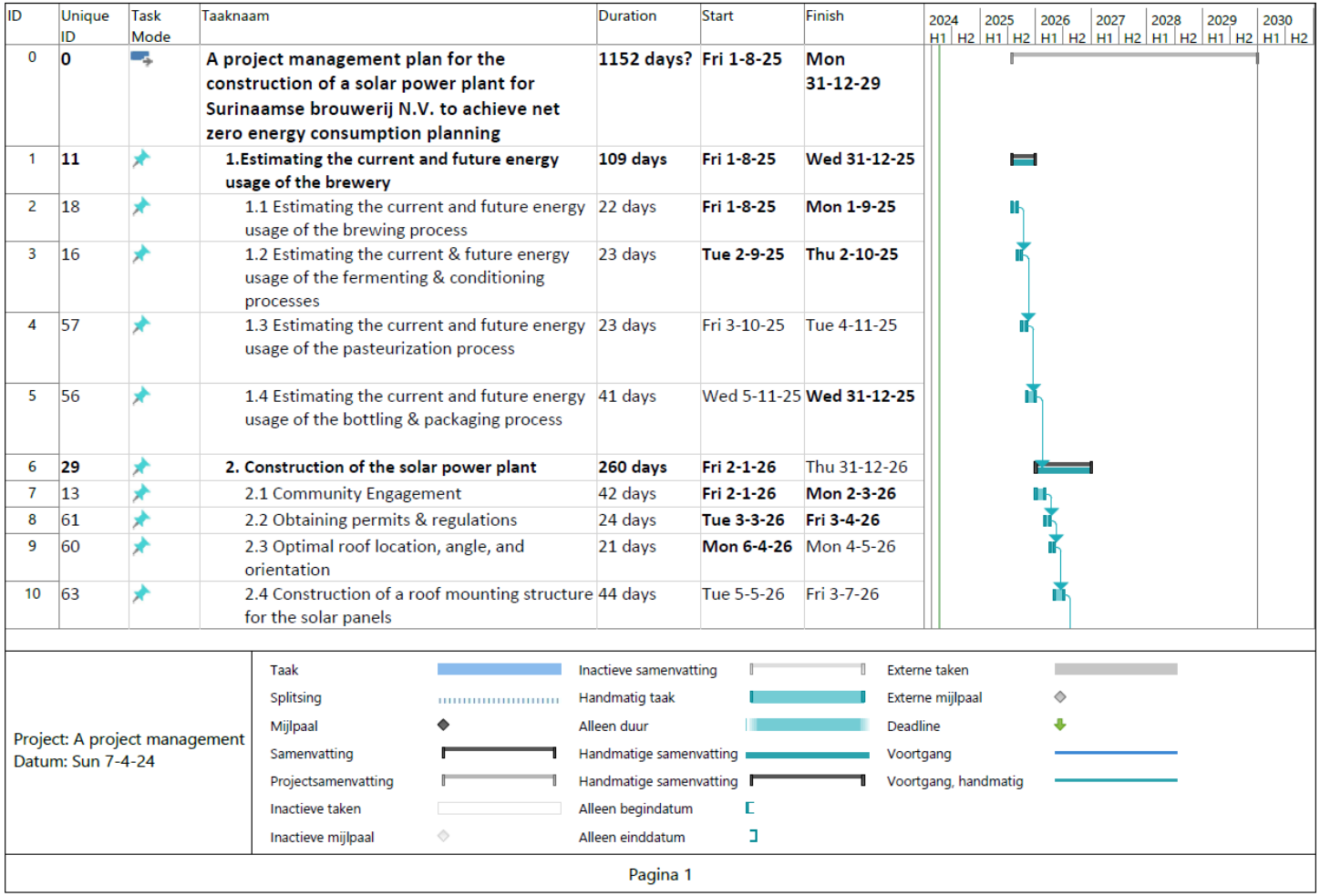
From the project Work Breakdown Structure (WBS), a comprehensive list of activities has been formulated. This list served as the basis for sequencing the project activities and devising a timeline. Expert judgment played a pivotal role in determining both the sequence and duration of these activities. Moreover, the list encompassed crucial project cycle elements such as planning, activity implementation, monitoring, and evaluation, ensuring the holistic completion of project tasks. These activities are meticulously documented within the Project Schedule crafted using MS Project.

Develop Schedule

This procedure involves gathering and assessing data pertaining to activity sequencing, durations, resources, and schedule limitations in order to formulate the project schedule. The schedule for “The Construction of the Solar Power Plant for SB” Project has been generated using MS Project. Further information regarding the project schedule can be accessed in Figure 12 of the Solar Power Plant schedule.

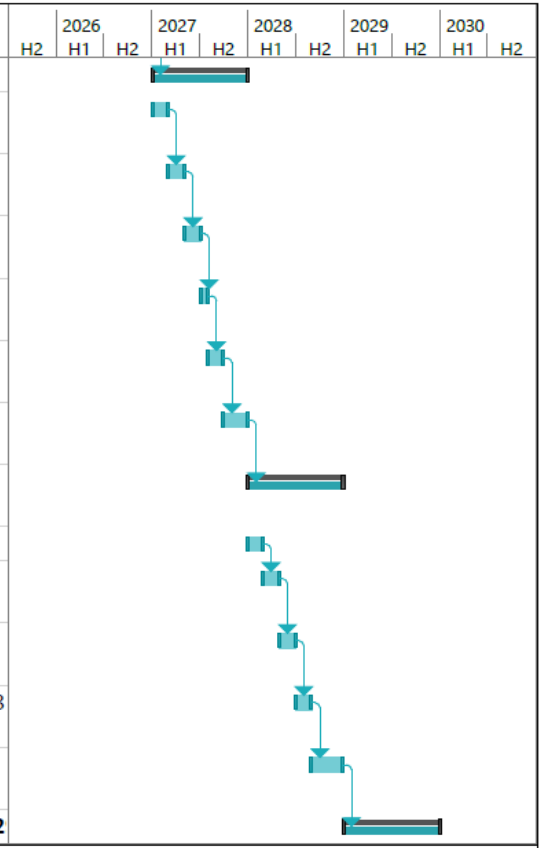
Figure 12

Construction of The solar power plant project Schedule



ID	Unique ID	Task Mode	Taaknaam	Duration	Start	Finish
0	**0**		**A project management plan for the construction of a solar power plant for Surinaamse brouwerij N.V. to achieve net zero energy consumption planning**	**1152 days?**	**Fri 1-8-25**	**Mon 31-12-29**
1	**11**		**1.Estimating the current and future energy usage of the brewery**	**109 days**	**Fri 1-8-25**	**Wed 31-12-25**
2	18		1.1 Estimating the current and future energy usage of the brewing process	22 days	**Fri 1-8-25**	**Mon 1-9-25**
3	16		1.2 Estimating the current & future energy usage of the fermenting & conditioning processes	23 days	**Tue 2-9-25**	**Thu 2-10-25**
4	57		1.3 Estimating the current and future energy usage of the pasteurization process	23 days	Fri 3-10-25	Tue 4-11-25
5	56		1.4 Estimating the current and future energy usage of the bottling & packaging process	41 days	Wed 5-11-25	**Wed 31-12-25**
6	**29**		**2. Construction of the solar power plant**	**260 days**	**Fri 2-1-26**	Thu 31-12-26
7	13		2.1 Community Engagement	42 days	**Fri 2-1-26**	**Mon 2-3-26**
8	61		2.2 Obtaining permits & regulations	24 days	**Tue 3-3-26**	**Fri 3-4-26**
9	60		2.3 Optimal roof location, angle, and orientation	21 days	**Mon 6-4-26**	Mon 4-5-26
10	63		2.4 Construction of a roof mounting structure for the solar panels	44 days	Tue 5-5-26	Fri 3-7-26

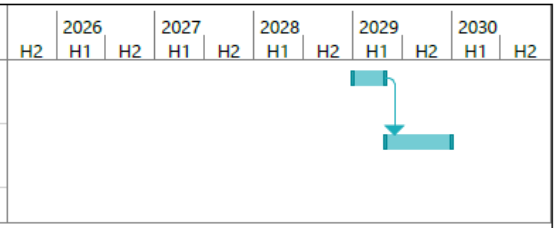
ID	Unique ID	Task Mode	Taaknaam	Duration	Start	Finish
14	**19**		**3. Modifications of the power house**	**260 days**	**Mon 4-1-27**	**Fri 31-12-27**
15	74		3.1 Expanding the power connections in the power house	42 days	Mon 4-1-27	Tue 2-3-27
16	75		3.2 Connecting the PV grid to the power house	45 days	Wed 3-3-27	Tue 4-5-27
17	73		3.3 Connecting the brewery process to the solar grid	44 days	Wed 5-5-27	Mon 5-7-27
18	25		3.4 Connecting the fermenting and conditioning process to the solar grid	20 days	Tue 6-7-27	Mon 2-8-27
19	26		3.5 Connecting the pasteurization process to the solar grid	43 days	Tue 3-8-27	Thu 30-9-27
20	27		3.6 Connecting the bottling & packaging process to the solar grid	66 days	Fri 1-10-27	Fri 31-12-27
21	**30**		**4. Realization of net metering (energy export to grid)**	**260 days**	**Mon 3-1-28**	**Fri 29-12-28**
22	67		4.1 Cheking regulations and policies	40 days	Mon 3-1-28	Fri 25-2-28
23	71		4.2 Making interconnection agreement, contraction agreements on energy export	45 days	Mon 28-2-28	Fri 28-4-28
24	69		4.3 Connecting the brewery process to the solar grid	44 days	Mon 1-5-28	Thu 29-6-28
25	72		4.4 Making interconnection agreement, contraction agreements on energy export	44 days	Fri 30-6-28	Wed 30-8-28
26	70		4.5 Making interconnection agreement, contraction agreements on energy export	86 days	Thu 31-8-28	Thu 28-12-28
27	**35**		**5. Training of personnel**	**260 days**	**Tue 2-1-29**	**Mon 31-12-2**



Project: A project management
Datum: Sun 31-3-24

Taak	Inactieve samenvatting	Externe taken
Splitsing	Handmatig taak	Externe mijlpaal
Mijlpaal	Alleen duur	Deadline
Samenvatting	Handmatige samenvatting	Voortgang
Projectsamenvatting	Handmatige samenvatting	Voortgang, handmatig
Inactieve taken	Alleen begindatum	
Inactieve mijlpaal	Alleen einddatum	

ID	Unique ID	Task Mode	Taaknaam	Duration	Start	Finish
28	36		5.1 Training the personal to use the power plant in on grid mode	87 days	**Tue 2-1-29**	Wed 2-5-29
29	37		5.2 Training the personal to use the power plant in off grid mode	173 days	Thu 3-5-29	Mon 31-12-29
30	48		Project complete			



Project: A project management
Datum: Sun 31-3-24

Taak	Inactieve samenvatting	Externe taken
Splitsing	Handmatig taak	Externe mijlpaal
Mijlpaal	Alleen duur	Deadline
Samenvatting	Handmatige samenvatting	Voortgang
Projectsamenvatting	Handmatige samenvatting	Voortgang, handmatig
Inactieve taken	Alleen begindatum	
Inactieve mijlpaal	Alleen einddatum	

The Schedule Management Plan outlined in this document can only be modified through the change management process initiated by the project sponsor. Any alterations must be documented and approved by both the PM and the sponsor. Failure to submit the Change Request Format will result in the rejection of proposed changes, with the PM retaining the authority to refuse them. Upon submission of a change request meeting the necessary criteria, the project sponsor will have a two-working-day window to either approve or deny the changes. All change requests will be meticulously documented, and approval will be contingent upon the priority of the request and its potential impact on project completion.

Table 13

Project Activities

WBS code	Task name	Duration	Start	Finish
	Project Schedule- Construction of Solar Power Plant for SB	**1561 days**	**01/08/2025**	**25/07/2025**
1	**1. Estimating the current and future energy usage of the brewery**	**109 days**	**01/08/2025**	**31/12/2025**
1.1	Estimating the current and future energy usage of the brewing process	22 days	01/08/2025	01/09/2025
1.2	Estimating the current & future energy usage of the fermenting & conditioning processes	23 days	02/09/2025	02/10/2025
1.3	Estimating the current and future energy usage of the pasteurization process	23 days	03/10/2025	01/11/2025
1.4	Estimating the current and future energy usage of the bottling & packaging processes	41 days	05/11/2025	31/12/2025

WBS code	Task name	Duration	Start	Finish
2.	**Construction of the solar power plant**	**260 days**	**02/01/2026**	31/12/2026
2.1	Community Engagement	42 days	**02/01/2026**	**02/03/2026**
2.2	Obtaining permits & regulations	24 days	**03/03/2026**	**03/04/2026**
2.3	Optimal roof location, angle, and orientation	21 days	**06/04/2026**	04/05/2026
2.4	Construction of a roof mounting structure for the solar panels	44 days	05/05/2026	03/07/2026
2.5	Choosing the best technology (mono, poly) based on site and project goals	23 days	06/07/2026	05/08/2026
2.6	System design: developing an optimal layout	106 days	06/08/2026	31/12/2026
3.	**3. Modifications of the power house**	**260 days**	**04/01/2027**	**31/12/2027**
3.1	Expanding the power connections in the power house	42 days	04/01/2027	02/03/2027
3.2	Connecting the PV grid to the power house	45 days	03/03/2027	04/05/2027
3.3	Connecting the brewery process to the solar grid	44 days	05/05/2027	05/07/2027
3.4	Connecting the fermenting and conditioning processes to the solar grid	20 days	06/07/2027	02/08/2027
3.5	Connecting the pasteurization process to the solar grid	43 days	03/08/2027	30/09/2027
3.6	Connecting the bottling & packaging process to the solar grid	66 days	Fri 1-10-27	Fri 31-12-27
4	**4. Realization of net metering (energy export to grid)**	**260 days**	**Mon 3-1-28**	**Fri 29-12-28**
4.1	Checking regulations and policies	40 days	Mon 3-1-28	Fri 25-2-28
4.2	Making interconnection agreement, contraction agreements on energy export	45 days	Mon 28-2-28	Fri 28-4-28

WBS code	Task name	Duration	Start	Finish
4.3	Connecting the brewery process to the solar grid	44 days	Mon 1-5-28	Thu 29-6-28
4.4	Making interconnection agreement, contraction agreements on energy export	44 days	Fri 30-6-28	Wed 30-8-28
4.5	Making interconnection agreement, contraction agreements on energy export	86 days	Thu 31-8-28	Thu 28-12-28
5	**5. Training of personnel**	**260 days**	**02/01/2029**	**31/12/2029**
5.1	Training the personal to use the power plant in on grid mode	87 days	**02/01/2029**	02/05/2029
5.2	Training the personal to use the power plant in off grid mode	173 days	03/05/2029	31/12/2029
	Project complete			

Schedule Control

Upon project commencement, team members are tasked with informing the PM upon completion of their assigned tasks. Any delays in meeting activity deadlines necessitate a change request submitted by the responsible team member. This request should outline corrective actions to be taken to align with the project's schedule, in accordance with the project work breakdown structure.

The project sponsor will employ the communication framework according to their designated roles and responsibilities. Access to monitor the project's current status will be facilitated through an updated Gantt diagram created in MS Project.

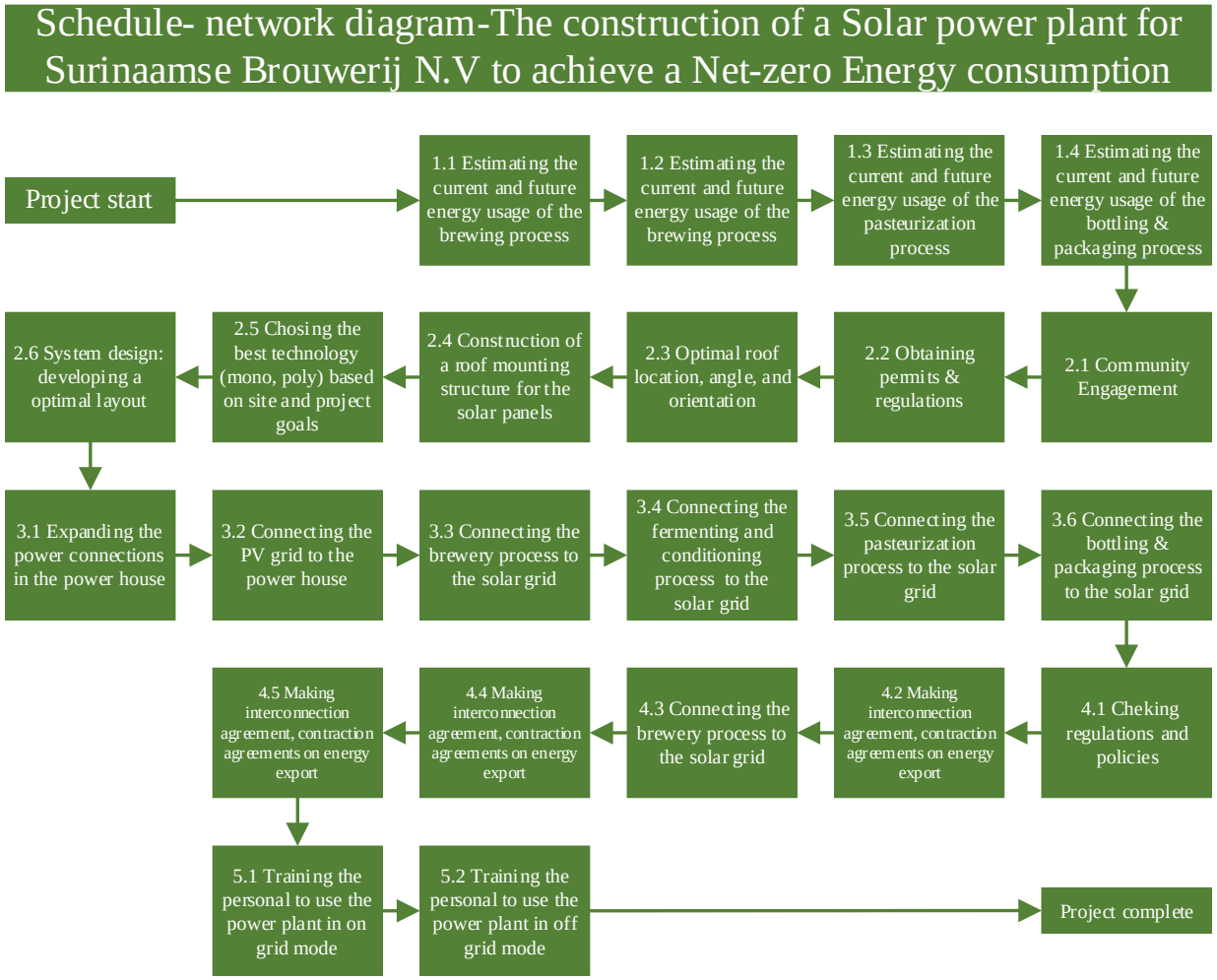
To ensure adherence to the project schedule baseline, the PM and their team will undertake the following tasks:

1. Assess the current status of all project activities.
2. Analyze and address factors that could potentially impact the schedule.
3. Identify any deviations from the schedule and promptly inform the project sponsors.
4. Supervise any changes as they arise.

In addition to these measures, a schedule network diagram will serve as an additional tool for schedule control, displaying project activities as outlined in Table 14.

Figure 13

Schedule Network Diagram



Reserve Analysis

The project schedule development includes a reserve for the public holidays each year in August, September, and December. The added days were provided to account for the holiday and the rainy season experienced in Paramaribo known for heavy rains. Due to the unpredictable rainy season, the design phase and construction of the project are scheduled to occur around the dry season. Most outdoor construction and design timelines occur after January and before June to provide optimal weather and working conditions.

Table 14

Reserve Analysis

WBS	Description	Duration	Extra Time	Total
2.4	Construction of a roof mounting structure for the solar panels	34 Days	+10 Days	44 Days
2.6	System design: developing an optimal layout	80 Days	+26 Days	106 Days
3.2	Connecting the PV grid to the power house	30 Days	+15 Days	45 Days
3.3	Connecting the brewery process to the solar grid	34 Days	+10 Days	44 Days
3.4	Connecting the fermenting and conditioning processes to the solar grid	15 Days	+5 Days	20 Days
3.5	Connecting the pasteurization process to the solar grid	35 Days	+8 Days	43 Days
3.6	Connecting the bottling & packaging processes to the solar grid	40 Days	+26 Days	66 Days

Planned Progress

Project progress and activities will be addressed in monthly status meetings. Given the project's five-year timeline, monthly meetings are deemed adequate for conducting schedule reviews. The activity list and project schedule established in MS Project will serve as primary discussion points during these meetings. Progress updates and project

development activities will be reported monthly through the "monthly report," accessible in the Appendix. This report includes a graph illustrating planned activities aligned with key project milestones. Table 15 depicts the projected progress over the ensuing months of the project.

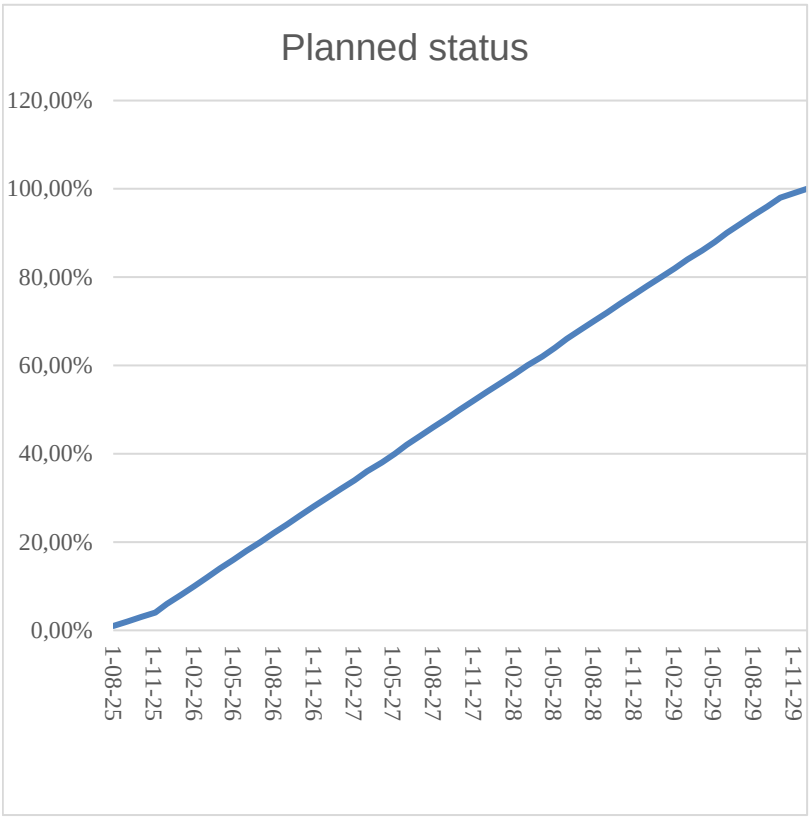
Table 15

Project Planned Progress

Month	date	Planned status
1	1-08-25	1,00%
2	2-09-25	2,00%
3	3-10-25	3,00%
4	5-11-25	4,00%
5	1-12-25	6,00%
	2-01-26	8,00%
7	1-02-26	10,00%
8	3-03-26	12,00%
9	1-04-26	14,00%
10	2-05-26	16,00%
11	1-06-26	18,00%
12	2-07-26	20,00%
13	1-08-26	22,00%
14	1-09-26	24,00%
15	1-10-26	26,00%
16	1-11-26	28,00%
17	1-12-26	30,00%
18	2-01-27	32,00%
19	2-02-27	34,00%
20	3-03-27	36,00%
21	6-04-27	38,00%
22	5-05-27	40,00%
23	1-06-27	42,00%
24	1-07-27	44,00%
25	1-08-27	46,00%
26	1-09-27	48,00%
27	1-10-27	50,00%
28	1-11-27	52,00%
29	1-12-27	54,00%
30	2-01-28	56,00%
31	2-02-28	58,00%
32	3-03-28	60,00%
33	6-04-28	62,00%
34	5-05-28	64,00%

Figure 14

Project planned status



35	1-06-28	66,00%
36	1-07-28	68,00%
37	1-08-28	70,00%
38	1-09-28	72,00%
39	1-10-28	74,00%
40	1-11-28	76,00%
41	1-12-28	78,00%
42	2-01-29	80,00%
43	2-02-29	82,00%
44	3-03-29	84,00%
45	6-04-29	86,00%
46	5-05-29	88,00%
47	1-06-29	90,00%
48	1-07-29	92,00%
49	1-08-29	94,00%
50	1-09-29	96,00%
51	1-10-29	98,00%
52	1-11-29	99,00%
53	1-12-29	100,00 %

4.4 Project Cost Management

The construction of a solar power plant for SB primarily encompasses building and labor expenses. Project management costs, covering permits, compliance with regulations, safety measures, roof mounting structures, power house modifications, grid connections, and linking the brewery and nearby workers' residences, are estimated based on each respective item's average. Additionally, an average for construction materials is computed. Labor costs for the construction team are determined based on the average team size required to complete the building construction and the pay rate for each worker. Any deviation from the projected project costs outlined in the cost management plan will necessitate the submission of a change request form through the change control process. The project sponsor holds the authority to approve or reject such requests.

Document Tracking (*Cost Management Plan*)

General Information

	Information
Document Id	*005-SB-CMP*
Document Owner	*Shiwam Isrie*
Issue Date	*March 29, 2024*
Last Saved Date	*March 29, 2024*
File Name	*Cost Management Plan*

Change Control

Version	**Issue Date**	**Changes**
1.0	*March 29, 2024*	*Release*

Approvals

Role	**Name**	**Signature©**	**Date**
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.4.1 Cost Management Plan

	**Cost Management Plan**	
Version 1.0	Document ID: 005-SB-CMP	03/24/2024

Project Cost

The project expenses will be fully funded by Heineken International in the Netherlands. Heineken International is supporting the project with the aim of assisting SB in transitioning towards net-zero CO_2 emissions by 2030 and achieving energy independence from the local, unreliable power grid. This initiative also enables SB to produce their beers in a more sustainable and environmentally friendly manner. SB management will oversee the application for a construction permit and obtain approvals from the municipality, Ministry of Public Works, and EAS. Both Heineken management and SB management will collaborate to select a construction company with affordable rates and extensive experience in solar power plant construction.

Project Cost Estimation

The construction of a solar power plant for SB focuses mainly on building and labor expenses. Project management costs, including land assessment, safety measures, and architectural design, are estimated based on the average for each component. Additionally, the average cost of construction materials is computed. Labor costs for the construction team are determined based on the average salary of Surinamese construction workers. A

quantitative assessment was conducted to ascertain the cost of all activities outlined in the Work Breakdown Structure (WBS). Three-point estimating methodologies were utilized to calculate labor costs accurately.

Most Likely (cM) estimate: This cost is calculated as the actual effort for work and duration. The average salary of a solar power plant construction worker in Suriname is €950 per month.

Optimistic (cO) estimate: This is the optimum scenario for labor, considering a lower salary of €650 per month is utilized.

Pessimistic (cP) estimate: This is the least optimum scenario because the highest salary level of a construction worker is €1.200 per month.

Knowing the defined costs of each option, the expected cost (cE) is obtained by using a beta distribution formula:

$$cE = \frac{cO + 4cM + cP}{6}$$

A construction worker gets a monthly payment based on a typical Surinamese company pay schedule. Per the Labor Code of Suriname 1943, Section 140, the ordinary day shift cannot exceed eight hours per day with a defined work week of 5 days. A regular schedule equals a maximum of 180 hours per month. Table 16 shows the cost per hour based on the most Likely, Optimistic, and Pessimistic Scenarios.

Table 16

Solar power plant Construction Team Cost Scenarios

Scenario	Salary per month (€)	Hours Per Month (hr.)	Cost per hour (€)
Most Likely (cM)	950	180	5,27
Optimistic (cO)	650	180	3,61
Pessimistic (cP)	1.200	180	6,67
Expected	**941,67**	**180**	**5,23**

$$cE = \frac{cO + 4cM + cP}{6} = \frac{3.61 + 4 \cdot 5.27 + 6.67}{6} = € 5{,}23$$

After the expected costs are determined for a construction worker per month, the total labor cost needs to be calculated. An average construction team size for a large plant is 10-30 workers. Given that this building is large, the project utilized a scale of 10, 20, and 30 workers for the construction team. This team includes the workers required to complete the project as detailed in the WBS. Using the information from Table 16, the table below details the average expected project costs for construction team labor.

Table 17

Expected Construction Team Labor Costs

Scenario	Expected Salary per month (€)	Months worked	Expected Salary cost for project (€)
10 workers	9.416,7	12	113.000,4
20 workers	18.833,4	12	226.000,8
30 workers	28.250,1	12	339.001,2
Average Expected project costs for construction labor	**18.833,40**	**12**	**226.00,4**

After the costs for construction labor were identified, the remaining costs for the WBS were calculated. Local companies were consulted on the average prices for each item. Table 18 gives a review of the cost estimate.

Cost estimate

Table 18

Project Cost Estimate

WBS code	Task name	Duration (days)	Most likely (€)	Optimistic (€)	Pessimistic (€)	Expected cost (€)
	Total costs - Construction of Solar power plant for SB	**1561**	1.930.000,0	1.837.500,0	2.185.000,0	1.984.166,7
1	**1.Estimating the current and future energy usage of the brewery**	**109**				
1.1	1.1 Estimating the current and future energy usage of the brewing process	22	2.000,0	1.500,0	3.000,0	2.166,7
1.2	1.2 Estimating the current & future energy usage of the fermenting & conditioning processes	23	2.000,0	1.500,0	3.000,0	2.166,7
1.3	1.3 Estimating the current and future energy usage of the pasteurization process	23	2.000,0	1.500,0	3.000,0	2.166,7
1.4	1.4 Estimating the current and future energy usage of the bottling & packaging processes	41	4.000,0	3.000,0	6.000,0	4.333,3
2.	**2. Construction of the solar power plant**	**260**	1.600.000,0	1.500.000,0	1.800.000,0	1.633.333,3
2.1	2.1 Community Engagement	42				
2.2	2.2 Obtaining permits & regulations	24				
2.3	2.3 Optimal roof location, angle, and orientation	21				
2.4	2.4 Construction of a roof mounting structure for the solar panels	44				

WBS code	Task name	Duration (days)	Most likely (€)	Optimistic (€)	Pessimistic (€)	Expected cost (€)
2.5	2.5 Choosing the best technology (mono, poly) based on site and project goals	23				
2.6	2.6 System design: developing an optimal layout	106				
3.	**3. Modifications of the power house**	**260**	210.000,0	200.000,0	220.000,0	210.000,0
3.1	3.1 Expanding the power connections in the power house	42				
3.2	3.2 Connecting the PV grid to the power house	45				
3.3	3.3 Connecting the brewery process to the solar grid	44				
3.4	3.4 Connecting the fermenting and conditioning process to the solar grid	20				
3.5	3.5 Connecting the pasteurization process to the solar grid	43				
3.6	3.6 Connecting the bottling & packaging processes to the solar grid	66				
4	**4. Realization of net metering (energy export to grid)**	**260**	70.000,0	80.000,0	90.000,0	80.000,0
4.1	4.1 Checking regulations and policies	40				
4.2	4.2 Making interconnection agreements and contraction agreements on energy export	45				
4.3	4.3 Connecting the brewery process to the solar grid	45				
4.4	4.4 Making interconnection agreement and contraction agreements on energy export	44				

WBS code	Task name	Duration (days)	Most likely (€)	Optimistic (€)	Pessimistic (€)	Expected cost (€)
4.5	4.5 Making interconnection agreement, contraction agreements on energy export	86				
5	**5. Training of personnel**	**260**				
5.1	5.1 Training personnel to use the power plant in on grid mode	87	40.000,0	50.000,0	60.000,0	50.000,0
5.2	5.2 Training the personnel to use the power plant in off grid mode	173				

Contingency Reserve Cost Analysis

The contingency reserve is the budget amount determined to cover all uncertain costs that may appear as the project advances. Table 19 shows the calculation of the project contingency reserve. The calculation is based on the contingency schedule reserve shown in Table 14 to cover known unknowns that might affect the project. For instance, rework or the chances of being unable to work on the project due to competing work or others given assignments to the solar power plant construction company. The expected cost is calculated using the average project cost per month for the workers. According to table 17, this is around €**18.833,40 for workers per month, and each month has 20 effective workdays , so for one day this is** €944,17. In the table below (table 19), you can see the total expected cost for the entire project. For the entire project with a maximum total delay of 100 days, this is around € **94.441,7.**

Table 19

Project Contingency Reserve

WBS	Description	Duration (days)	Extra Time (days)	Total time (days)	Expected Cost (average) (€)
2.4	Construction of a roof mounting structure for the solar panels	34	+10	44	9.441,17
2.6	System design: developing an optimal layout	80	+26	106	24.548,42
3.2	Connecting the PV grid to the power house	30	+15	45	14.162,55
3.3	Connecting the brewery process to the solar grid	34	+10	44	9.441,17
3.4	Connecting the fermenting & conditioning processes to the solar grid	15	+5	20	4.720,85
3.5	Connecting the pasteurization processes to the solar grid	35	+8	43	7.553,36

WBS	Description	Duration (days)	Extra Time (days)	Total time (days)	Expected Cost (average) (€)
3.6	Connecting the bottling & packaging processes to the solar grid	40	+26	66	24.548,42
	Total		**+100**		**94.441,7**

Management reserve

The management reserve is the budget within the cost baseline to respond to any delay or unforeseen work within the project scope when, as in this case, it is equal to 10% over the estimated project's cost.

$$Management\ Reserve = cE \cdot 10\% = €1.983.500 \times 10\% = €198.350$$

Project's Budget.

The cost related to the project's development is shown in Table 20.

Table 20

Project Costs

Construction of Solar power plant for SB	
	Costs(€)
Total Costs Estimate- Construction of Solar power plant for SB	1.983.500
Contingency Reserve	94.441,7
Cost Baseline	2.077.941,7
Management Reserve	198.350
Total Project Budget	**2.276.291,7**

Cost Control Process

Due to the importance of achieving project development within an established timeframe and cost, the PM and project sponsor will follow and assess the activities as they are completed. The emphasis will be on the defined dates in this plan. The Earned Value

Analysis (EVA) will measure the project's schedule completion and related cost to accurately estimate each activity's completion and maintain the cost within the budget. The following terms are necessary to understand EVA:

- **Planned Value (PV.):** the authorized budget assigned to complete the activities.
- **Earned Value (EV.)**: measure of work performed expressed in terms of the budget authorized.
- **Actual Cost (AC.)**: the current job performance cost during a specific time.

To obtain these values and make the Earned Value Analysis, formulas such as the Schedule Variance, Cost Variance, and Earned Value are necessary. Additionally, the following indicators, such as Schedule Performance Index, and Cost Performance Index, will be monitored using Table 21, which analyzes the cost expenses over time, as they are calculated using the following formulas:

$$Schedule\ Variance = SV = EV - PV$$
$$Cost\ Variance = CV = EV - AC$$
$$Schedule\ Performance\ Index = SPI = \frac{EV}{PV}$$
$$Cost\ Performance\ Index = CPI = \frac{EV}{AC}$$

Table 21

Cumulative costs

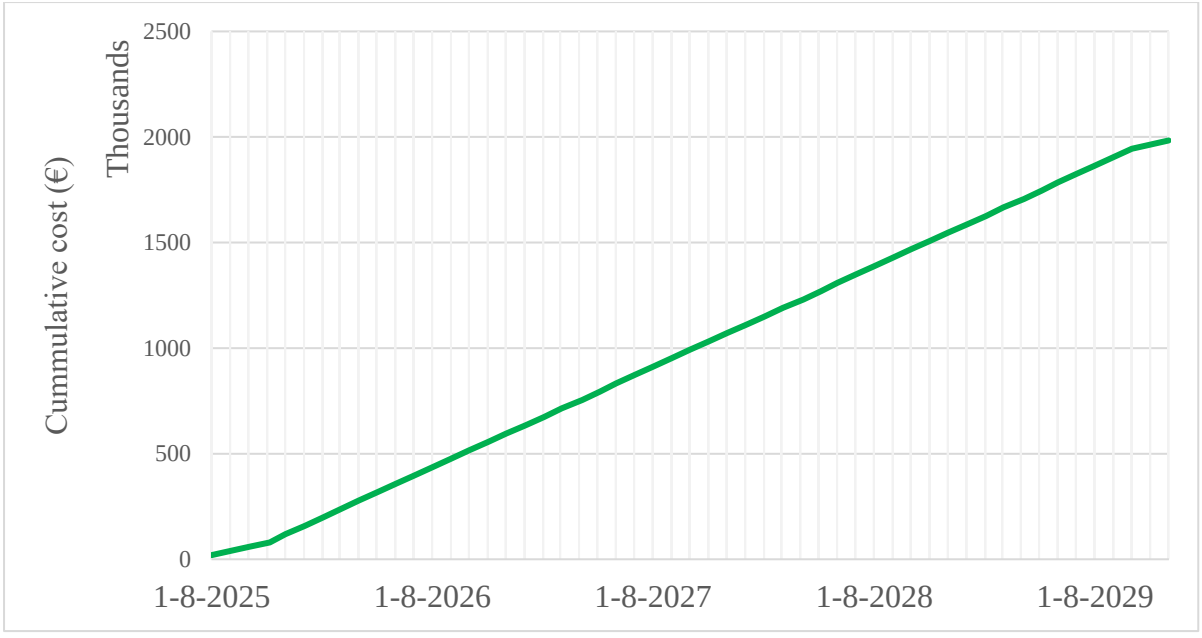
Month	date	Planned status	Cummulative costs (€)
1	1-8-2025	1,00%	19835
2	2-9-2025	2,00%	39670
3	3-10-2025	3,00%	59505
4	5-11-2025	4,00%	79340
5	1-12-2025	6,00%	119010
6	2-1-2026	8,00%	158680

Month	date	Planned status	Cummulative costs (€)
7	1-2-2026	10,00%	198350
8	3-3-2026	12,00%	238020
9	1-4-2026	14,00%	277690
10	2-5-2026	16,00%	317360
11	1-6-2026	18,00%	357030
12	2-7-2026	20,00%	396700
13	1-8-2026	22,00%	436370
14	1-9-2026	24,00%	476040
15	1-10-2026	26,00%	515710
16	1-11-2026	28,00%	555380
17	1-12-2026	30,00%	595050
18	2-1-2027	32,00%	634720
19	2-2-2027	34,00%	674390
20	3-3-2027	36,00%	714060
21	6-4-2027	38,00%	753730
22	5-5-2027	40,00%	793400
23	1-6-2027	42,00%	833070
24	1-7-2027	44,00%	872740
25	1-8-2027	46,00%	912410
26	1-9-2027	48,00%	952080
27	1-10-2027	50,00%	991750
28	1-11-2027	52,00%	1031420
29	1-12-2027	54,00%	1071090
30	2-1-2028	56,00%	1110760
31	2-2-2028	58,00%	1150430
32	3-3-2028	60,00%	1190100
33	6-4-2028	62,00%	1229770
34	5-5-2028	64,00%	1269440
35	1-6-2028	66,00%	1309110
36	1-7-2028	68,00%	1348780
37	1-8-2028	70,00%	1388450
38	1-9-2028	72,00%	1428120
39	1-10-2028	74,00%	1467790
40	1-11-2028	76,00%	1507460
41	1-12-2028	78,00%	1547130
42	2-1-2029	80,00%	1586800

Month	date	Planned status	Cummulative costs (€)
43	2-2-2029	82,00%	1626470
44	3-3-2029	84,00%	1666140
45	6-4-2029	86,00%	1705810
46	5-5-2029	88,00%	1745480
47	1-6-2029	90,00%	1785150
48	1-7-2029	92,00%	1824820
49	1-8-2029	94,00%	1864490
50	1-9-2029	96,00%	1904160
51	1-10-2029	98,00%	1943830
52	1-11-2029	99,00%	1963665
53	1-12-2029	100,00%	1983500

Figure 15

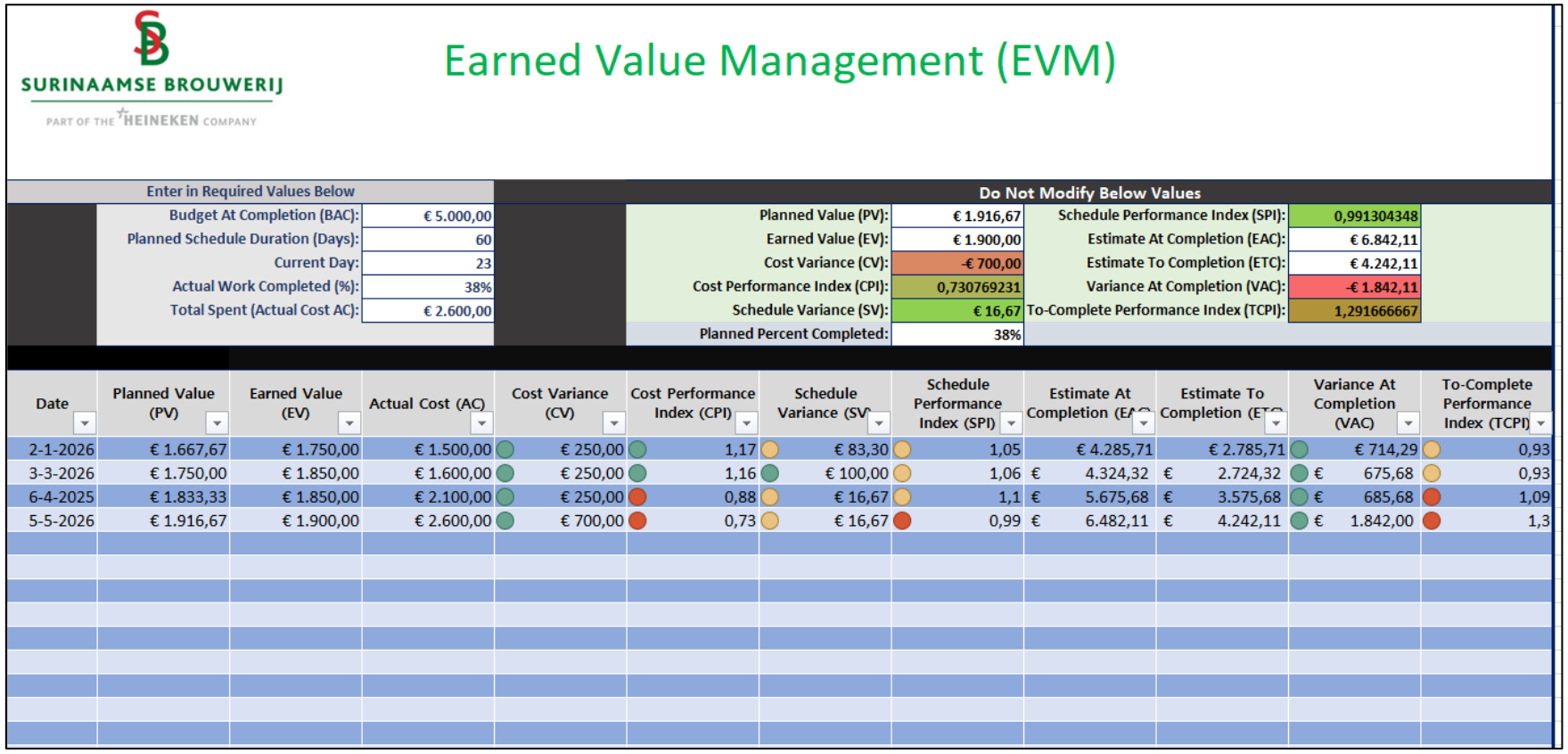
Cumulative costs



In figure 32, a template and three examples are shown how the earned value management analysis will be done. This template has been used by several projects of SB earlier. In figure 33, the EVM tracker is shown, where pivot charts can be generated with different views, PV, EV, AC, CV, versus dates.

Figure 16

Earned Value Management



SURINAAMSE BROUWERIJ
PART OF THE HEINEKEN COMPANY

Earned Value Management (EVM)

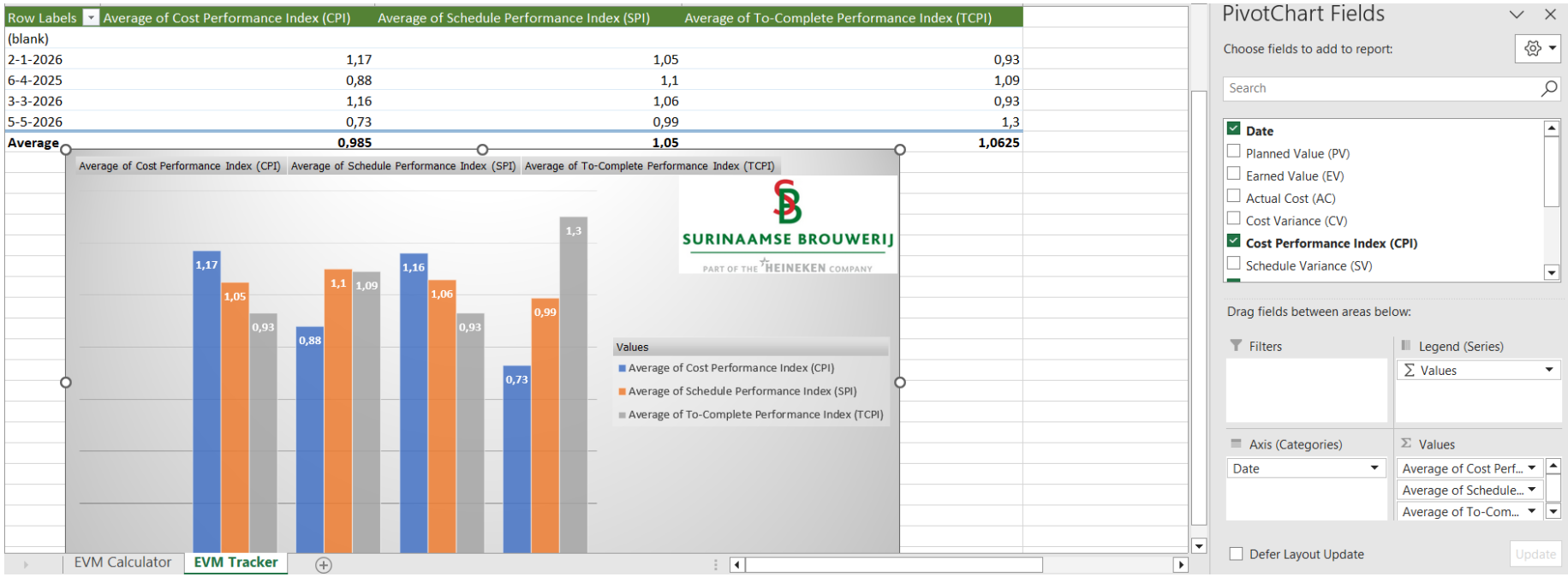
Enter in Required Values Below		Do Not Modify Below Values			
Budget At Completion (BAC):	€ 5.000,00	Planned Value (PV):	€ 1.916,67	Schedule Performance Index (SPI):	0,991304348
Planned Schedule Duration (Days):	60	Earned Value (EV):	€ 1.900,00	Estimate At Completion (EAC):	€ 6.842,11
Current Day:	23	Cost Variance (CV):	-€ 700,00	Estimate To Completion (ETC):	€ 4.242,11
Actual Work Completed (%):	38%	Cost Performance Index (CPI):	0,730769231	Variance At Completion (VAC):	-€ 1.842,11
Total Spent (Actual Cost AC):	€ 2.600,00	Schedule Variance (SV):	€ 16,67	To-Complete Performance Index (TCPI):	1,291666667
		Planned Percent Completed:	38%		

Date	Planned Value (PV)	Earned Value (EV)	Actual Cost (AC)	Cost Variance (CV)	Cost Performance Index (CPI)	Schedule Variance (SV	Schedule Performance Index (SPI)	Estimate At Completion (EA	Estimate To Completion (ET	Variance At Completion (VAC)	To-Complete Performance Index (TCPI)
2-1-2026	€ 1.667,67	€ 1.750,00	€ 1.500,00	€ 250,00	1,17	€ 83,30	1,05	€ 4.285,71	€ 2.785,71	€ 714,29	0,93
3-3-2026	€ 1.750,00	€ 1.850,00	€ 1.600,00	€ 250,00	1,16	€ 100,00	1,06	€ 4.324,32	€ 2.724,32	€ 675,68	0,93
6-4-2025	€ 1.833,33	€ 1.850,00	€ 2.100,00	€ 250,00	0,88	€ 16,67	1,1	€ 5.675,68	€ 3.575,68	€ 685,68	1,09
5-5-2026	€ 1.916,67	€ 1.900,00	€ 2.600,00	€ 700,00	0,73	€ 16,67	0,99	€ 6.482,11	€ 4.242,11	€ 1.842,00	1,3

Note. Own work.

Figure 17

Earned value management analysis tracker



Note. Own work.

Performance Index response

Utilizing data from the Schedule Performance Index (SPI) and Cost Performance Index (CPI), the PM will ascertain the current status of the project and develop contingency plans as necessary. Employing the SPI and CPI monitoring tools outlined in table 22, the PM may need to implement changes or corrective actions to safeguard the project's success.

Table 21

Project SPI/CPI Monitoring

CPI & SPI	SPI < 1	SPI = 0	SPI > 1
CPI < 0	Over budget, behind schedule	Over budget, on schedule	Over budget, ahead of schedule
CPI=1	On budget, behind schedule	On budget, on schedule	On budget, ahead of schedule
CPI>1	Under budget, behind schedule	Under budget, on schedule	Under budget, ahead of schedule

Cost Management Plan, Change Process

The Cost Management Plan outlined in this document can only undergo alterations through the change management process initiated by the project sponsor. All requirements must be documented and authorized by both the PM and the project sponsor. Failure to submit the Change Request Format will result in no changes being implemented, with the PM retaining sole discretion to refuse any proposed changes. Upon submission of a change request meeting all requirements, the project sponsor will have a two-working-day window to either approve or deny the changes. All change requests must be documented, and approval will be contingent upon the request's priority and its potential impact on the project’s completion.

Roles and Responsibilities

Table 22

Cost Roles and Responsibilities

Name	Role	Responsibilities
Heineken International	Project Sponsor	Approves any cost additions
Shiwam Isrie	PM	Ensures project completion on schedule and includes all activities listed in the plan.
Construction team: electrical, mechanical, and infrastructure engineer	Construction and installation	Develops the project with current resources.

4.5 Project Quality Management

Quality is seamlessly woven into the project development process to align with stakeholder requirements and project objectives. The Quality Management Plan delineates the quality prerequisites and acceptable benchmarks for project deliverables, guaranteeing adherence to standards. This plan encompasses a detailed document leveraging the Quality Control Template, meticulously evaluating all project requisites to ensure alignment with expected standards and functionality.

Document Tracking (*Quality Management Plan*)

General Information

	Information
Document Id	*006-SB -QMP*
Document Owner	*Surinaamse Brouwerij N.V*
Issue Date	*March 31, 2024*
Last Saved Date	*March 31, 2024*
File Name	*Quality Management Plan*

Change Control

Version	**Issue Date**	**Changes**
1.0	*March 31, 2024*	*Release*

Approvals

Role	**Name**	**Signature©**	**Date**
Project Sponsor	*Heineken international*		
Project Manager	*Shiwam Isrie*		

4.5.1 Quality Management Plan

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Quality Management Plan**	
Version 1.0	Document ID: 006 SB-QMP	03/31/2024

Project Quality

Project quality pertains to fulfilling all the attributes and criteria outlined by the project sponsor and other stakeholders as delineated in the project charter.

Quality Metrics

To facilitate the project's progress, it's imperative to gauge the Cost Performance Index and Schedule Performance Indexes on a monthly basis. These metrics should be reported to the project sponsor (Heineken international) during the monthly meeting, utilizing Appendix 6: Monthly Report. Further details regarding project indicators are available in Table 23, while Table 25 illustrates the anticipated indicators.

Table 23

Quality Metrics

Metrics	Indicator Scale
CPI	0.9<X<1.1
SPI	0.9<X<1.1
Change Request Attention	≤3 days
Project Satisfaction	>95%
CV	≥0
S.V.	≥0

Table 25 outlines the project requirements and the acceptable criteria that the PM needs to scrutinize to ensure their fulfillment. This inspection process utilizes Appendix 9 for assessing project deliverables, aiding in the verification of stakeholder requirements satisfaction.

Roles and Responsibilities

Table 24

Quality Roles and Responsibilities

Name	Role	Responsibilities
Heineken International	Project Sponsor	• Approved quality changes. • Accept completed project deliverables.
Shiwam Isrie	Project Manager	• Oversees the Quality Management Plan. • Project quality control. • Ensures that project requirements are accomplished. • Schedules monthly meetings and quarterly presentations.
Construction team (electrical, mechanical, and infrastructure engineers)	Construction	• Handle the process to ensure quality. • Ensures the construction requirements are followed. • Makes sure that each construction phase is accomplished. • Manages construction team members for quality craftsmanship.

Quality Management Plan, Change Process

The Quality Management Plan outlined in this document can undergo modifications solely through the change management process, detailed in the project management section and initiated by the project sponsor. Requirements necessitate authorization and documentation by both the PM and sponsor. In the absence of a Change Request Format submission, alterations will not proceed, with the PM retaining the authority to decline

changes. Upon a change request submission meeting requirements, the project sponsor will be granted one week to approve or reject the proposed modifications. Each change request must be meticulously documented, with approval contingent upon prioritization and potential impacts on project completion resulting from approval or denial.

Quality Control

For quality control purposes, the project team is required to utilize the provided template to evaluate each requirement, ensuring adherence to the acceptance criteria outlined in table 26. Quality Control procedures should be conducted for each requirement upon completion of project deliverables or conditions. The Quality Control documents are available in Appendix 9 and are to be filled out by the PM.

Quality Control Process

1. Project deliverables are being developed.
2. Upon categorization of each deliverable or requirement as completed, it is reported to the PM.
3. If the reported deliverable or requirement meets the acceptance criteria outlined in table 25, it is accepted; otherwise, it will be returned for correction.
4. Update the project progress.
5. Record the assessment of each requirement or deliverable using the Quality Control 007- SB -QMP template available in Appendix 9: Quality Control.

Table 25

Quality Acceptable Criteria

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Quality Acceptable Criteria**
Project Name:	Construction of a solar power plant for Surinaamse Brouwerij N.V
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

I.D.	Requirement Description	Requested by	Responsible	Acceptable Criteria	Additional Comments
1	Safety	Project sponsor	Project Manager	The solar power plant is located in an area with few environmental dangers (flooding, thunder, heavy winds, and mudslides). The solar power plant should be constructed near an available water, and source for cooling purposes.	
2	Solar power plant registry (legal ownership)	Project sponsor	Project Manager	The solar power plant is legally registered with the Ministry of Public Works and the municipality in Suriname.	
3	Solar power plant accessibility	Project sponsor	Project Manager	The facility is accessible to trucks/commercial vehicles transporting resources and other services such as ambulances, fire brigade, and police.	

I.D.	Requirement Description	Requested by	Responsible	Acceptable Criteria	Additional Comments
4	Solar power plant size	Project sponsor	Project Manager	The brewery roof size should be no smaller than 6000 m2. The roof can support 3000 solar panels. To obtain maximum power output, the solar power plant should not encounter shadow effects.	
5	Roof construction	Project sponsor	Construction Team	The roofing sheets will be a 24-gauge standing seam, finished in PVDF paint, to carry the solar panels.	
6	Power/Electrical	Project sponsor	Construction Team	Surplus energy needs to be stored in the battery first, and any excess can be sold to the power grid. The solar power plant should be able to run the brewery 24×7, even if the power grid fails for a longer time. A total power blackout should never occur. The solar power plant can be configured for off-grid/on-grid electrical connections.	
7	Capacity expansion	Project sponsor	Construction Team	The solar power plant needs to supply enough energy for further brewery capacity expansion.	
8	Training	Project sponsor	Construction Team	All personnel should be trained to operate the solar power plant.	

4.6 Project Resource Management

The project's resource management plan ensures efficient management of personnel needs within the schedule, cost, and scope constraints. It's tailored to utilize local resources from Amps Suriname, a company specializing in solar panels and accessory materials. To work efficiently with costs and time, the project team will strive to source and deliver physical resources within Paramaribo whenever feasible. All labor and technical tasks will be carried out by the local workforce.

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Information**
Document Id	*008-SB-RMP*
Document Owner	*Surinaamse Brouwerij N.V*
Issue Date	*April 07, 2024*
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File Name	*Resource Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*April 07, 2024*	*Release*

Approvals

Role	Name	Signature©	Date
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.6.1 Resource Management Plan

	**Resource Management Plan**	
Version 1.0	Document ID: 008-SB-RMP	04/07/2024

Project Resources

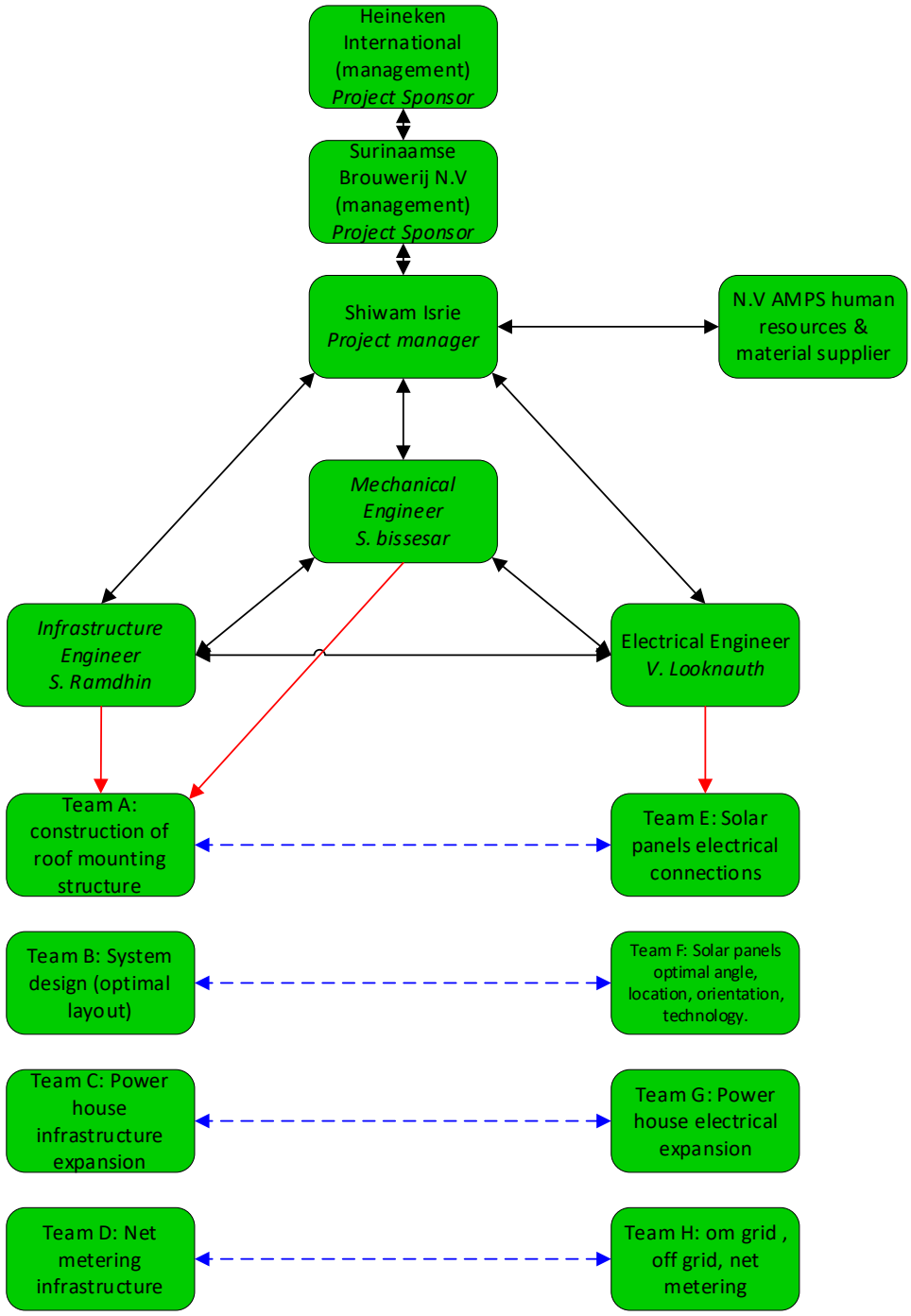
Are referenced as all the resources needed to attain the project standards.

Project Team

The diagram below outlines the responsibilities of the project staff to be utilized in the project. It also establishes the hierarchy within the project and delineates the communication channels to be employed.

Figure 18

Project Team



Note. Own work. (Isrie, 2024)

Activity Resources Estimation

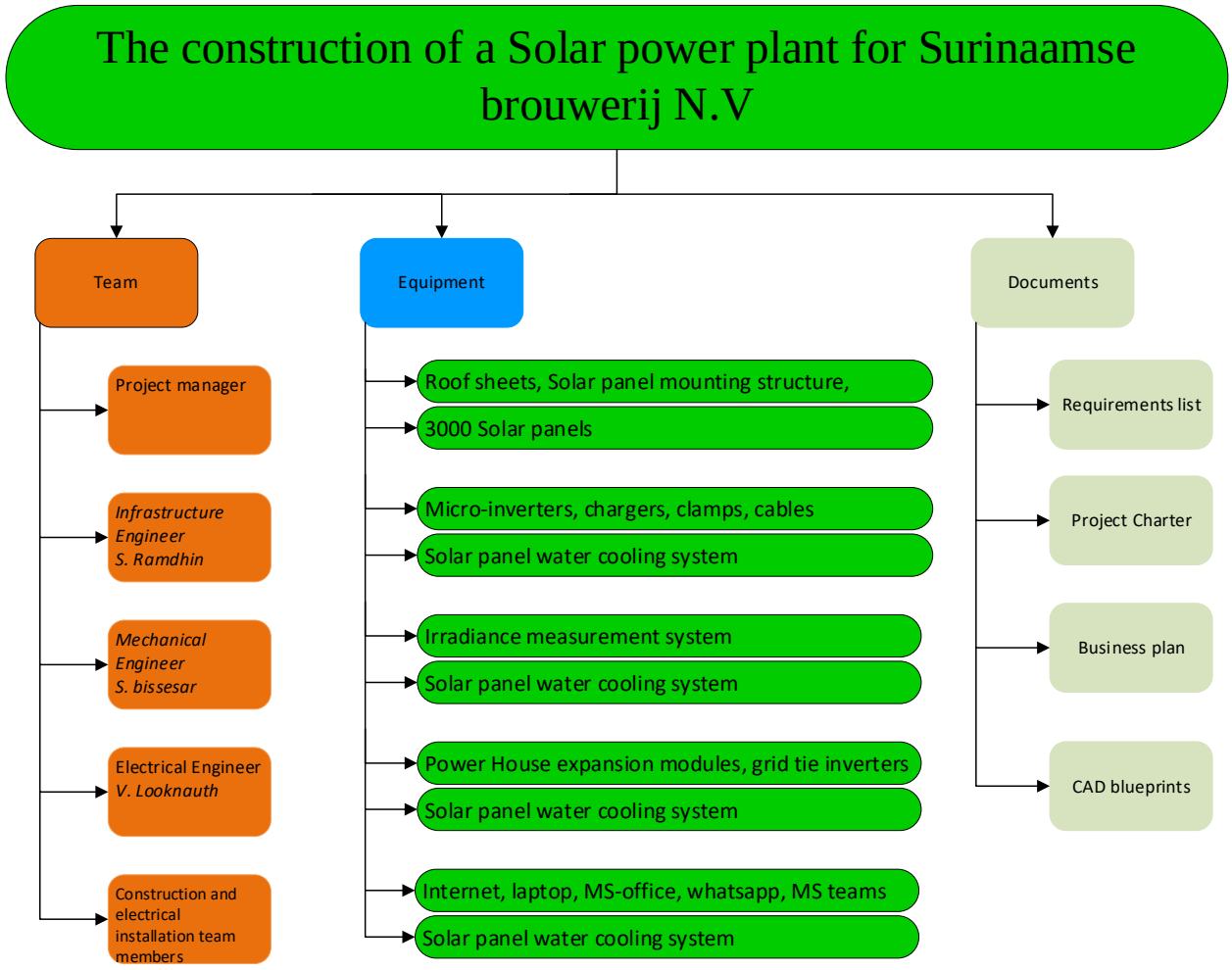
This phase involves quantifying the necessary team resources, materials, equipment, and supplies for project execution. Resource estimation employs the bottom-up estimating process outlined in Table 8, complemented by the capabilities of Microsoft Project. Each work package incorporates resources, generating an automated report detailing resource hours and their designated usage, as depicted in figure 14.

Resources Breakdown Structure

The organizational representation provided categorizes all resources essential for project development across its lifecycle. Figure 14 illustrates the Resource Breakdown Structure of the project.

Figure 19

Resource Breakdown Structure



Note. Own work.

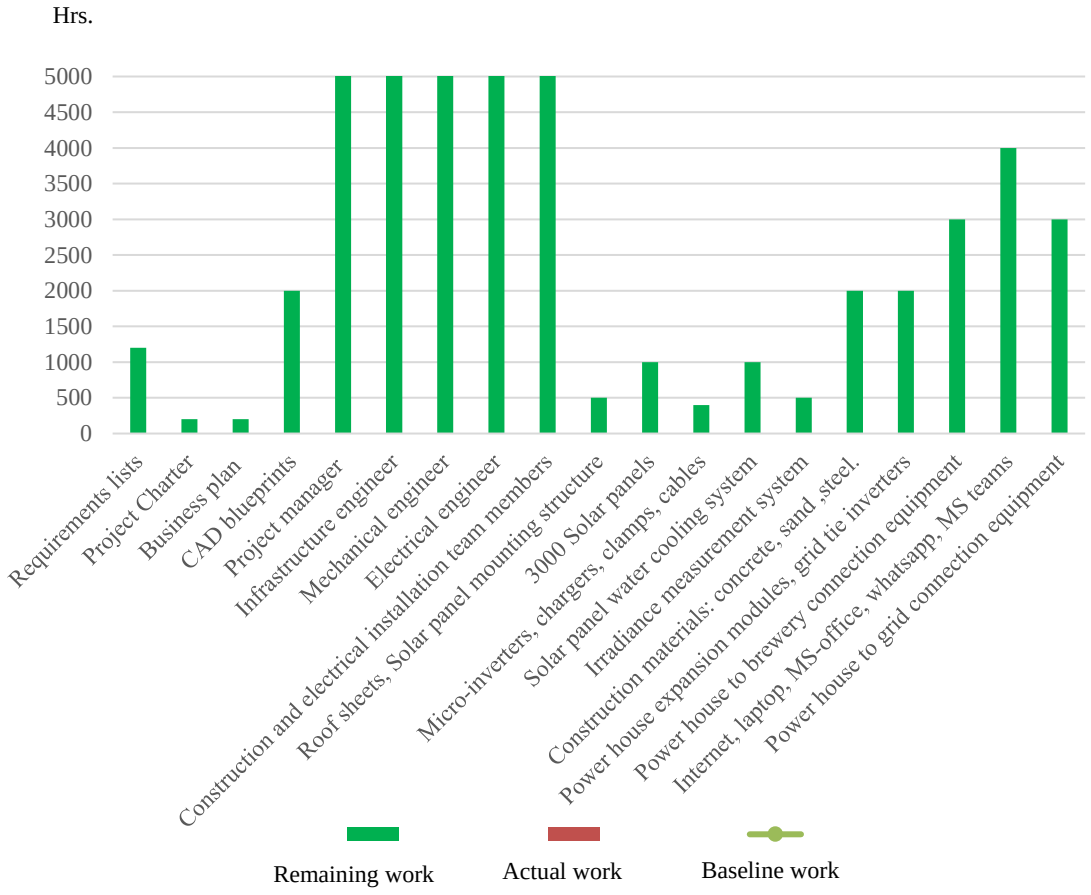
Table 26

Resources Estimation

Resources	Category	Start	Finish	Remaining Work (hrs.)
Requirements lists	Documents	1-8-2025	31-12-2029	1200
Project Charter		1-8-2025	31-12-2029	200
Business plan		1-8-2025	31-12-2029	200
CAD blueprints		1-8-2025	31-12-2029	2000
Project manager	Team	1-8-2025	31-12-2029	8000
Infrastructure engineer		1-8-2025	31-12-2029	8000
Mechanical engineer		1-8-2025	31-12-2029	8000
Electrical engineer		1-8-2025	31-12-2029	8000
Construction and electrical installation team members		1-8-2025	31-12-2029	30000
Roof sheets, Solar panel mounting structure	Equipment	5-5-2026	3-7-2026	500
3000 Solar panels		6-8-2026	31-12-2026	1000
Micro-inverters, chargers, clamps, cables		6-8-2026	31-12-2026	400
Solar panel water cooling system		5-5-2026	3-7-2026	1000
Irradiance measurement system		6-8-2026	31-12-2026	500
Construction materials: concrete, sand ,steel.		1-8-2025	31-12-2028	2000
Power house expansion modules, grid tie inverters		4-1-2027	31-12-2027	2000
Power house to brewery connection equipment		4-1-2027	31-12-2027	3000
Internet, laptop, MS-office, whatsapp, MS teams		1-8-2025	31-12-2029	4000
Power house to grid connection equipment		4-1-2027	31-12-2027	3000

Figure 20

Remaining hours to work



Assumption of Estimation

- The project team has internet and mobile connectivity at all times.
- The construction phases will utilize mostly local materials, as indicated in the cost management plan.
- The resource estimate is based on a 40-hr. work week, Monday through Friday, excluding national holidays.
- A personal laptop or tablet or smartphone with MS Teams and WhatsApp's is available to all team leads.

- The necessary project equipment will be procured during the procurement phase, and the costs of resources are based on these amounts.
- The project will finish on December 31, 2028, but is scheduled until December 31, 2029 including training activities and as a schedule reserve.

Team Development

The project team will be comprised of various personnel resources. Construction professionals, including infrastructure experts, mechanical and electrical engineers, and team members, will oversee power plant construction and the establishment of on/off grid connections. Heading the team is the PM, Shiwam Isrie, tasked with ensuring effective communication among all team members. It will be the PM's responsibility to enforce the interpersonal communication management plan throughout the project.

Team Interpersonal Communication Management

- **Collective communication platform**: project information will be communicated through email, MS-Teams and in urgent cases using WhatsApp.
- **Video conference capability**: This capability will be necessary due to distance and time zone differences. The project sponsor is Heineken international, and most of the team members are located in The Netherlands Zoeterwoude. So stakeholders will have to communicate virtually.
- **E-mail and MS-team group chat**: Communications between team members with crucial and long texts should be done using e-mail, and short messages should be done using MS-Teams group chats. In urgent cases where no MS-Teams is available, WhatsApp will be used as an alternative.

Staff Acquisition and Release

The staff needed for this project is composed of the current company employees and does not require hiring new members. Once the project starts, the team must focus its actions on the project's development. Nevertheless, it will be possible to attend other activities due to any emergency or company requirement. Each member will be released from responsibility as the project finishes, returning to their former roles. During this project also, employees of the company AMPS Suriname will also be hired on a temporary basis, since SB is doing this for many years, these employees are considered SB employees.

Training Requirements

The project will require all team members to be certified and current in their respective disciplines. The certification documents will be authenticated as a condition of the project contract before the project starts. Currently, around 50% of the workers are already certified to construct solar power plants due to their past work experiences and similar projects.

Meetings

Meetings will be organized to discuss project performance and conflict resolution topics. The project team will meet on MS Teams. The PM will determine the meeting length. Daily meetings will be held between engineers during the construction phases. All team leads (A till H) will attend weekly standup meetings on Mondays.

Resource Management Plan and Change Process

The Resource Management Plan outlined in this document is subject to modification solely through the change management process initiated by the project sponsor. Any alterations must be formally documented and authorized jointly by the PM and sponsor. Failure to adhere to the Change Request Format will result in no changes being made, with the PM retaining the authority to reject any proposed modifications. Upon submission of a change request, the project sponsor is allotted two working days to either approve or reject the proposed changes. All change requests must be meticulously documented, with approval contingent upon their priority and impact on project completion. Appendix 4 contains the Change Request Format for reference.

Roles and Responsibilities

Roles and responsibilities during the project life cycle are listed in table 27.

Table 27

Resources Management Roles and Responsibilities

Name	Role	Responsibilities
Heineken International	Project Sponsor	• Promote the project's value • Support the PM • Maintain ongoing communication with stakeholders • Review changes to the project environment(schedules, tasks, priorities, etc.). • Approve changes in scope. • Evaluate the need for scope changes. • Accept project deliverables. • Approve schedule changes. • Evaluate the need for schedule changes. • Accept project deliverables. • Approve each advance in the schedule plan. • Approves any cost addition.

Name	Role	Responsibilities
		• Approved quality changes. • Approve changes and communication channels. • Approves any resources needing procurement.
Shiwam Isrie	PM	• Plan and develop the project idea. • Create and lead the team. • Monitor project progress and set deadlines. • Solve issues that arise. • Manage the funding. • Maintain ongoing communication with stakeholders. • Ensure stakeholder statisfaction. • Evaluate project performance. • Facilitates project change requests. • Approve changes in scope. • Organize and facilitate schedule change control. • Facilitates project change requests. • Request that the project sponsor approve schedule changes. • Organize and facilitate schedule change control. • Communication outcomes of schedule change requests. • Communication of advances in the project activities of scope change requests. • Ensures that the project accomplishes the schedule and activities within the plan. • Oversight of the Quality Management Plan. • Ensures that quality control is completed. • Ensures that project requirements are fulfilled. • Schedule meetings for testing processes. • Prepare the final presentation of the project review. • Schedule face to face and online meetings. • In charge of quotations for software, hardware, or services.
S. Ramdhin, V.Looknauth, S. Bissesar	Infrastructure engineer, Electrical Engineer, Mechanical Engineer	• Participate in change process analysis. • Validate if scope changes can be applied. • Propose scope changes. • Document any delay in the project activities. • Request schedule changes. • Update the calendar activities.

Name	Role	Responsibilities
		• Use the company's resources. • Facilitate processes to ensure quality. • Ensures that platform requirements are followed. • Document all fulfilled requirements. • Provide frequent communication flow related to project updates. • Generate reports related to the project status.
Teamleader A, B,C,D,E,F,G,H	Teamleader of groups	• Work with engineers to develop team goals and delegate tasks to the appropriate team members. • Create and communicate a clear list of expectations and goals for team members to follow. • Offer emotional support to the project team members and make people feel valued. • Maintain frequent communication to offer encouragement, amend tasks, and provide updates on project goals. • Provide frequent feedback on employee performance, address weaknesses or inefficiencies, and offer support to improve skill gaps. • Nurture collaboration between team members. • Quickly and effectively resolve team conflicts. • Reward team members for their continued efforts and celebrate achievements.

Responsibility Assignment Matrix

Table 28 details the project work responsibilities from all the work packages. The categories are as follows:

R: Responsible

A: Accountable

C: Consult

I: Inform

Table 28

Responsibility Assignment Matrix (RAM)

WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
1	1.Estimating the current and future energy usage of the brewery					
1.1	1.1 Estimating the current and future energy usage of the brewing process	I	I	R	I	C
1.2	1.2 Estimating the current & future energy usage of the	I	I	R	I	C

WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
	fermenting & conditioning processes					
1.3	1.3 Estimating the current and future energy usage of the pasteurization processes	I	I	R	I	C
1.4	1.4 Estimating the current and future energy usage of the bottling & packaging processes	I	I	R	I	C
2.	2. Construction of the solar power plant					
2.1	2.1 Community Engagement	R	A	A	A	C
2.2	2.2 Obtaining permits & regulations	R	A	A	A	C
2.3	2.3 Optimal roof location,	I	R	A	R	C

WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
	angle, and orientation					
2.4	2.4 Construction of a roof mounting structure for the solar panels	I	R	I	R	C
2.5	2.5 Choosing the best technology (mono, poly) based on site and project goals	I	I	R	I	C
2.6	2.6 System design: developing an optimal layout	I	R	R	R	C
3.	3. Modifications of the power house					
3.1	3.1 Expanding the power connections in the power house	I	A	R	A	C
3.2	3.2 Connecting the PV grid	I	A	R	A	C

WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
	to the power house					
3.3	3.3 Connecting the brewery process to the solar grid	I	A	R	A	C
3.4	3.4 Connecting the fermenting and conditioning processes to the solar grid	I	A	R	A	C
3.5	3.5 Connecting the pasteurization processes to the solar grid	I	A	R	A	C
3.6	3.6 Connecting the bottling & packaging processes to the solar grid	I	A	R	A	C
4	4. Realization of net metering (energy					

WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
	export to grid)					
4.1	4.1 Checking regulations and policies	R	A	R	A	C
4.2	4.2 Making interconnection agreement, contraction agreements on energy export	R	A	R	A	C
4.3	4.3 Connecting the brewery process to the solar grid	I	A	R	A	C
4.4	4.4 Making interconnection agreement, contraction agreements on energy export	R	A	R	A	C
4.5	4.5 Making interconnection agreement, contraction agreements on energy export	R	A	R	A	C
5	5. Training of personnel					

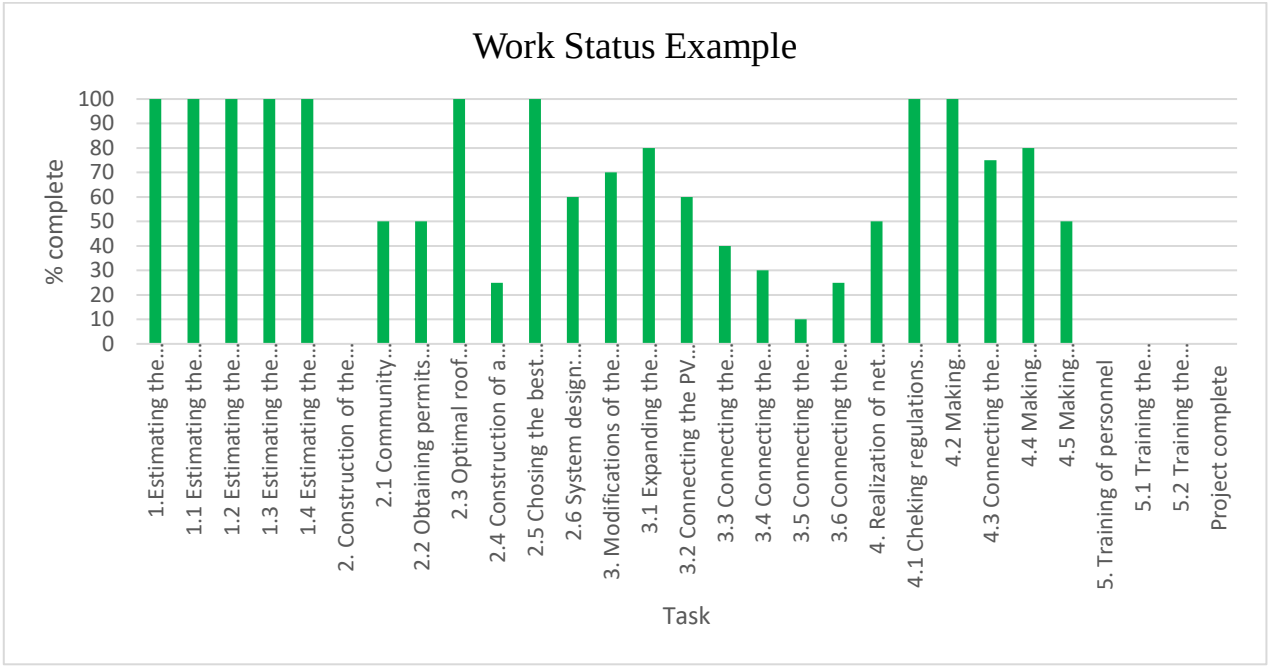
WBS code	Task name	Team Members				
		Project manager	Infrastructure Engineer	Electrical Engineer	Mechanical Engineer	Teamleaders
5.1	5.1 Training the personnel to use the power plant in on grid mode	I	R	R	R	C
5.2	5.2 Training the personnel to use the power plant in off grid mode	I	R	R	R	C
	Project complete					

Resource Control

The resource control process will be performed daily as the project evolves, utilizing MS. Project. The Resource Overview report will be generated and display the percentage of work done via the work resources. highlights an example work status report.

Figure 21

Work Status Example


Work Status Example
% complete
100
90
80
70
60
50
40
30
20
10
0
1.Estimating the...
1.1 Estimating the...
1.2 Estimating the...
1.3 Estimating the...
1.4 Estimating the...
2. Construction of the...
2.1 Community...
2.2 Obtaining permits...
2.3 Optimal roof...
2.4 Construction of a...
2.5 Chosing the best...
2.6 System design:...
3. Modifications of the...
3.1 Expanding the...
3.2 Connecting the PV...
3.3 Connecting the...
3.4 Connecting the...
3.5 Connecting the...
3.6 Connecting the...
4. Realization of net...
4.1 Cheking regulations...
4.2 Making...
4.3 Connecting the...
4.4 Making...
4.5 Making...
5. Training of personnel
5.1 Training the...
5.2 Training the...
Project complete
Task

4.7 Project Communication Management

Project communication management, as outlined in the PMBOK, encompasses the essential processes necessary for the timely and suitable generation, gathering, distribution, storage, and ultimate handling of project information. This entails recognizing the communication requirements of all stakeholders, strategizing the communication approach, disseminating information, and overseeing stakeholder expectations. The communication management plan offers the advantage of encapsulating the pertinent project communication tasks and the required information for all members of the project team.

Document Tracking (*Communication Management Plan*)

General Information

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Communication Management Plan**
Document Id	*009-SB-CMP*
Document Owner	*Surinaamse Brouwerij N.V*
Issue Date	*April 14, 2024*
Last Saved Date	*April 14, 2024*
File Name	*Communication Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*April 14, 2024*	*Release*

Approvals

Role	Name	Signature©	Date
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.7.1 Communication Management Plan

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Communication Management Plan**	
Version 1.0	Document ID: 009-SB-CMP	04/14/2024

Project Communication

In the PMBOK, project communication refers to the process of planning, executing, and managing the flow of information within a project. Effective communication is crucial for project success, as it ensures that all stakeholders are informed, aligned, and engaged throughout the project lifecycle. Its purpose is to guarantee the accurate gathering, generation, distribution, and authentication of information within the project framework.

Roles and Responsibilities

In table x the different roles and responsibilities are visible.

Table 29

Communication Management Roles and Responsibilities

Name	Role	Responsibilities
Heineken International	Project Sponsor	• Approved quality changes. • Accept completed project deliverables.
Shiwam Isrie	Project Manager	• Oversees the Quality Management Plan. • Project quality control. • Ensures that project requirements are accomplished. • Schedules weekly, monthly meetings and quarterly meetings & presentations.
V. Looknauth	Electrical engineer	• Performs installation according to NEN 1010 installation guidelines.

Name	Role	Responsibilities
		• Ensures all the electrical installation requirements are met as set by the EAS and N.V. EBS. • Manages electrical team leads members for quality craftsmanship.
S. Ramdhin	Infrastructure engineer	• Handle the process to ensure quality. • Ensures the construction requirements are followed. • Makes sure that each construction phase is accomplished. • Manages construction team leads members for quality craftsmanship.
S. bissesar	Mechanical engineer	• Performs installation according to the guidelines of the Ministry of Public Works in Suriname. • Ensures all the mechanical construction requirements are met. • Manages mechanical teamleads members for quality craftsmanship.

Stakeholders Identification requirements

Table 30 shows the communication requirements organized by the project's stakeholders.

Table 30

Stakeholders Communication Requirements

Stakeholders	Name	Key Concerns	Communication Method	Frequency	Contact Information
Project Sponsor	Heineken internationa l	Status Reports, virtual meetings, project phases, budget, schedule, and risk monitoring.	Email, MS Teams, WhatsApp, phone calls, face to face	Monthly	albert.collier@ heineken.com
Project Manager	Shiwam Isrie	Status Reports, virtual meetings, project phases, budget, schedule, and risk monitoring.	Email, MS Teams, WhatsApp, phone calls, face to face	Weekly	Shiwam.isrie @parbobier.co m
Electrical engineer	V. Looknauth	Status Reports, virtual meetings, project phases, budget, schedule, and risk monitoring.	Email, MS Teams, WhatsApp, phone calls, face to face	Daily	Vishnu.lookna uth@parbobie r.com
Mechanical engineer	S. Bissesar	Status Reports, virtual meetings, project phases, budget, schedule, and risk monitoring.	Email, MS Teams, WhatsApp, phone calls, face to face	Daily	s.bissesar@par bobier.com
Infrastructure engineer	S. Ramdhin	Status Reports, virtual meetings, project phases, budget, schedule, and risk monitoring.	Email, MS Teams, WhatsApp, phone calls, face to face	Daily	s. ramdhin@par bobier.com

Communication Matrix

In Table 31 the communication matrix is presented.

Table 31

Communication Matrix

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Communication Matrix**
Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

I.D.	Deliverable	Description	Delivery Method	Frequency	Responsible	Audience
1	Project updates	Regular communication	Telephone calls, emails, and MS Teams	Monthly	Project Manager	Project Sponsor, Project Manager
2	Reports	Project Status	Email	Weekly	Project Manager	Project Sponsor, Project Manager
3	Presentations	Project review	Emails, virtual meetings	Once the project is finished.	Project Manager	Project Sponsor
4	Reviews and Meetings	Project Status	Emails, virtual meetings	Weekly, Monthly	Project Manager	Project Sponsor, All stakeholders

Communication Standards

The project's communication protocol will establish an ongoing exchange between message senders and recipients. Any information disseminated through official channels will be treated as proprietary and strictly confidential, not for public disclosure. All communication channels will be routed through VPN networks and encrypted to ensure secure transmission.

The message sender will also confirm that all information was received and properly understood. The benchmark for this conformation includes, but is not limited to:

- **Communication capability**: aspects such as clarity of intent when sharing information, effective leadership, and followership behaviors.
- **Feedback**: information requested through the official communication channels must be responded to within 48 hours. Communication within the project team and with other project stakeholders is a collaborative endeavor.
- **Presentations**: daily, weekly and monthly reports are the official medium to share information related to project evolution. This information must be secured within the MS SharePoint extension and shared through encrypted email using MS outlook

Communication requirements analysis

Communication channels must be available to facilitate the requirements of the five main stakeholders involved in the project. The following formula (PMBOK guide 5th edition, p. 291-292) is used to calculate the required number of communication channels for the project:

$$Channels = \mathrm{N} \times \frac{(\mathrm{N}-1)}{2}$$

Where: N= the number of stakeholders (or team members).

Since there are 5 main stakeholders in this project, N=5. So the number of channels are:

$$Channels = 5 \times \frac{(5-1)}{2} = \mathbf{10}$$

Where N= the number of communication channels of the main stakeholders (team members)

Authorized communication channels

1. **Email:** via MS Outlook and Sharepoint will be used to communicate and share project information. Key topic elements include progress, updates, equipment orders, changes, and meetings. All result data will be transmitted using the personal emails assigned to team members. The official project communication with all external stakeholders will be through encrypted email.
2. **Written material (hardcopies):** Includes the physical documentation exchanged between stakeholders such as the PM and, the management team of SB, and all the engineers of SB. Limited information will be exchanged in written format, as email will be the primary communication method.
3. **Mobile devices**: This communication method facilitates the exchange of information between the project team and other stakeholders using mobile data or Wi-Fi-enabled devices. The project will require all team leaders to have a mobile device capable of messaging with MS Teams and as alternative WhatsApp. Other apps, like Sharepoint will also help access M.S. Project documents.

4. **Virtual meetings:** MS Teams will be the trusted platform to communicate with all project stakeholders. The mobile device capability will also pair well with sessions hosted via computer. This communication medium will be used to avoid face-to-face meetings that cannot occur due to weather, time zone differences or feasibility.

Monitoring Communication

Meetings will serve as conduits for the acquisition and facilitation of project-related information exchange between the project team and stakeholders. Within these sessions, the project team will undertake an assessment of the project's communication efficacy, address any stakeholder inquiries, and promptly attend to emerging project requisites as they arise throughout the month. Meetings will be conducted either virtually or in person, with the frequency of gatherings structured according to project phases. Initially, the project's inaugural phase will entail monthly meetings, whereas during subsequent construction phases, meetings will convene on a weekly basis. The determination of meeting frequency during later project stages will be contingent upon the complexity and dynamics of ongoing project components, aiming to optimize the utilization of participants' time.

Meetings

Meetings serve as instrumental platforms for the dissemination of information, bolstering the implementation of actions delineated in the communication plan, and resolving potential challenges. They constitute a conduit for the effective transmission of directives,

the exchange of ideas, and the identification of resolutions to pertinent project issues. The delineation of meetings will encompass:

- **Daily meetings:** this meeting will be held between the engineers of the project and the PM to discuss progress, resolve conflicts, and determine the activities to be taken for the next day.
- **Weekly Meetings**: this meeting is used to share project updates and to request information related to project needs. Will be accomplished during the construction phase.
- **Monthly Meetings**: this meeting is performed by the PM, Project Sponsor, and stakeholders. Its objective is to exchange information related to project execution, financial matters, conflicts/resolution, possible delays, and change request submission.

Project Reporting

Project reporting in PMBOK involves the systematic communication of project-related information to stakeholders to support effective project management and decision-making processes.

Monthly Report: In PMBOK terms, a monthly report is a recurring document that provides an overview of the project's status, progress, and key metrics on a monthly basis. The record agreements established during meetings will be formalized through a report summarizing the meeting and will be shared via email. The change process must formalize changes to these reports or formats. (See Appendix 7: Monthly Report).

Project Report: Information concerning the project will be captured using M.S. Project and will be included within the report as detailed below (see Appendix 8: Project Report):

- **Cost Overview:** provides a concise summary of the project's overall costs, remaining expenditures, and percentage of completion.
- **Burndown analysis**: illustrates the progress of completed work and the remaining tasks yet to be finished.
- **Task Burndown**: offers insights into the completion status of individual tasks, distinguishing between completed and pending assignments.
- **Progress vs. Cost Status:** tracks the correlation between project progress and corresponding expenditures over time.
- **Completion Percentage:** provides an overview of the completion status of all high-level tasks within the project.
- Late Tasks Identification: highlights tasks that have surpassed their scheduled due dates.
- **Upcoming Tasks:** presents the status of tasks scheduled to commence in the upcoming week.
- **Remaining Tasks:** offers an update on the status of tasks slated for completion within the current week.
- **Earned Value Assessment:** calculates the project's earned value based on the designated project status date.
- **Variance Analysis over Time:** evaluates both cost and schedule variances for the project, considering the status date.

- **Performance Indices over Time:** tracks the Cost Performance Index (CPI) and Schedule Performance Index (SPI) for the project relative to the status date.
- **Resource Status Review:** provides an overview of the work status for all allocated resources within the project.
- **Work Progress:** reports the percentage of work completed by each assigned resource.

Communication Management Plan, Change Process

The Communication Management Plan outlined in this document is subject to modification exclusively through the change management process, with requests initiated by the project sponsor (Heineken International). Requirements for such alterations must be meticulously documented and authorized jointly by the PM (Shiwam Isrie) and the project sponsor.

In the event that the prescribed Change Request Format is not adhered to or submitted, proposed changes will not progress, and the PM reserves the sole authority to decline them. Subsequently, upon the identification of a necessary change that meets established requirements, the project sponsor will be afforded a period of five working days to either approve or reject the proposed modifications.

Every change request is to be formally documented, and its approval status hinges upon factors such as prioritization and the potential impact of its endorsement or rejection on the project's overall timeline for completion.

4.8 Project Risk Management

Project risk management, according to PMBOK, refers to the systematic process of identifying, analyzing, responding to, and monitoring risks throughout the project life cycle. This process aims to minimize the negative impacts of risks on project objectives and maximize opportunities for achieving project success.

Project risks were initially identified during the creation of the project charter, with additional risks incorporated during the development of the project plan. The Risk Management Plan (RMP) encompasses risks that have the potential to impact the certainty of project development. Furthermore, qualitative analysis has been conducted for each identified risk to assess the likelihood of occurrence, with corresponding response plans devised for risks deemed to have high probabilities of occurrence.

Given the scope of the project, a more granular approach to risk management and assessment is deemed unnecessary, as the Risk Management Plan adequately addresses the project's requirements. The plan comprehensively delineates all areas susceptible to impacting project development, while also ensuring that each primary risk is acknowledged and updated throughout the project life cycle.

Document Tracking (*Risk Management Plan*)

General Information

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risk Management Plan**
Document Id	*010-SB-RMP*
Document Owner	*Surinaamse Brouwerij N.V*
Issue Date	*April 21, 2024*
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File Name	*Risk Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*April 21, 2024*	*Release*

Approvals

Role	Name	Signature	Date
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.8.1 Risk Management Plan

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risk Management Plan**	
Version 1.0	Document ID: 010-SB-RMP	04/21/2024

Identifying Risk

The initial stage of risk identification occurs during the development of the project charter. However, this process remains dynamic and undergoes updates throughout all project phases, facilitated by the change management process. Risks may be introduced or removed based on evolving project conditions and scenarios. The prescribed format for documenting these risks is available in Appendix 10: The Risk Register, which mandates continual updates to accommodate any risks that may manifest during the project development.

Table 32

Risk Breakdown Structure

RBS Level 0	RBS Level 1	RBS Level 2	RBS Level 3
Project risk	1. Project management	1.1 Team	1.1.1 Poor team communication
			1.1.2 Changes in team
			1.1.3 Inadequate number of staff
		1.2 Tactics	1.2.1 Cost control
			1.2.2 Time control
			1.2.3 Quality control

RBS Level 0	RBS Level 1	RBS Level 2	RBS Level 3
			1.2.4 Change control
		1.3 Tasks	1.3.1 Site
			1.3.2 Design
	1. Technical Risk	2.1 Requirement	
		2.2 Technology	2.2.1 Mono crystalline solar panels
			2.2.2 Polycrystalline solar panels
			2.2.3 Bif-facial solar panels
		2.3 Complexity and interfaces	2.3.1 On grid system
			2.3.2 Off grid system
			2.3.3 Hybrid system
		2.4 Quality	2.4.1 15 year system warranty
			2.4.2 30 year system warranty
			2.4.3 Low Mean time before failure
	2. External Risk	3.1 Subcontractors and suppliers	3.1.1 Type of contract
			3.1.2 Restrictions
			3.1.3 Dependencies
			3.2.1 Change in politics

RBS Level 0	RBS Level 1	RBS Level 2	RBS Level 3
		3.2 Regulatory and permits	3.2.2 Change in local regulations and permits
			3.2.3 Delays in approval of regulations and permits
		3.3 Weather	3.3.1 Dry season
			3.3.2 Rainy season
			3.3.3 Storm season
	3. Organizational risk	4.1 Project dependencies	4.1.1 Experience
		4.2 Resources	4.2.1 Human
			4.2.2 Material
		4.3 Funding	4.3.1 Internal
			4.3.2 External (bank)
		4.4 Prioritization	

Risk Management Plan, Change Process

The Risk Management Plan outlined in this document is subject to modification exclusively through the change management process, with requests initiated solely by the project sponsor (Heineken International). Requirements for such alterations must be meticulously documented and jointly authorized by both the PM (Shiwam Isrie) and the project sponsor.

Failure to adhere to the prescribed Change Request format will result in the rejection of proposed changes, with the PM retaining the authority to refuse such alterations. Subsequently, upon submission of a change request, the project sponsor will be afforded a period of two working days to either approve or deny the request.

All change requests will be formally documented, and the approval status thereof will be contingent upon the prioritization of the change and its potential impact on the project's overall completion timeline.

Risk Analysis

Quantitative Analysis

In PMBOK terms, quantitative risk analysis is a method used to numerically analyze the effect of identified risks on project objectives. Specifically, quantitative risk analysis involves assigning monetary values or other numerical measures to risks and their potential impacts. This analysis typically utilizes techniques such as simulation, decision tree analysis, and sensitivity analysis to assess the likelihood and magnitude of project risks and their potential effects on project objectives, including cost, schedule, and performance.

In the case of the construction of the solar power plant project, quantitative analysis will not be needed due to the untechnical nature of the project management plan. Qualitative analysis will be used instead as the primary risk analysis tool.

Qualitative Analysis

In PMBOK terms, qualitative risk analysis is a method used to assess the likelihood and impact of identified risks on project objectives based on subjective judgment and

qualitative information. Rather than assigning numerical values to risks, qualitative risk analysis focuses on evaluating risks based on their relative importance and potential consequences.

During qualitative risk analysis, project teams typically use techniques such as risk probability and impact assessment, risk categorization, and risk urgency assessment to prioritize risks based on their likelihood of occurrence and potential impact on project objectives. Risks are often categorized according to their severity or potential effect on project scope, schedule, cost, and quality.

Qualitative risk analysis provides valuable insights into the nature and significance of identified risks, allowing project teams to focus their efforts on addressing the most critical risks first. While qualitative risk analysis does not provide precise numerical assessments like quantitative risk analysis, it helps PMs and stakeholders prioritize risk responses and allocate resources effectively to manage project risks. Each project risk will be analyzed using qualitative analysis and the following scale, provided in the Probability and Impact Matrix.

Table 33

Qualitative Risk Analysis Classification

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY		IMPACT				
		Insignificant	**Less significant**	**Potentially significant**	**Significant**	**Very significant**
	Likelihood score	**LOW**				**HIGH**
		1	**2**	**3**	**4**	**5**
HIGH	**5**	**5**	**10**	**15**	**20**	**25**
	4	**4**	**8**	**12**	**16**	**20**
	3	**3**	**6**	**9**	**12**	**15**
	2	**2**	**4**	**6**	**8**	**10**
LOW	**1**	**1**	**2**	**3**	**4**	**5**

Risk Response

Risk response refers to the planned actions taken to address identified risks throughout the project lifecycle. Risk response is a crucial component of the risk management process, which aims to minimize the probability and impact of negative risks (threats) and maximize the probability and impact of positive risks (opportunities). Based on the results of the qualitative analysis applied to each risk, the PM will use the following chart to determine the actions required to respond to each risk.

Table 34

Risk Response

Priority	Score	Strategy	Description
Very High Risk	$x \geq 15$	Escalate Transfer	Depending on the situation, these risks will be elevated to the project sponsor or contracted to an expert for resolution.
High risk	$9 < x < 15$	Address	These risks must also be addressed, but they are not prioritized as highly as in the Very High-Risk category.
Medium Risk	$4 < x < 8$	Mitigate	It is necessary to define corrective actions to reduce the probability and impact of these risks.
Low Risk	$x \leq 3$	Accept	No action will be taken.

Risk Monitoring and Controlling

Regular risk monitoring and control activities will be conducted on a weekly basis or as deemed necessary by the PM. This process is primarily geared towards scrutinizing the project's ongoing risk landscape and identifying any potential threats to its progress. The project team will automatically evaluate risk factors in tandem with their weekly meetings. Any identified risks will be documented and assessed using the Risk Register Template (refer to Appendix 10: Risk Register).

The PM holds the responsibility for overseeing the weekly assessment of risk exposure, which will be integrated into the agenda of the weekly meetings and reported on in the monthly report. Within the weekly review, current risk responses will be analyzed to verify the effectiveness of project risk mitigation tactics.

Risk Identified

Table 35

Risks Identified

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risks Identified**
Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

RBS Code	Cause	Risk	Consequence
1.1 Team	Team staffing shortages	Lack of experienced team members.	Decline in quality of project construction
1.2 Tactics	Less experience dealing with changes in the project	Cost overruns, delays, and poor construction quality	Reduced ability to handle project changes, leading to cost overruns, delays, and poor construction quality
1.3 Tasks	Too many dependent tasks	Project delays	Project delays due to dependencies between tasks
2.1 Requirement	Unclear or changing project requirements	Scope creep, project delays	Scope creep and project delays due to unclear or changing requirements
2.2 Technology	Technological limitations	Project delays, increased costs	Delays and increased costs due to technological limitations

RBS Code	Cause	Risk	Consequence
2.3 complexity and interfaces	Complex integration requirements or interfaces	Integration failures, project delays	Integration failures can lead to project delays.
2.4 quality	Poor quality control or assurance	Defective deliverables, rework, and project delays	Defective deliverables and rework can lead to project delays.
3.1 Subcontractors and suppliers	Unreliable subcontractors or suppliers	Delays, quality issues, and cost overruns	Delays, quality issues, and cost overruns may occur.
3.2 Regulatory and Permits	Regulatory hurdles or permit delays	Project delays and legal issues	Regulatory hurdles or permit delays can cause project delays and legal issues.
3.3 Weather	Adverse weather conditions	Project delays and safety risks	Adverse weather conditions can cause project delays and safety risks.
4.1 Project dependencies	Dependencies on external factors or projects	Delays, bottlenecks	Dependencies on external factors or projects can cause delays and bottlenecks.
4.2 Resources	Insufficient or misallocated resources	Delays, decreased productivity	Insufficient or misallocated resources can lead to delays and decreased productivity.
4.3 Funding	Lack of funding or budget constraints	Project delays, scope reduction	Lack of funding or budget constraints can cause project delays and scope reductions.
4.4 Prioritization	Poor project prioritization	Misallocation of resources, project delays	Poor project prioritization can lead to misallocation of resources and project delays.

Risk Identified-Qualitative Analysis

Table 36

Risk Identified- Risk Qualitative Analysis

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risk Identified-Qualitative Analysis**
Project Name:	The construction of a Solar power plant for Surinaamse Brouwerij N.V.
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

RBS Code	Cause	Risk	Consequence	Probability	Impact	P ×I
1.1 Team	Team staffing shortages	Lack of experienced team members.	Decline in quality of project construction	1	5	5
1.2 Tactics	Less experience dealing with changes in project	Cost overruns, delays, and poor construction quality	Reduced ability to handle project changes, leading to cost overruns, delays, and poor construction quality	3	5	15

RBS Code	Cause	Risk	Consequence	Probability	Impact	P ×I
1.3 Tasks	Too many dependent tasks	Project delays	Project delays due to dependencies between tasks	2	5	10
2.1 Requirement	Unclear or changing project requirements	Scope creep, project delays	Scope creep and project delays due to unclear or changing requirements	1	5	5
2.2 Technology	Technological limitations	Project delays, increased costs	Delays and increased costs due to technological limitations	2	4	8
2.3 complexity and interfaces	Complex integration requirements or interfaces	Integration failures, project delays	Integration failures can lead to project delays.	3	5	15
2.4 quality	Poor quality control or assurance	Defective deliverables, rework, and project delays	Defective deliverables and rework can lead to project delays.	1	5	5
3.1 Subcontractors and suppliers	Unreliable subcontractors or suppliers	Delays, quality issues, and cost overruns	Delays, quality issues, and cost overruns may occur.	2	5	10
3.2 Regulatory and Permits	Regulatory hurdles or permit delays	Project delays, legal issues	Regulatory hurdles or permit delays can cause project delays and legal issues.	4	5	20
3.3 Weather	Adverse weather conditions	Project delays, safety risks	Adverse weather conditions can cause	3	5	15

RBS Code	Cause	Risk	Consequence	Probability	Impact	P ×I
			project delays and safety risks.			
4.1 Project dependencies	Dependencies on external factors or projects	Delays, bottlenecks	Dependencies on external factors or projects can cause delays and bottlenecks.	3	5	15
4.2 Resources	Insufficient or misallocated resources	Delays, decreased productivity	Insufficient or misallocated resources can lead to delays and decreased productivity.	1	5	5
4.3 Funding	Lack of funding or budget constraints	Project delays, scope reduction	Lack of funding or budget constraints can cause project delays and scope reduction.	1	3	3
4.4 Prioritization	Poor project prioritization	Misallocation of resources, project delays	Poor project prioritization can lead to misallocation of resources and project delays.	1	4	4

Risk Responses

Table 37

Critical Risk Responses

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risk Responses**
Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

RBS Code	Cause	Risk	Consequence	P ×I	Response
1.2 Tactics	Less experience dealing with changes in project	Cost overruns, delays, and poor construction quality	Reduced ability to handle project changes, leading to cost overruns, delays, and poor construction quality	15	Implement additional training programs for team members to improve their adaptability and skillset in dealing with project changes.
1.3 Tasks	Too many dependent tasks	Project delays	Project delays due to dependencies between tasks	10	Review and streamline task dependencies to minimize delays and improve project efficiency.

RBS Code	Cause	Risk	Consequence	P ×I	Response
2.3 complexity and interfaces	Complex integration requirements or interfaces	Integration failures, project delays	Integration failures can lead to project delays.	15	Conduct thorough testing and simulations to identify and address integration issues early in the project lifecycle.
3.1 Subcontractors and suppliers	Unreliable subcontractors or suppliers	Delays, quality issues, and cost overruns	Delays, quality issues, and cost overruns may occur.	10	Establish clear performance metrics and communication channels with subcontractors/suppliers, and implement backup plans to mitigate potential delays or quality issues.
3.2 Regulatory and Permits	Regulatory hurdles or permit delays	Project delays, legal issues	Regulatory hurdles or permit delays can cause project delays and legal issues.	20	Assign dedicated personnel to monitor and manage regulatory compliance, and proactively address potential permit delays through early engagement with regulatory authorities.
3.3 Weather	Adverse weather conditions	Project delays, and safety risks	Adverse weather conditions can cause project delays and safety risks.	15	Develop contingency plans and flexible scheduling to accommodate adverse weather conditions, and prioritize worker safety measures during inclement weather.
4.1 Project dependencies	Dependencies on external factors or projects	Delays, bottlenecks	Dependencies on external factors or projects can cause delays and bottlenecks.	15	Identify critical dependencies early in the project planning phase, establish communication channels with external stakeholders, and implement risk mitigation strategies such as parallel work streams or alternative suppliers.

4.9 Project Procurement Management

Project Procurement Management, according to PMBOK, refers to the processes involved in acquiring goods and services from external sources to support project needs. It encompasses the planning, selection, contracting, and administration of procurement activities throughout the project lifecycle.

A Procurement Management Plan has been devised in alignment with the directives provided by project stakeholders. Given that SB lacks the necessary materials and resources for project construction, contracted work will be utilized. Considering the intricate nature of the project, the procurement process necessitates the solicitation and evaluation of three quotes for each task, ensuring thorough assessment and approval. The Procurement Management Plan is designed to select the most suitable contracts for procuring goods and services, taking into account the specific requirements outlined by stakeholders.

Document Tracking (*Procurement Management Plan*)

General Information

	**Procurement Management Plan**
Document Id	*011-SB-PMP*
Document Owner	*Surinaamse Brouwerij N.V*
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File Name	*Procurement Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*April 28th, 2024*	*Release*

Approvals

Role	Name	Signature	Date
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.9.1 Procurement Management Plan

	**Procurement Management Plan**	
Version 1.0	Document ID: 011-SB-PMP	04/28/2024

Procurement Plan Purpose

The main purpose of the procurement management plan is to offer guidance on the procurement process, including the selection of resources, goods, and services necessary for the project.

Procurement Statement

The procurement process outlined in this plan is designed to facilitate the acquisition of construction materials required for the solar power plant, including items such as solar panels, grid-tie inverters, battery banks, mounting frames for solar panels, and power house equipment necessary for project development.

Estimate Cost

Table 38

Estimate Resources Cost

Type	Description	Cost(€)
3000 solar panels	Mono crystalline Bi-facial	300.000
Solar panel mounting frame 6000m2	Aluminum frame for mounting solar panels on the roof	100.000
500 Micro-inverters	For solar panels that will experience shading effects	20.000
100 Grid inverters	For solar panels that will not experience shading effects	30.000
10 Solar chargers	For charging the solar power batteries for power backup	45.000
Solar panels clamps & cables	For connecting and fixing the solar panels	15.000
Irradiance measurement system	For measuring solar irradiance	2.000
4 power house expansion modules	For making power connections with the brewery	40.000
Power house to Off grid/on grid connection	For exporting surplus energy to the power grid	50.000
100 solar power storage batteries	Power storage for off grid connection	100.000
15 workers	Human resources to construct the power pant	226.000
	Total	928.000

Procurement Description

Any additional materials needed will be procured on a case-by-case basis, exclusively through the change management plan approved by the project sponsor (Heineken International) and the management of SB. This process will entail cooperation with local vendors and will require obtaining at least three price quotations as a mandatory step.

Procurement Management Plan and Change Process

Modifications to the Procurement Management Plan outlined in this document can solely be made through the change management process, upon request of the project sponsor, Heineken International. Requirements must be authorized and documented by both the PM, Shiwam Isrie, and the project sponsor. Any changes must be submitted using the Change Request format; failure to adhere to this format will result in no changes being implemented, with the PM retaining the authority to decline requests. Upon submission, the project sponsor will have two working days to either approve or deny the request. All change requests will be meticulously documented, with approval contingent upon the change's prioritization and its impact on project completion.

Performance Metrics for Procurement Activities

Table 39 details the evaluation of services, goods, or product vendors and will be used for assessment and decision-making:

Table 39

Performance Metrics

Vendor	Product Quality	Delivery Time	Documentation Quality	Development		Cost Unit	Total
				Cost	Time		
1							
2							
3							

Scale:

1- Unsatisfactory

2- Sufficient

3- Outstanding

The procurement process will proceed with selecting the product/service/ provider attaining the highest score based on table 39.

Procurement Team Roles and Responsibilities

Table 40

Procurement Management Roles and Responsibilities

Name	Role	Responsibilities
Heineken international	Project Sponsor	Approves all resources that need procurement.
Shiwam Isrie	Project Manager	Charged with quotations for materials and companies.
Shailesh Ramdhin	Infrastructure engineer	Specify the technical requirements of infrastructure, building expansion, and roof mounting systems for solar panels.
V. Looknauth	Electrical Engineer	Specify the technical requirements of electrical wiring, solar panels, power house expansion, battery storage, grid inverters, and on/grid off grid systems.
S. Bissesar	Mechanical Engineer	Specify the technical requirements of steel construction.

4.10 Project Stakeholder Management

Project Stakeholder Management, as outlined in PMBOK, underscores the significance of actively engaging stakeholders to comprehend their needs, address concerns, and manage expectations. Through adept stakeholder management, PMs cultivate robust relationships, mitigate risks, and bolster the project's chances of success. This stakeholder management plan serves the purpose of identifying all project stakeholders, categorizing them into distinct types, such as direct and indirect stakeholders. Direct stakeholders are those directly involved in project work and development, while indirect stakeholders benefit from or are affected by project deliverables without holding direct authority. Recognizing the value of each stakeholder and understanding their influence, power, and impact within the project enhances the likelihood of project success. Employing appropriate strategies to manage each stakeholder can spell the difference between project success and failure.

Document Tracking (*Stakeholder Management Plan*)

General Information

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Stakeholder Management Plan**
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File Name	*Stakeholder Management Plan*

Change Control

Version	Issue Date	Changes
1.0	*May 02nd , 2024*	*Release*

Approvals

Role	Name	Signature©	Date
Project Sponsor	*Heineken International*		
Project Manager	*Shiwam Isrie*		

4.10.1 Stakeholder Management Plan

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Stakeholder Management Plan**	
Version 1.0	Document ID: 012- SB -STMP	02/05/2024

Project Stakeholders

According to the PMBOK, project stakeholders are individuals and organizations who are actively involved in the project, or whose interests may be affected by the project's execution or completion. The stakeholders have been categorized into two groups, direct and indirect stakeholders, as exhibited in table 41.

Table 41

Stakeholder Classification

Direct Stakeholders	Indirect Stakeholders
• Project Sponsor: Heineken International • Board of directors of SB • Project Manager (Shiwam Isrie) • Infrastructure engineer • Electrical engineer • Mechanical engineer • Construction team members • Neighbors living in the area • N.V. AMPS	• Local companies • Ministry of Public Works in Suriname • Neighborhood organizations • Beer consumers • Local governmental agencies • EAS • N.V. EBS

Stakeholder Responsibility

The direct stakeholders are listed within table 42, where each stakeholder's responsibility and authority are stated.

Table 42

Stakeholder Responsibility

Name	Organization	Job Title	Responsibility and Authority
Albert Collier	Heineken International	Project Sponsor	In charge of the approval of changes, providing support, and receiving deliverables of the project, providing financial and supportive resources.
Shiwam Isrie	SB	Project manager	Responsible for day-to-day management by managing tasks, team members, and project progress.
A. Baasaron, MSc.	N.V AMPS	Director of the company	Responsible for supplying materials to SB and human resources
V. Looknauth	SB	Electrical Engineer	Responsible for the correct and complete electrical installation of solar panels and systems. Reports to the project manager.
S. Bissessar	SB	Mechancial engineer	Responsible for the correct and complete mechanical construction of the project. Reports to the project manager.
S. Ramdhin	SB	Infrastructure engineer	Responsible for the correct and complete construction of the project. Reports to the project manager.
Construction team members	SB	Construction team members	Responsible for the correct and complete construction of the project. Responds engineers.
Neighbors living in the area, local companies, beer consumers,	-	-	To support/permit the construction of the solar power plant, take part in the community trainings.

Name	Organization	Job Title	Responsibility and Authority
local governmental agencies, and neighborhood organizations			
A. Kalpoe, MSc.	EAS	Director	To permit the construction of the solar power plant.
M. Eyndhoven	EBS		To permit the export of surplus electrical energy to the power grid.
Prof. Dr. Ir. R. Nurmohamad	Ministry of Public Works in Suriname	Minister	To permit the construction of the solar power plant.

Stakeholder Register

This project document is used to register any new stakeholder and includes the following information (see **Error! Reference source not found.**43):

- **ID:** A unique sequential number, starting from one, assigned to each stakeholder for identification purposes.
- **Stakeholder:** The individual's name or organization being registered within the chart.
- **Functional Area:** The specific area or department where the stakeholder is involved.
- **Roles and Responsibilities:** Description of the stakeholder's activities and assigned roles within the project.
- **Main Expectations:** Stakeholders' anticipated outcomes or desired results from the project.
- **Major Requirements:** Specific needs or demands of the stakeholders pertinent to the project.
- **Influence and Impact:** Assessment of the stakeholder's level of influence and potential impact on project progress.
- **Additional comments:** Any supplementary comments aimed at enhancing the stakeholder description."

Stakeholder Management Plan and Change Process

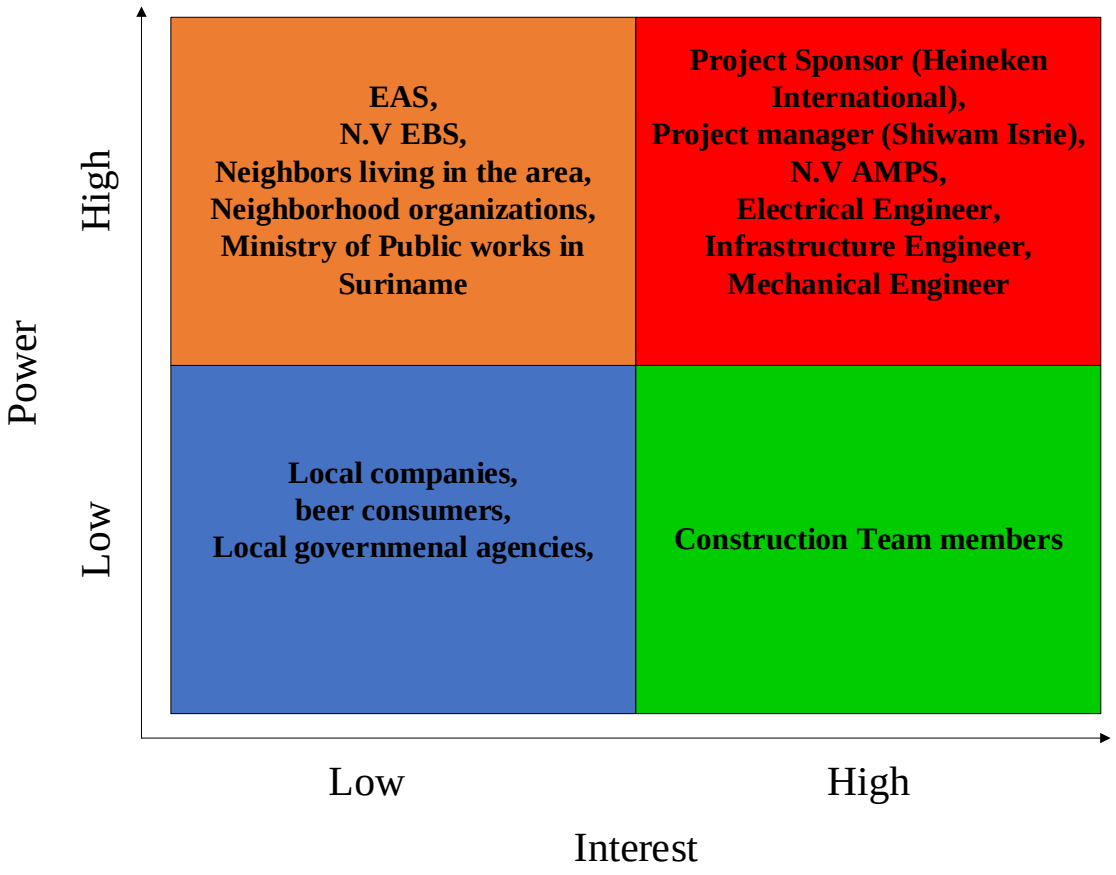
The Stakeholder Management Plan outlined in this document is subject to modification exclusively through the change management process initiated by the project sponsor. Any adjustments must receive authorization and documentation from both the PM and project sponsor. Failure to adhere to the Change Request format will result in no changes being implemented, with the PM retaining the authority to reject alterations. Following submission, the project sponsor will have a two-working-day window to either approve or deny the request. All change requests will be meticulously documented, and approval will be based on the change's priority and its potential impact on project progression.

Power Interest Matrix

Error! Reference source not found.38 is used to group the stakeholders according to their authority (power) level within the project and their corresponding level of concern (interest) related to the project’s completion.

Figure 22

Power Interest Graph



Note. Own work.

Stakeholder register

Table 43

Stakeholder Register

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Stakeholder register**
Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

ID	Stakeholders	Functional Area	Roles-Responsibilities	Main Expectations	Major Requirements	Power-Interest	Additional Comment
1	Heineken International	Project Sponsor	In charge of the approval of changes, providing support, and receiving deliverables of the project, providing financial and supportive resources.	Financial funding is promptly available and sourced for the project, and all objectives are met.	Construction of the solar power plant will be delivered on time and within the defined costs.	High/High	

ID	Stakeholders	Functional Area	Roles-Responsibilities	Main Expectations	Major Requirements	Power-Interest	Additional Comment
2	Surinaamse Brouwerij N.V.	A subsidiary company of Heineken International	In charge of taking decisions together with the project sponsor.	To provide the human resources to work on the construction of the solar power plant.	The construction of the solar power plant will be delivered on time and within the defined costs and won't interrupt the production of local beer.	High/High	
3	Shiwam Isrie	Project manager	Responsible for day-to-day management by managing tasks, team members, and project progress.	Construction materials and funding are available for the project.	Construction of the solar power plant will be delivered on time and within the defined costs.	High/High	
4	N.V AMPS	Material Supplier	Responsible for supplying materials to SB and human resources	Materials are available for the project within the time frame.	Funding is available on time to buy materials and other resources.	High-High	

ID	Stakeholders	Functional Area	Roles-Responsibilities	Main Expectations	Major Requirements	Power-Interest	Additional Comment
5	Electrical Engineer	Electrical installation	Responsible for the correct and complete electrical installation of solar panels and systems. Reports to the project manager.	Ensure the accurate and complete electrical installation of solar panels and systems.	Adequate tools and equipment are needed for electrical installation.	High-High	
6	Mechanical engineer	Mechanical construction	Responsible for the correct and complete mechanical construction of the project. Reports to the project manager.	Ensure the accurate and complete mechanical construction of the project.	Adequate tools and equipment are needed for mechanical construction.	High-High	
7	Infrastructure engineer	Construction	Responsible for the correct and complete mechanical construction of the project. Reports to the project manager.	Ensure the accurate and complete mechanical construction of the project.	Adequate tools and equipment are needed for construction.	High -High	

ID	Stakeholders	Functional Area	Roles-Responsibilities	Main Expectations	Major Requirements	Power-Interest	Additional Comment
8	Construction team members	Construction	Responsible for the correct and complete construction of the project. Responds engineers.	Ensure proper and complete construction of the project as per engineer's instructions.	Compliance with safety protocols and engineering standards.	Low-High	
9	Neighbors living in the area,	Permits, community engagement	To support/permit the construction of the solar power plant, take part in community engagement trainings.	Support and permit the construction, active participation in community engagement.	Support and cooperation for permit acquisition and community engagement.	High-Low	
10	Local companies, beer consumers, neighbors living in the area, local governmental agencies, and neighborhood organizations	Supporters	To support the construction of the solar power plant, take part in the community engagement trainings.	Support and permit the construction, active participation in community engagement.	Support and cooperation for permit acquisition and community engagement.	Low-Low	

ID	Stakeholders	Functional Area	Roles-Responsibilities	Main Expectations	Major Requirements	Power-Interest	Additional Comment
11	EAS	Permits	To permit the construction of the solar power plant.	Timely issuance of permits for the construction of the solar power plant	Permit issuance for the construction of the solar power plant.	High-Low	
12	N.V EBS	Permits	To permit the export of surplus electrical energy to the power grid.	Timely issuance of permits for exporting surplus electrical energy	Permit issuance for exporting electrical energy to the power grid.	High-Low	
13	Prof. Dr. Ir. R. Nurmohamad	Ministry of Public Works in Suriname	Minister	To permit the construction of the solar power plant.	Permit issuance for exporting electrical energy to the power grid.	High-Low	

Power interest Matrix

Table 44

Stakeholder's Power Interest Matrix

Stakeholders		Classification (Low/High)		Comments
ID	Name	Power	Interest	
1	Albert Collier - Heineken International (project sponsor)	High	High	Project Sponsor. Holds high power towards the project as the primary financial source. Has an increased interest in the project's success as the regional Technical Director of Heineken International.
2	SB management	High	High	A subsidiary of Heineken International: holds high power to influence the project since it will provide the human resources. It is also highly interested due to its aim to reduce carbon emissions by 2030 and to become independent of the local power grid (high interest).
3	Shiwam Isrie (project manager)	High	High	Project Manager: Works for SB Has high power and interest as a project manager, directing all project work. He will ensure the solar power plant fulfills all requirements set by the project sponsor and other stakeholders.
4	A. Baasaron- N.V. AMPS (director of company)	High	High	Director of the Company: Holds high power and interest. He will ensure that all materials for the solar power plant are delivered on time, preventing time and cost overruns.
5		High	High	The electrical engineer: has high power and high interest due to the importance of his work. He will ensure the correct and

Stakeholders		Classification (Low/High)		Comments
ID	Name	Power	Interest	
	V. Looknauth-Electrical Engineer			complete electrical installation of solar panels and electrical systems, and he will also ensure that the project deliverables are completed within the given timeframe.
6	S. Bissesar-Mechanical Engineer	High	High	The mechanical engineer: has high power and high interest due to the importance of his work. He will ensure the correct and complete mechanical construction of the solar power plant and will also ensure that the project deliverables are completed within the given timeframe.
7	S. Ramdhin-Infrastucture engineer	High	High	The infrastructure engineer: has high power and high interest. He will ensure the correct and complete electrical installation of solar panels and systems, and will also ensure that the project deliverables are completed within the given timeframe.
8	Construction team members	Low	High	All 8 members: have low power and high interest, as they are interested in working to earn a monthly salary but are also easily replaceable due to their temporary contracts. They also carry out the physical construction.
9	Neighbors living in the area	High	Low	Neighbors living in the area have high power since they can stop the construction of the solar power plant by not granting permission, but they also have low interest due to a lack of direct involvement in project construction/design.
10	Local companies, beer consumers	Low	Low	Local beer consumers and local companies in the area have low power and low interest since they have no influence on the project and no involvement in project construction/design.
11	A. Kalpoe, MSc.-EAS-director	High	Low	The director of EAS has high power since he has to grant permission for the construction but low interest since the brewery

Stakeholders		Classification (Low/High)		Comments
ID	Name	Power	Interest	
				will benefit mostly from the generated power and become energy independent.
12	N.V. EBS- M. Eyndhoven-Technical director	High	Low	The director of EBS has high power since he has to grant permission for the construction, but low interest since the brewery will benefit mostly from the generated power and become energy independent.
13	Ministry of Public Works in Suriname- Prof. Dr. Ir. R. Nurmohamad- Minister	High	Low	The director of EBS has high power since he has to grant permission for the construction, but low interest since the brewery will benefit mostly from the generated power and become energy independent.

5 CONCLUSIONS

After the development of all project objectives, the following conclusions were reached regarding the project:

1. The established project management plan details all ten (10) knowledge areas and can assist SB in the realization of the project and achieving the project deliverables and objectives. This project management plan will guide the project execution to maximize its chances of success. Given the company's past unsuccessful project experiences, the creation and utilization of a project management plan will help better define project objectives, success criteria, resource allocation, and everything else needed for the project's success. Additionally, this project management plan will become an organizational asset for the company and serve as the basis for future project plans.
2. The integration management plan includes the project charter, which is the main document the SB has to sign. This document mandates SB to implement the project and defines the six (6) objectives of the project.
3. The Scope Management Plan list the 33 work packages, which needs to be executed to complete the project. The project is designed as a theoretical project that could be executed in the next few years, given the support of the local municipality, the Ministry of Public Works, N.V. EBS and EAS in Suriname, and financial funding from Heineken International. The Scope Management Plan provides the necessary depth to the project and can be adjusted when the project is ready for execution.
4. The Schedule Management Plan details the project schedule needed to complete the construction of the solar power plant. The project schedule spans five years, with work

scheduled for Monday through Friday, eight hours per day. Due to historical data regarding rainfall and thunderstorms, outdoor construction is planned during favorable weather seasons, with optimal timing to complete all planning and construction requirements. Extra time has been allocated for the construction of the roof mounting structure, realization of modifications to the power house, net metering, and training phase (one year), accounting for potential schedule overruns.

5. The Project's Cost Management Plan details the planned project costs. Due to the specialists required for the project, such as solar panel installers, power house technicians, on-grid/off-grid technicians, and other construction technicians, the local company N.V. AMPS was chosen for its years of partnership and positive work experience. The Cost Management Plan also includes additional costs for any delays or unforeseen works, computed using a three-point estimation.
6. The Quality Management Plan elaborates on the project's various quality requirements. Quality specifications are crucial for the sustainable/regenerative properties of the solar power plant. The construction of the solar power plant necessitates a location safe from hurricanes, storms, heavy floods, and heavy winds, near a water source (the Surinamese water canals) for cooling purposes, accessible by trucks and public services, with a strong roof, on-grid/off-grid connection capabilities, storage and export of surplus energy, and the ability to supply enough energy in case brewery production capacity expands. All these requirements are addressed in the Quality Management Plan.
7. The Resources Management Plan for the project construction details the specific staff and material resources required. The staff resources required include a 15-member

construction team for the project, estimated based on the construction of similar solar power plants over a one-year period (3000 solar panels). Additionally, the plan includes the seven primary stakeholders responsible for ensuring all project resources are secured and provided, including Heineken International (the project sponsor), SB subsidiary of Heineken, the PM, infrastructure engineer, mechanical engineer, electrical engineer, and the human resources and material supplier (N.V. AMPS).

8. The Communication Management Plan heavily focuses on communication between various project stakeholders. The plan emphasizes mobile communication methods such as MS Teams, email, and WhatsApp as alternative capabilities. Additionally, in-person meetings between engineers and the PM are planned daily, and between the PM and project sponsor weekly and monthly. Meeting intervals increase, especially daily during the construction phase of the project, as the majority of project resources will be involved during this phase. In the training phase, this will be limited to weekly.
9. The Risk Management Plan identified 14 risks for the project. Using qualitative analysis, five high risks were identified that the project could face. These include: cost overruns, delays, poor construction quality, integration failures, project delays, regulatory hurdles or permit delays, adverse weather conditions resulting in delays, and external dependencies resulting in delays. It is vital that the construction team contracted for this project understands the objectives and contributes qualified and dependable workers. Lastly, community engagement through the PM and the Ministry of Public Works, N.V. EBS, and EAS is crucial to obtain permits on time and to prevent delays and possible cost overruns.

10. The procurement management plan specifies the process involved in acquiring goods and services from external sources to support the project's needs. The plan describes a total cost estimate of €928,000. It also outlines the roles and responsibilities of the various stakeholders.
11. The solar power plant project involves many diverse stakeholders. The Stakeholder Management Plan facilitates the need to categorize all stakeholders (direct vs. indirect) and highlights the degrees of power and influence. The stakeholder management plan establishes the formal commitment of all stakeholders toward project success. The project utilized a power-interest matrix to detail to all stakeholders how each stakeholder is involved in the project regarding project responsibility. All the direct stakeholders have high power and high influence, as they are either the project sponsor or the person in charge of the main deliverables of the project. The indirect stakeholders (EBS, N.V. EBS, neighbors living in the area, and Ministry of Public Works) have high power as well, but low interest since they can counteract the construction of the power plant. The local companies and beer consumers are the groups with low power and low interest since the solar power plant won’t have any impact on them. The construction team members are the ones with high interest and low power since they are interested in working and earning, but as they are flex workers and easily replaceable, they have low power. This transparency will create a united team and enhance the cooperation of all stakeholders to achieve a successful project outcome.
12. The entire project management plan was created to reduce carbon emissions to zero and adopt sustainable and regenerative production practices, aiming to become energy

independent from Suriname's unreliable electrical power supply. Extensive research was conducted to assess the feasibility of building the solar power plant in the operational area. The social aspect involved engaging neighbors and providing training for all workers. The social program also aimed to address the concerns of the neighbors, who will ultimately benefit from the surplus energy exported to the power grid. Lastly, the economic considerations focused on the cost of constructing the solar power plant to ensure that the energy produced is affordable and clean. This will enable the brewery to rely on a reliable power supply 24 hours a day and achieve net zero energy emissions.

6 RECOMMENDATIONS

1. The SB should have a department within its organizational structure that is dedicated to project management. This department should be able to provide the various projects with a qualified and full-time PM.
2. The SB should start negotiations with Heineken International (the project sponsor) to secure funding for the project on time to prevent delays.
3. The SB should monitor the performance of the solar power plant on a yearly basis, as solar panels undergo power degradation. The data provided in the datasheets are for standard test conditions with a room temperature of 25°C, but in a tropical climate, this temperature can reach 40°C, resulting in faster performance degradation of the solar panels. This can have an effect on the amount of available power for the brewery.
4. The SB management should request project management plans and lessons learned registers from similar solar power plants at Heineken breweries in tropical climates and should take those outcomes into account when constructing the solar power plant to maximize its success.
5. The SB should also consider investing in a wind turbine power project. This could reduce the need for battery storage systems and lower the maintenance costs of the solar power plant over a long period of time.
6. The SB should provide training to other local companies to encourage them to adopt sustainable and regenerative practices, such as producing their products using solar power.

7 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

The construction of the solar power plant for SB is in response to the greater need to reduce carbon emissions to zero, adopt sustainable and regenerative production practices, and become energy independent from the unreliable electrical power supply of Suriname. This solar power plant will reduce long-term environmental impact by minimizing fossil fuel depletion and environmental pollution, thus reducing the carbon footprint of the company and Suriname as a country. It will also have a positive impact on local ecosystems near the company.

It will have a social impact by hiring local workers and providing them with decent work and salaries. Additionally, it will implement a community engagement program during its construction phase by involving neighbors and providing a training program for all workers. The community engagement program will also contribute to social well-being and address the concerns of neighbors.

The construction of the solar power plant will have an economic impact for other local companies as it will create job opportunities and income for them.
Additionally, it will create a positive economic ripple effect due to the surplus energy export capability of the power plant. This surplus energy can help prevent load shedding in situations where the local power company can't supply enough power. On the other hand, it will also generate extra income for the company after the payback period has passed.
This project is related to the U.N. SDGs 3, 7, 8, 9, 11, 12, 13, and 15.

The solar power plant will contribute to good health and well-being (SDG 3) since it will produce zero noise pollution and emit no carbon. Previously, the brewery used diesel generators as backup, resulting in significant noise pollution and carbon emissions, leading to frustrated neighbors and health issues such as respiratory problems. All these problems will now be mitigated.

The power plant will also contribute to affordable and clean energy (SDG 7) by becoming energy independent, reducing reliance on the power grid, and exporting surplus energy, thus contributing to clean electrical power generation for Suriname. Furthermore, the power plant will contribute to decent work and economic growth (SDG 8) for both the company and the Surinamese economy. With a payback period of 7 years and a life expectancy of over 30 years, the power plant will generate cash flow after 7 years, leading to increased income for workers.

The solar power plant will also contribute to industry, innovation, and infrastructure (SDG 9) as the generated clean energy will be used for industrial production processes, making it one of the net-zero energy companies in Suriname. Additionally, the beer delivery trucks will be electric, utilizing the power plant's electricity.

Moreover, the solar power plant will contribute to sustainable cities and communities (SDG 11) by promoting sustainable electrical generation practices in Paramaribo, Suriname. Neighbors, who are also partly workers, will benefit from the surplus energy of the power plant, fostering a sustainable community.

Furthermore, the solar power plant will contribute to responsible consumption and production (SDG 12), as all beers will now be produced using clean energy, reducing the carbon footprint of the company and Suriname. This will also contribute to SDG 13, climate action.

Additionally, the power plant will contribute to life below water (SDG 14) and life on land (SDG 15). Previously, fishers in Suriname's canals faced danger due to hot and oily water discharged from diesel generators used for cooling processes. By resolving this issue, the project contributes to SDG 14. Furthermore, noise pollution from diesel generators disturbed birds and other animals breeding in the area. With the solar power plant, there will be zero noise pollution, contributing to SDG 15.

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APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)

1. Student name

Shiwam Vikesh Isrie

2. FGP name

A project management plan for the construction of a solar power plant for Surinaamse Brouwerij N.V. to achieve net-zero energy consumption.

3. Application Area (Sector or activity)

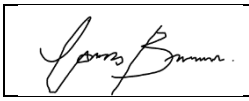
Construction, Energy transition, renewable energy, beer brewery (beverage production).

4. Student signature

5. Name of the Graduation Seminar facilitator

Carlos Brenes Mena & Róger valverde

6. Signature of the facilitator



7. Date of charter approval

21-02-2024

8. Project start and finish date

04-03-2024	04-07-2024

9. Research question

How can an effective project management plan be developed and implemented for the construction of a solar power plant to ensure timely and cost-effective completion, while maximizing energy output and adhering to sustainable practices?"

10. Research hypothesis

The successful implementation of a well-structured project management plan for the construction of a solar power plant will lead to the timely completion of the project, efficient resource utilization, reduced costs, and increased energy output, contributing to the overall success and sustainability of the solar power plant."

11. General objective

To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.

12. Specific objectives

Specific objectives

1. To develop an integration management plan to ensure that all aspects of the project are properly coordinated, aligned with the project's objectives, and contribute to its overall success.
2. To develop a scope management plan in order to ensure that the project includes all the work required to complete the project successfully.

3. To develop a schedule management plan to manage the timely completion of the project.
4. To develop a cost management plan for effective budgeting and financial control throughout the project.
5. To develop a quality management plan , outlining measures to ensure the delivery of a high-quality solar power plant.
6. To develop a resource management plan for optimal utilization of resources, including manpower and materials.
7. To develop a communication management plan , ensuring effective and transparent communication among project stakeholders.
8. To develop a risk management plan , identifying, assessing, and mitigating potential risks that may impact the project.
9. To develop a procurement management plan , outlining strategies for the acquisition of necessary resources and services.
10. To develop a stakeholder management plan , addressing the needs and expectations of key stakeholders throughout the project lifecycle.
11. To validate the project from a sustainable/regenerative development perspective.

13. FGP purpose or justification

The aim of this FGP is to create a project management plant for the "Surinaamse Brouwerij" for the construction of a solar power plant that will eventually guide the project execution to maximize its success chances. Given that the company has had unsuccessful project experiences in the past, the creation and use of a project management plan will help better to define project objectives, success criteria, resource allocation, and in general plan everything that is needed for the project success. Also, this project management plan will become an organizational asset for the company that might be used as the basis for future project's plans. The project for the construction of the solar power plant is critical for Surinaamse Brouwerij N.V. and its mother company, Heineken, for the following reasons:

- Currently, there are no industries in Suriname that are using renewable energy sources for production processes, Surinaamse Brouwery N.V. (part of the Heineken company) wants to be the first company to do this and to set an example for other local companies.
- The current brewery of Surinaamse Brouwery N.V. depends on local a power supply, during power blackout the entire production process lays still, and the company deals with a loss of over $200.000 per day .
- Heineken International has set goals for a lot of their breweries to work towards zero CO_2 net production by 2030 and to achieve many sustainable development goals. To achieve this, new breweries need to have renewable energy sources installed to supply enough power for all production and transportation facilities.

14. WBS

1. Graduation seminar
    - 1.1 FGP Deliverables
        - 1.1.1 Charter
        - 1.1.2 WBS
        - 1.1.3 Chapter I Introduction
        - 1.1.4 Chapter II Theoretical framework
        - 1.1.5 Chapter III Methodological framework
        - 1.1.6 Annexes
            - 1.1.6.1 Bibliography
            - 1.1.6.2 Schedule
            - 1.1.6.3 Preliminary bibliographical research
        - 1.1.7 Chapter VII Validation of the FGP in the field of Regenerative and Sustainable Development
    - 1.2 Graduation seminar approval

2. Tutoring process FGP course Tutorship : 3 months
    - 2.1 Tutor: Carlos Brenes
        - 2.1.1 Tutor assignment
        - 2.1.2 Communication
    - 2.2 Adjustments of previous chapters (If needed)
    - 2.3 Chapter IV. Development (Results)
        - 2.3.1 Integration management plan
        - 2.3.2 Scope management plan
        - 2.3.3 Schedule management plan
        - 2.3.4 Cost management plan
        - 2.3.5 Quality management plan
        - 2.3.6 Resource management plan
        - 2.3.7 Communication management plan
        - 2.3.8 Risk management plan
        - 2.3.9 Procurement management plan
        - 2.3.10 Stakeholder management plan
    - 2.4 Chapter V Conclusions
    - 2.5 Chapter VI Recommandations

3. Reading by reviewers: readership phase: 1 month
    - 3.1 Reviewers assignment request
        - 3.1.1 Assignment of two reviewers
        - 3.1.2 Communication
        - 3.1.3 FGP submission to reviewers
    - 3.2 Reviewers work

3.2.1 Reviewers 1
3.2.1.1 FGP reading
3.2.1.2 Reader 1 report
3.2.2.2 Reader 2 report

3.2.2 Reviewers 2
3.2.2.1 FGP reading
3.2.2.2 Reader 2 report

4. Adjustments Readership phase 1: 1 month
4.1 Report for reviewers
4.2 FGP update

15. FGP budget

The total costs for doing the FGP document is detailed below in the table.

Work	Cost ($)
Work tours	$100
Interviews in person (focus group)	$50
Information processing	$200
Data collection and analysis	$100
Project document research	$50
Meetings with CEO board members (group meetings)	$50
Costs of philologist (English teacher) for document review	$200
Total costs	$750

16. FGP planning and development assumptions

- It is assumed that all the required information to execute this FGP will be readily available at Surinaamse Brouwerij NV.
- It is assumed that the company, board of directors and managers will provide all the project specific information on a timely manner and without any significant restrictions to create the project management plan.

- It is assumed that information about applying renewable energy sources in the industrial field is available at the Surinamese energy authority without any significant restrictions.
- Qualitative and qualitative data regarding the energy generation and consumption of the new brewery will be non-restricted, and there will be no limitations to its use for academic purposes.
- The brewery company information will be non-restricted, and there will be no limitations to its use for academic purposes.
- Reacher time for the FGP will be at least 15 hours per week during the FGP development process, and I (the student) will make that time free.

17. FGP constraints

- The maximum time frame to finalize the FGP is 12 weeks.
- There will be only one human resource available to develop the FGP.
- The information will only be available from Surinaamse Brouwerij NV and no other breweries of Heineken.
- The project evaluation will be done with local resources (humans, materials, facilities, and software).
- The Release of new technological developments in the field of renewable energy sources may negatively impact the project's success.
- The project quality will depend on (communication, project changes, and poor design of development skills)

18. FGP development risks

- A hurricane or rainy season might delay the work tours and the data collection in the field, which might delay the deliverables development.
- Dependence on information from Surinaamse Brouwery N.V. might delay the deliverables development.
- Changes in plans might delay the deliverables development.
- Long term Sickness of the student may also delay the deliverables development.

19. FGP main milestones

Milestones are related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS of section 14 of this Charter. At the same time, the deliverables are related to the specific objectives (in the case of the FGP, please include the times for the tutorship reviews as well as for the readership).

Deliverable	**Finish estimated date**
1 FGP deliverables	
1.1 FGP deliverables	25-02-2024
1.1.1 Charter	28-01-2024
1.1.2 WBS	21-01-2024
1.1.3 Chapter I Introduction	18-02-2024
1.1.4 Chapter II Theoretical framework Introduction	04-02-2024
1.1.5 Chapter III Methodological framework	11-02-2024
1.1.6 Annexes	25-02-2024
1.1.7 Chapter VII validation of the FGP in the field of Regenerative and sustainable development	18-02-2024
1.2 Graduation seminar approval	25-02-2024
2 Tutoring process FGP course: 3 months	
2.1 Tutor	06-03-2024
2.1.1 Tutor assignment	04-03-2024
2.1.1 Communication	07-03-2024
2.2 Adjustments of previous chapters (if needed)	14-03-2024
2.3 Chapter IV. Development (results)	17-05-2024
2.3.1 Integration management plan	10-03-2024

2.3.2 Scope management plan	10-03-2024
2.3.3 Resource management plan	17-03-2024
2.3.4 Stakeholder management plan	17-03-2024
2.3.5 Change management plan	24-03-2024
2.3.6 Schedule management plan	24-03-2024
2.3.7 Risk management plan	31-03-2024
2.3.8 Cost management plan	31-03-2024
2.3.9 Quality management plan	07-04-2024
2.3.10 Procurement management plan	07-04-2024
2.4 Chapter V Conclusions	27-04-2024
2.5 Chapter VI recommendations	04-05-2024
3. Reading by reviewers: readership phase: 1 month	
3.1 Reviewers assignment request	28-05-2024
3.1.1 Assignment of two reviewers	28-05-2024
3.1.2 Communication	31-05-2024
3.1.3 FGP submission to reviewers	15-06-2024
3.2 Reviewers works	02-06-2024
3.2.1 Reviewer I	17-06-2024
3.2.1.1 FGP reading	14-06-2024
3.2.1.2 Reader report 1	17-06-2024
3.2.2 Reviewer 2	17-06-2024
3.2.2.1 FGP reading	14-06-2024
3.2.2.2 Reader report 2	17-06-2024
4. Adjustments Readership phase 1: 1 month	
4.1 Report for reviewers	21-07-2024
4.2 FGP update	06-08-2024
4.3 Second review by reviewers	06-08-2024
5. Presentation to board of examiners, readership phase: 1 month	
5.1 Final review by board	08-08-2024
5.2 FGP grade report	09-08-2024

20. Theoretical framework

20.1 Estate of the “matter”

Currently, Surinaamse Brouwerij N.V. has no project plan available for the construction of a solar power plant. In the past, most of the projects were done by in-company engineers without project plans, which resulted in projects being

delivered with cost & schedule overruns and without risk management plans to deal identify, assess, and mitigate potential risks that may impact the project. Also, they don't have a stakeholder management plan that ensures all stakeholders are satisfied.

In the past, the brewery used a spreadsheet with some budget, resource, and cost planning, but since it was not often updated and the engineers lacked project management knowledge, the projects were often not a success due to several reasons related to cost, time, resources, and risks. Recently, the brewery manager decided to do proper project planning before starting it.

In order to complete this section, several research activities can be used: bibliographical (reports, theses, books or magazines, interviews to experts of clinic functionaries, field observation, etc.).

20.2 Basic conceptual framework

Project management, sustainable design and construction, and renewable energy.

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
The aim of this FGP is to create a project management plant for the "Surinaamse brouwerij" for the construction of a solar power plant that will eventually guide the project execution to maximize its success chances. Given that the company had unsuccessful project experiences in the past, the creation and use of the project management plan will help better to define project objectives, success criteria, resource	Project charter, work breakdown structure (WBS), Project schedule, Status reports. Resource calendar, dependency log, Schedule baseline, change log process, quality metrics and key performance indicators (KPI's), quality audit plan, Risk mitigation plan for resources, Risk response plan, Risk monitoring and control framework, Risk register, Procurement documents, supplier evaluation reports, Risk mitigation plan for procurement, Communication plan for procurement, Procurement performance metrics, Stakeholder identification report, Stakeholder analysis report,	**Primary:** • Jan-willem paans: the managing director • Margarita van der Zwart: the people & corporate affairs manager • Willem bieren de haan- Finance manager **Secondary:** • Year books of Surinaamse Brouwerij N.V • Internal database of Surinaamse Brouwerij N.V. • Financial, quality standards, human and material resources, PR&V	**Analytic:** In the planning phase, an analytic approach will be used to break down the project into its constituent elements. **Synthetic approach:** During the integration management phase, a synthetic approach will be employed to combine various project components, plans, and processes. This will be done to integrate different aspects to create a comprehensive project plan that aligns with overall objectives. Inductive research method: the inductive research method will be used as the second method. **The inductive method:** This method will be used to analyze project risks and derive general principles. By examining historical project data, generalizations can be made	Interviews, focus groups, decomposition, expert judgment, analogous estimating, Cost of Quality (COQ), Bottom-Up Estimating, Stakeholder Analysis, SWOT Analysis, Make-or-Buy Analysis, The Triple Bottom Line (TBL)	**Time Constraints:** • Limited time for conducting the research. • Tight deadlines for project completion **Budgetary Limitations:** • Constraints on financial resources available for the research. • Limited funds for data collection, analysis tools, or other expenses. **Access Restrictions:** • Limited access to certain data sources, archives, or locations. • Privacy and confidentiality issues restricting access to certain information. **Data Quality Issues:** • Incomplete or unreliable data sources. • Restrictions on the availability of high-quality data.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
allocation, and in general plan everything that is needed for the project success. Also, this project management plan will become an organizational asset for the company that might be used as the basis for future project plans.	stakeholder engagement matrix, stakeholder needs and expectations document, stakeholder management strategy, stakeholder engagement plan, Regenerative Impact Analysis document, Sustainable/regenerative development assessment report, sustainable validation plan	communication, previous projects' lessons learned, standard suppliers' relationships, energy consumption, and KPI databases.	about potential risks and strategies for risk mitigation. **Deductive reasoning:** this will help to break broad project objectives into specific tasks, activities, and requirements. The Work Breakdown Structure (WBS) will be used as a tool that uses deductive reasoning to decompose project deliverables. The summary of research methods 1 and 2 is shown in chart 2 below.		**Technological Constraints:** • Limitations in the availability or functionality of research tools and technologies. • Technical challenges affecting data collection or analysis. **Legal Restrictions:** • Limitations imposed by laws and regulations. • Compliance with legal requirements affecting the research process **Expertise Limitations:** • Constraints related to the expertise of the research team. • Challenges in understanding and interpreting certain aspects of the research. **Scope Limitations:** • Narrow scope due to specific research objectives. • Constraints on the breadth of the study.

22. Validation of the work in the field of the regenerative and sustainable development.

The solar power plant will have the following sustainable and regenerative development contributions:

Environmental:

1. **Renewable Energy Generation:**
    - Indicator: percentage of energy generated from renewable sources.
    - Measurement: track the solar power plant's contribution to the overall energy consumption of the brewery company.
2. **Reduction in Carbon Emissions:**
    - Indicator: tons of CO2 emissions avoided.
    - Measurement: compare the expected CO2 emissions from the solar power plant to what would be emitted using traditional energy sources.
3. **Resource Conservation:**
    - Indicator: reduction in non-renewable resource usage.
    - Measurement: assess the decrease in the consumption of fossil fuels and other non-renewable resources due to the solar power plant.

Social Contributions:

1. **Job Creation and Training:**
    - Indicator: number of jobs created and training programs implemented.

- Measurement: monitor employment figures and track the participation of local residents in training initiatives related to solar energy.

2. Community Engagement:

- Indicator: participation in community solar training programs and feedback.
- Measurement: organize community solar trainings and regular community meetings, gather feedback, and document the involvement of the local community in the project.

3. Enhanced Energy Access:

- Indicator: improved access to electricity in the surrounding areas.
- Measurement: evaluate the extension of electricity access to nearby communities and businesses that may benefit from the solar power plant.

Economic Contributions:

1. Cost Savings and Revenue Generation:

- Indicator: reduction in energy costs for the industrial company.
- Measurement: compare the costs of energy before and after the implementation of the solar power plant, and evaluate any revenue generated from excess energy production.

2. Local Supply Chain Impact:

- Indicator: utilization of local suppliers and services.

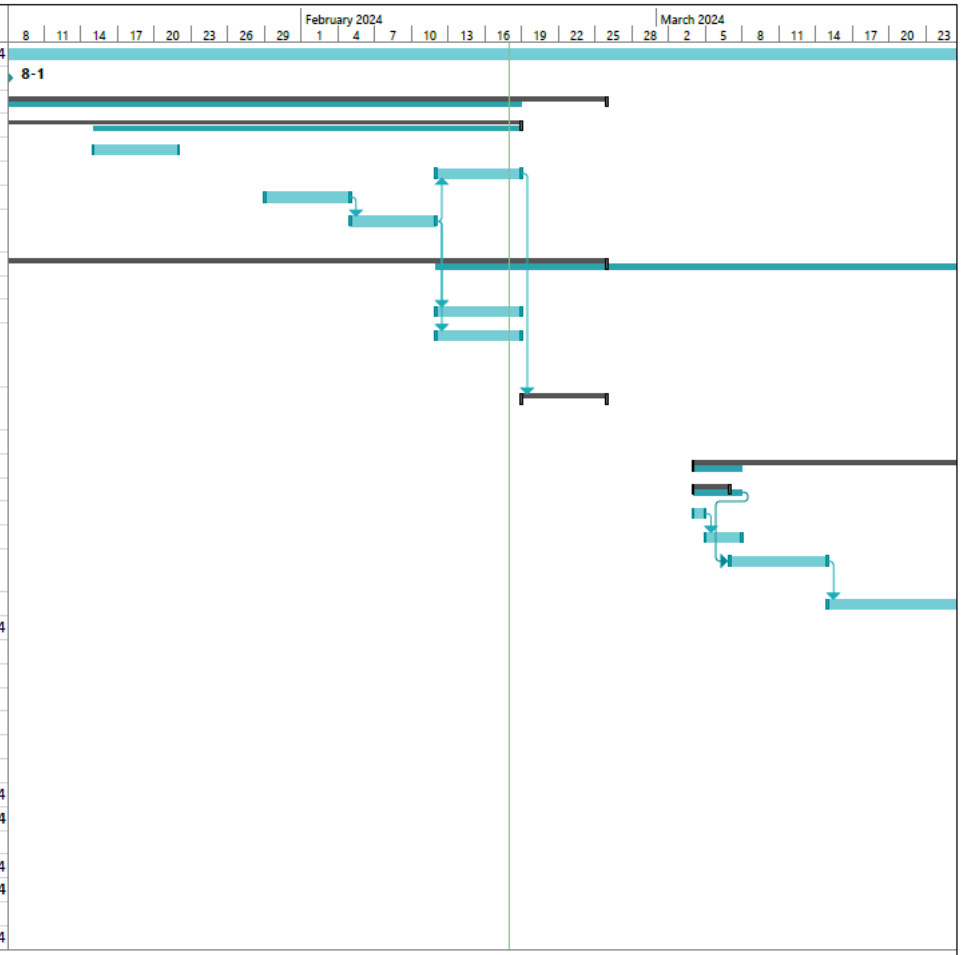
- Measurement: assess the percentage of project-related goods and services sourced locally, contributing to the economic development of nearby businesses.

3. **Return on Investment (ROI):**
    - Indicator: financial performance and payback period.
    - Measurement: calculate the return on investment by assessing the financial gains against the initial and ongoing project costs.

Appendix 2: FGP WBS

Appendix 3: FGP Schedule

ID	Unique ID	Task Mode	Taaknaam	Duration	Start	Finish
1	1		Final Graduation project	156 days	Mon 8-1-24	Mon 12-8-24
2	2		FGP start	0 days	Mon 8-1-24	Mon 8-1-24
3	**3**		**1,Graduation seminar**	**36 days**	**Mon 8-1-24**	**Sun 25-2-24**
4	**4**		**1.1, FGP Deliverables**	**31 days**	**Mon 8-1-24**	**Sun 18-2-24**
5	5		1.1.2 ,WBS	6 days	Mon 15-1-24	Sun 21-1-24
6	6		1.1.3, Chapter I introduction	6 days	Mon 12-2-24	Sun 18-2-24
7	7		1.1.4, Chapter II Theoretical Framework	6 days	Mon 29-1-24	Sun 4-2-24
8	8		1.1.5, Chapter III Methodological Framework	6 days	Mon 5-2-24	Sun 11-2-24
9	**11**		**1.1.6, Annexes**	**36 days**	**Mon 8-1-24**	**Sun 25-2-24**
10	18		1.1.6.1, Bibliography	6 days	Thu 20-6-24	Thu 27-6-24
11	16		1.1.6.2, Schedule	6 days	Mon 12-2-24	Sun 18-2-24
12	14		1.1.7, Chapter VII validation of the FGP in the field of Regenrative and sustainable development	6 days	Mon 12-2-24	Sun 18-2-24
13	**29**		**Executive Summary, Abstract, Bibliographical references, indexes, Signed FGP charter**	**6 days**	**Mon 19-2-24**	**Sun 25-2-24**
14	13		1.2, Graduation Seminar Approval	0 days	Sat 25-2-23	Sat 25-2-23
15	**19**		**2, Tutoring Process**	**61 days**	**Mon 4-3-24**	**Sun 26-5-24**
16	**20**		**2.1, Tutor**	**3 days**	**Mon 4-3-24**	**Wed 6-3-24**
17	21		2.1.1, Tutor assignment	1 day	Mon 4-3-24	Mon 4-3-24
18	22		2.1.2, Communication	3 days	Tue 5-3-24	Thu 7-3-24
19	23		2.2, Adjustments of previous chapters (if needed)	6 days	Thu 7-3-24	Thu 14-3-24
20	24		2.3, Chapter IV Development (Results)	46 days	Fri 15-3-24	Fri 17-5-24
21	25		2.4 Chapter V. Conclusions	6 days	Mon 20-5-24	Mon 27-5-24
22	26		2,5 Chapter VI. Recommendations	6 days	Mon 29-5-23	Sun 4-6-23
23	27		Tutor aproval	0 days	Sun 26-5-24	Sun 26-5-24
24	30		**3, Reading by reviewers**	6 days	Mon 27-5-24	Sun 2-6-24
25	**31**		**3.1.1, Assignment of two reviewers**	**2 days**	**Mon 27-5-24**	**Tue 28-5-24**
26	32		3.1.2, Communication	3 days	Wed 29-5-24	Fri 31-5-24
27	33		3.1.3, FGP submission to reviewers	1 day	Sun 2-6-24	Sun 2-6-24
28	34		**3.2, Reviewers work**	11 days	Mon 3-6-24	Mon 17-6-24
29	**35**		**3.2.1, Reviewer 1**	**11 days**	**Mon 3-6-24**	**Mon 17-6-24**
30	36		3.2.1.1, FGP reading	10 days	Mon 3-6-24	Fri 14-6-24
31	37		3.2.1.2, Reader 1 report	1 day	Sun 16-6-24	Mon 17-6-24
32	**38**		**3.2.2, Reviewer 2**	**11 days**	**Mon 3-6-24**	**Mon 17-6-24**
33	39		3.2.2.1, FGP reading	10 days	Mon 3-6-24	Fri 14-6-24
34	40		3.2.2.2, Reader 2 report	1 day	Sun 16-6-24	Mon 17-6-24



Project: Project1
Datum: Sun 18-2-24

Taak | Splitsing | Mijlpaal | Samenvatting
Projectsamenvatting | Inactieve taken | Inactieve mijlpaal | Inactieve samenvatting
Handmatig taak | Alleen duur | Handmatige samenvatting | Handmatige samenvatting
Alleen begindatum | Alleen einddatum | Externe taken | Externe mijlpaal
Deadline | Voortgang | Voortgang, handmatig

Appendix 4: Preliminary bibliographical research

Throughout the past few decades, industries have been one of the prime sectors responsible for a large share of energy demand and greenhouse gas (GHG) emissions worldwide (IEA, 2018). For example, in the United States, the residential sector alone accounts for 21.2% of the national primary energy demand (EIA, 2020) and 15.6% of the total GHG emissions (EPA, 2018).

In Suriname, industries account for 48 % of the total energy consumption, and renewable energy technologies such as solar account for only 0.4%. Around 40% of energy produced still comes from fossil fuels using diesel generators, while the other 59.6% comes from a hydropower. Currently, Suriname faces challenges for the future with regard to the energy demand: a growing energy demand on the one hand and a relative lower electricity output from the hydropower plant as a result of extreme droughts (ETI, 2020).
Given the fact that there will be an increased demand for electricity in the near future on the one hand and, on the other hand, the effects of climate change will minimize the potential of the current energy system, the country should commit to a fully sustainable energy system. (IPCC, 2023).

Moreover, Suriname has committed to the Millennium Development Goals (MDGs) aiming at eight specific targets. Although these MDGs do not directly address energy, it is acknowledged that access to sustainable energy contributes directly to realizing all MDGs (ENERGYPEDIA, 2024). During the 41st Special Meeting of COTED (Council for Trade and Economic Development), where Suriname is part of a member state of the CARICOM (Caribbean Community) the target of realizing 47% renewable power capacity and, at the

same time, CO2 reductions of 36% in the power sector by 2027 was agreed upon (Harrison, 2018).

Surinaamse Brouwery N.V. is the biggest and largest brewery in Suriname and is currently planning to build a second brewery with a commitment to have net-zero productions by 2030 (SURINAAMSE BROUWERIJ, 2022). To achieve this, they have purchased electric delivery trucks (Surinaamse Brouwerij, 2023) and also installed a solar rooftop in their new office building to become the first net-zero building in Suriname. They have also increased their energy efficiency by using sub-zero coolers and reducing their impact on CO_2 emissions (SURINAAMSE BROUWERIJ, 2016).

In general, an increase in building energy demand is accompanied by economic and environmental problems, such as increased electric utility costs and GHG emissions. Thus, it is essential to find reasonable solutions to reduce operating costs and GHG emissions associated with high energy demand in the industrial sector. As a way to solve these problems, most countries around the world are targeting “net-zero emission” as a future governmental initiative (Mishra et al., 2022), which leads to growing expectations for net-zero energy buildings (NZEBs) (Zhang et al., 2021). More specifically, many developed countries have a carbon-neutral target set up for 2050, and most governments in these nations require all new constructions from then on to be implemented as NZEBs (Zhang et al., 2020).

Appendix 4: Change Request Format

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Change Request Format**	
Version 1.0	Document ID: 002-change-	03/24/2024

Project Name:			
Requested by:			
Issue Date:		**Change ID**	

Change Request (Please explain the reasons why change requesting):	
Expected impact:	**Priority**
	High ( )
	Medium ( )
	Low ( )

Areas Affected	
Integration	Resources
Scope	Communication
Schedule	Risk
Cost	Procurement
Quality	Stakeholders

Comments

Resolution	**Final Status**
	Approved ( )
	Denied ( )
Project Manager Signature:	Date:
Decision Maker Signature:	Date:

Appendix 5: Lesson Learned register

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Lesson Learned register**	
Version 1.0	Document ID: xxxxx	03/24/2024

Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.
Issued by:	
Issue Date:	

Project Name:	Construction of Solar power plant for SB			
Project Manager:	Shiwam Isrie			
Notes:	(add any extra info here)			
WIN or ISSUE	**Describe What Happened**	**What Was the Impact?**	**How Does This Change Future Projects?**	**Action Items**
WIN				
ISSUE				
WIN				

Appendix 6: Document Tracking

Document Tracking (*Document Name*)

General Information

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Information**
Document Id	*Insert document I.D.*
Document Owner	*Shiwam Isrie*
Issue Date	*Insert Date*
Last Saved Date	*Insert Date*
File Name	*Insert Document Name (same as above)*

Change Control

Version	Issue Date	Changes
1.0	*Insert date*	*Detail Changes*

Approvals

Role	Name	Signature©	Date
Project Sponsor	*Heineken international*	*Insert Digital Signature*	*Insert date*
Project Manager	*Shiwam Isrie*	*Insert Digital Signature*	*Insert date*

Appendix 7: Monthly Report

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Monthly Report**	
Version 1.0	Document ID: xxxxx	03/24/2024

Project Name:	The construction of a Solar power plant for Surinaamse brouwerij N.V
Issued by:	
Issue Date:	

CPI		**% Project Complete**		**AC**	
SPI		**Planned Completion**		**CV**	

Description of Monthly updates
Reasons for Delays
Corrective Actions
Other information
Meeting Participants

Name	**Signature**

Appendix 8: Project Report

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Project Report**	
Version 1.0	Document ID: 015-SB-PR	03/24/2024
Project Name:	The construction of a solar power plant for Surinaamse Brouwerij N.V.	
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.	

Appendix 9: Earned value management analysis

SURINAAMSE BROUWERIJ
PART OF THE HEINEKEN COMPANY

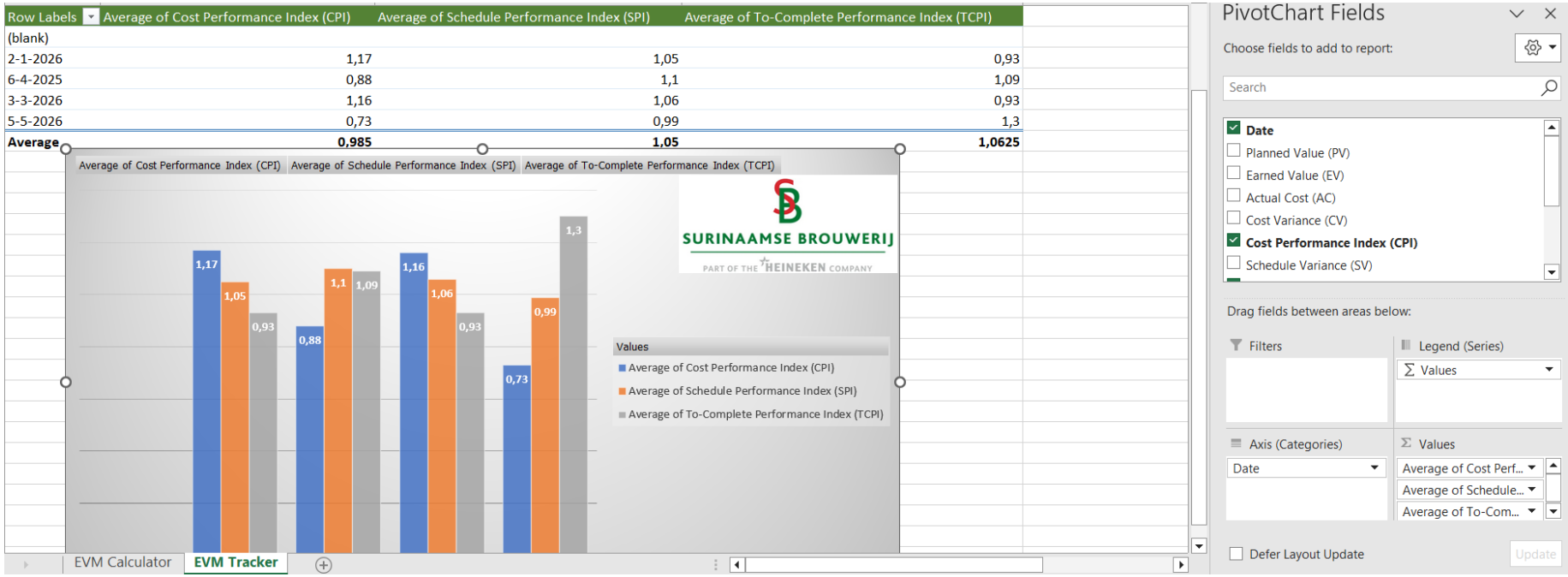
Earned Value Management (EVM)

Enter in Required Values Below	
Budget At Completion (BAC):	€ 5.000,00
Planned Schedule Duration (Days):	60
Current Day:	23
Actual Work Completed (%):	38%
Total Spent (Actual Cost AC):	€ 2.600,00

Do Not Modify Below Values			
Planned Value (PV):	€ 1.916,67	Schedule Performance Index (SPI):	0,991304348
Earned Value (EV):	€ 1.900,00	Estimate At Completion (EAC):	€ 6.842,11
Cost Variance (CV):	-€ 700,00	Estimate To Completion (ETC):	€ 4.242,11
Cost Performance Index (CPI):	0,730769231	Variance At Completion (VAC):	-€ 1.842,11
Schedule Variance (SV):	€ 16,67	To-Complete Performance Index (TCPI):	1,291666667
Planned Percent Completed:	38%		

Date	Planned Value (PV)	Earned Value (EV)	Actual Cost (AC)	Cost Variance (CV)	Cost Performance Index (CPI)	Schedule Variance (SV)	Schedule Performance Index (SPI)	Estimate At Completion (EAC)	Estimate To Completion (ETC)	Variance At Completion (VAC)	To-Complete Performance Index (TCPI)
2-1-2026	€ 1.667,67	€ 1.750,00	€ 1.500,00	€ 250,00	1,17	€ 83,30	1,05	€ 4.285,71	€ 2.785,71	€ 714,29	0,93
3-3-2026	€ 1.750,00	€ 1.850,00	€ 1.600,00	€ 250,00	1,16	€ 100,00	1,06	€ 4.324,32	€ 2.724,32	€ 675,68	0,93
6-4-2025	€ 1.833,33	€ 1.850,00	€ 2.100,00	€ 250,00	0,88	€ 16,67	1,1	€ 5.675,68	€ 3.575,68	€ 685,68	1,09
5-5-2026	€ 1.916,67	€ 1.900,00	€ 2.600,00	€ 700,00	0,73	€ 16,67	0,99	€ 6.482,11	€ 4.242,11	€ 1.842,00	1,3

Appendix 10: Earned value management analysis tracker



Row Labels	Average of Cost Performance Index (CPI)	Average of Schedule Performance Index (SPI)	Average of To-Complete Performance Index (TCPI)
(blank)			
2-1-2026	1,17	1,05	0,93
6-4-2025	0,88	1,1	1,09
3-3-2026	1,16	1,06	0,93
5-5-2026	0,73	0,99	1,3
Average	**0,985**	**1,05**	**1,0625**

Appendix 11: Quality Control

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Quality Control**	
Version 1.0	Document ID: 007-SB-QC	03/31/2024

Project Name:	The construction of a Solar power plant for Surinaamse brouwerij N.V		
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.		
Date		**Inspection No.**	

Requirement id	

Description	**Acceptable Criteria**

Findings	**Resolution**
	Approved ◯
	Rejected ◯

Comments	
Supervised by:	PM approval:

Appendix 12: Risk Register

SURINAAMSE BROUWERIJ PART OF THE HEINEKEN COMPANY	**Risk Register**	
Version 1.0	Document ID: 014-SB-RR	03/24/2024

Project Name:	The construction of a Solar power plant for Surinaamse brouwerij N.V			
Project Objective:	To develop and implement a robust project management plan for the construction of a solar power plant, ensuring the timely, cost-effective, and sustainable completion of the project, with a focus on optimizing energy production and minimizing environmental impact.			
Status:	Approved ( )	Denied ( )	**Change ID:**	

Please describe the risk found in the following table.

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI

Please assess the risk based on the results obtained in PxI and compare them within the following table.

Priority	Score	Strategy	Description
Very High Risk	$x \geq 15$	Escalate Transfer	The risk will be elevated to the project sponsor or contracted to an expert for resolution, depending on the situation.
High risk	$9 < x < 15$	Address	These risks must also be addressed but are not prioritized as high as very high-risk category.
Medium Risk	$4 < x < 8$	Mitigate	It is necessary to define corrective actions to reduce the probability and impact of these risks.
Low Risk	$x \leq 3$	Accept	No action will be taken.

Does the risk require planning a response:	Yes	No
If yes, please describe the response proposed:		

Appendix 13: Project Management Plans and Tracking Documents

Document ID	*Document Name*	*Date*	*Version*
001-SB-PC	*Project Charter*	*March 24, 2024*	*1.0*
002-SB-CRF	*Change Request Format*	*March 26, 2024*	*1.0*
003-SB-SMP	*Scope Management Plan*	*March 25, 2024*	*1.0*
004-SB-SHMP	*Schedule Management Plan*	*March 27, 2024*	*1.0*
005-SB-CMP	*Cost Management Plan*	*March 29, 2024*	*1.0*
006-SB-QMP	*Quality Management Plan*	*March 31, 2024*	*1.0*
007-SB-QC	*Quality Control*	*March 31, 2024*	*1.0*
008-SB-RMP	*Resource Management Plan*	*April 7, 2024*	*1.0*
009-SB-CMP	*Communication Management Plan*	*April 14, 2024*	*1.0*
010-SB-RMP	*Risk Management Plan*	*April 21, 2024*	*1.0*
011-SB-PMP	*Procurement Management Plan*	*April 28th, 2024*	*1.0*
012-SB-STMP	*Stakeholder Management Plan*	*May 2nd , 2024*	*1.0*
013-SB-MR	*Monthly Report*	*March 24, 2024*	*1.0*
014-SB-RR	*Risk Register*	*March 24, 2024*	*1.0*
015-SB-PR	*Project Report*	*March 24, 2024*	*1.0*

Appendix 14: Certificate of Review

Roshni Ramsamoedj
Certified English Teacher from Institute of Teacher Training (IOL) Suriname

May 30, 2024

Academic Advisor
Masters Degree in Project Management (MPM) Universidad para la Cooperacion Internacional (UCI)

Dear Academic Advisor,

Thorough Review and Proofreading of Final Graduation Project submitted by Shiwam Vikesh Isrie in partial fulfilment of the requirements for the Masters in Project Management (MPM) Degree
I hereby confirm that Shiwam Vikesh Isrie has made all the corrections to the Final Graduation Project document as I have advised. In my opinion, the document does now meet the literary and linguistic standards expected of a student for a degree at the Masters level.

30-05-2024
Roshni Ramsamoedj
Certified English Teacher

Appendix 15: Linguistic Credentials

INSTITUUT
VOOR DE OPLEIDING
VAN LERAREN

diploma

De examencommissie verklaart dat

Ramsamoedj, Roshni

geboren te Paramaribo de 8 dec. 1983

met goed gevolg heeft afgelegd het examen ter verkrijging van de

MO - A - akte Engels

Paramaribo, 21 feb. 2008

De examencommissie voornoemd,

DIRECTEUR

VOORZITTER

DE GEEXAMINEERDE

SECRETARIS

PLAKZEGEL

SURINAME

Het examen is afgenomen krachtens de Beschikking van de Minister van Onderwijs en Volksontwikkeling van 15 November 1971 G.B. 173