

PRE-FEASIBILITY REPORT VOLUME I INFRASTRUCTURE



Province Government
Province Policy and Planning Commission
Madhesh Pradesh
Janakpurdham, Nepal

2022

PRE-FEASIBILITY REPORT VOLUME I

INFRASTRUCTURE

2022



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Government of Madhesh Province
Province Policy and Planning Commission
Janakpurdham, Nepal

Foreword

The Province Policy and Planning Commission has been involved in the formulation of provincial policies and plans for the economic prosperity and poverty reduction of the province in close coordination with the government line ministries, development partners, private sector, and civil society.

We are pleased to come up with a published book entitled "Pre-feasibility study report of the selected Public Private Partnership possible project of the Madhesh province". The book has carried out the feasibility study report of the 16 selected projects of the province with detailed technical and financial analysis. The projects in the book have been selected in close coordination and consultation with the provincial ministries, private sector, and civil society. This list of projects in this publication will be helpful to meet the requirement of the investor whose interest to invest in the Madhesh province. Similarly, the publication will be helpful to select the project for investment summit under the implementation modality of the Public private partnership.

I hope that the document will be useful to interested planners of provincial and local level as well as private sector investors in economic development and poverty reduction, and that it will be able to attract investment opportunities in the province.

I would like to take this opportunity to extend my sincere thanks to Hon. Chief Minister Lalbabu Raut and the Hon. Ministers of the Government in Madhesh Province. My sincere thanks are also due to the Principal Secretary, the Secretaries of the Ministries and their colleagues, and other stakeholders for all their inputs to the various sectors covered by the publication. I would like to express my sincere thanks to the Economic Policy Incubator (EPI) for their technical support in preparing the final document of the project bank.



Dr. Bhogendra Jha
Vice Chairperson

May 2022

Acknowledgments

It gives me immense pleasure to see that the Policy and Planning Commission (PPC) of Madhesh Province is publishing the pre-feasibility reports of 16 projects in three volumes. These projects are related to tourism, infrastructure, education, agriculture, and industry. The reports present detailed technical and financial analysis, legal frameworks, environmental and social impact, risk analysis, and implementation modality for selected projects. This is an important exercise in terms of improving project preparation and prioritization in the Province and can help improve capital expenditure.

Capital expenditure has always been a challenge in Nepal, including at the provincial level. Budget allocated to development activities is not spent in time, which often leads to a bunching of expenditure towards the end of the fiscal year. This has implications for the quality of spending and raises questions over the quality of project outputs and, of course, value for money. Legislative and institutional efforts so far have yet to bear fruit. Poor preparation of projects, low project readiness, and the resulting delay in awarding contracts are other problems.

The guidelines on developing project bank issued by the National Planning Commission can be an important step forward in addressing this problem at all levels of government. The PPC was quick to recognize this opportunity and approached EPI for support towards institutionalizing the process for project prioritization based on feasibility assessments. We at EPI feel proud to have been able to work with the PPC on this innovative initiative.

I sincerely hope that the reports included in this publication will help the Province Government allocate resources to areas that offer high development returns. This would ultimately help improve capital expenditure of the Government, thereby creating economic opportunities for the people of the Province. The publication could also be a useful reference for private-sector investors.

EPI received significant support and guidance from the PPC in carrying out the feasibility work. I would like to extend my sincere thanks to Prof. Bhogendra Jha, Vice-Chair of the PPC and his team. All concerned line ministries of the Province Government provided critical support. I would like to express deep appreciation for their support and engagement. My special thanks are also due to Invest and Infra Pvt Ltd and Dikshya Consulting for carrying out the feasibility assessments and preparing these reports. Finally, I would like to acknowledge the crucial role of my colleagues at EPI. They have put significant efforts into this publication.

Hiramani Ghimire, PhD
Team Leader

June 2022

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PRE-FEASIBILITY STUDY OF
HIGHWAY REFRESHMENT CENTERS

LIST OF ACRONYMS

BCR	Benefit Cost Ratio
DESR	Debt Equity Service Ratio
DFID	Department for International Development
EIA	Environmental Impact Assessment
GoN	Government of Nepal
IEE	Initial Environmental Examination
IRR	Internal Rate of Return
NPV	Net Present Value
PPP	Public Private Partnership
USD	United States Dollar

EXECUTIVE SUMMARY

Entertainment is a component of several tourism settings and can be a strong incentive to visit particular places.¹ The pre dominant and most popular mode of travel is still heavily entertainment featured.² One of the vital components of a tourism destination's offering is entertainment and refreshment activities.³ It is also one of the most important variables in defining a destination's attractiveness and appeal, as well as contributing to tourist pleasure. Recently, entertainment and refreshment tourism has grown in popularity, and there are only a few refreshment centers, mostly clustered around a market along the highway, that provide a one-stop solution to traveler's needs. Highway Refreshment Centers is a project that has several attractions and amenities created at three strategic locations on the East-West Highway (Mahendra Highway) that may provide guests with a unique and one-stop travel experience.

By establishing a single platform at the next Investment Summit, the Provincial Planning Commission (PPC), Madhesh Province, hopes to attract investment in a variety of initiatives, including tourism projects. Highway Refreshment Centers are one of the primary sites designated for investment. This research on the Highway Refreshment Centers is primarily intended to document the project's technical and financial feasibility. Both primary and secondary data are used in the study. Primary data was acquired from field-based research, which included a field visit and stakeholder consultations and group discussions. Secondary data was gathered from a variety of sources, including published papers, journal articles, and other verified and trustworthy online sources.

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- 1 Sage Journals, 2015, Entertaining international Tourists: An Empirical Study of an Iconic Site in China, <https://journals.sagepub.com/doi/abs/10.1177/1096348015598202?journalCode=jhtd>
 - 2 Taylor & Francis online, 2018, Entertainment Tourism, <https://www.tandfonline.com/doi/abs/10.1080/02614367.2018.1454976?needAccess=true&journalCode=rlst20>
 - 3 Entertainment planet, 2007, The tourism and entertainment industry, <http://entplanet.blogspot.com/2007/09/tourism-entertainment-industries.html>

This project appears to be best suited for a Public Private Partnership (PPP) approach, in which GoN will assist in obtaining the necessary land for the project. The developer will then build all of the infrastructure required for the project's smooth execution and will run it for 30 years before handing it over to GoN in good working order.

The research examined the project's technical and financial elements and determined that it is technically and financially feasible, with a total anticipated cost of roughly NPR 1,248,858,112.86 (including interest component throughout the construction period) and an equity IRR of 18.69 percent.

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SALIENT FEATURES OF THE PROJECT

Table 1: Salient features of the project

General information of the project		
1	Name of Project	Highway Refreshment Centers
2	Project Location	Province: Madhesh Location: At least three strategic locations along the East West Highway. Potential locations in Rupani, Patlaiya, and Dhalkebar
3	Project Implementation Modality	☐ Public ☒ PPP ☐ Private ☐ Others / Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Physical Infrastructure
6	Type of Project (Sub Sector)	Infrastructure
7	Implementing/Facilitating Agencies	Private sector facilitated by the provincial Ministry of Physical Infrastructure Development
8	Project Management (Implementation Mechanism)	BOOT concession period of 30 years Private sector will manage the project with support from the Federal, Provincial and Local Governments and local stakeholders.

Project specific information

1	Salient Features of Project	This project will construct refreshment centers in three strategic locations along the East-West highway. The refreshment centers will include fuel stations, charging stations for electric vehicles, dining and lodging facilities, convenience stores, souvenir shops for promoting local art and culture, washroom facilities with basic amenities and motor vehicle repair facilities for travelers.
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	Local population where the centers are built, including competing businesses; unlikely to be affected a lot due to intentional choices of the locations.
	Land Requirement	2 Bighas for each refreshment center.
	Acquisition & Resettlement	No issue of resettlement.
	Materials and Ease of Access	The materials for constructing the refreshment centers are easily available. Access to the project site is not an issue since the project will be built across the national highway.
	Environmental and Social Management Plan (ESMP)	Careful consideration to be taken while establishing and operating a refreshment center. No destruction of natural resources to be ensured. Initial Environmental Examination will need to be carried out to determine ESMP.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desk Study ☐ Feasibility Study ☐ Detailed Engineering/DPR
4	Estimated Cost to Complete the Project	NRS 27 Crore per location
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months Approval and Financial Closure: 6 months Construction Period: 2 years Concession Period: 30 years
6	Project Financing Options	Majority investment of the private sector; Government to contribute to required infrastructure development. Government to be given a minority equity stake.
7	Project Technology/Components	● Fuel stations ● Charging stations for EVs ● Convenience store ● Hotels and restaurants ● Souvenir shops for local handicraft and art ● Washrooms with amenities ● Mechanical workshops ● Smart lighting

8	Contribution to SDG and Green Growth	This project will help attain the following sustainable development goals. Goal No. 8: Decent work and economic growth. Goal No. 11: Sustainable Cities and communities.
9	Project Capacity (at 100%)	100 vehicles, 5 charging stations, 50 hotel rooms, about 40 retail spaces
10	Project IRR	13.77%
11	Benefit Cost Ratio	1.30 times
12	Private Sector/Consumer Committee/ Beneficiary Roles	Planning, designing, building and financing the project.
13	Government's Roles	• The Provincial Government will coordinate with Nepal Oil Corporation to help get permission for fuel centers. • Facilitating various legal approvals/permits for the smooth operation of the project. • Coordination for land acquisition and land leasing with Local Government • The Province Government will support branding and promoting the refreshment centers.

Other project information

1	Target Beneficiaries	Highway Users
2	Market of Project's Service/Product	Highway Users
3	Key risks and opportunities of Project Development & Operation	
	Strengths and Opportunities	• The project will be situated in some of the most strategic locations along the highway; For instance, Dhalkebar's six lane road is connected all the way to Kalkota. • This project will fill a significant market gap in high quality highway refreshment in the province. • The project will also stimulate economic activity in the vicinity of the project site.
	Risks and Issues	• Solid waste management can be a potential issue with the project. However, this can be addressed with sustainable solid waste management projects in the province.

1

BACKGROUND

1.1 Introduction

Traveling is an unavoidable activity that encompasses a wide range of activities from refreshment to leisure. Travelers have a hurdle in continuing their journey without the expected services being provided to them along the road. The creation of a well-organized site for rest and refreshments is required to provide such services to aid travelers. Highway rest stops would provide a wealth of options for passengers, boost tourism, and assist towns in the surrounding region. Car parking, food courts, rest rooms, ATM counters, filling stations (petrol/gas), electric vehicle charging stations, and the selling of local delicacies might all be included in each center. It would also benefit the neighboring areas economically in terms of job development and the ability to market local items such as handicrafts, paintings, food items and so on.

Any country's economic, industrial, social, and cultural growth is aided by transportation. The development of rural transportation facilities aids the development of rural regions. In the transportation system, haphazard parking on the sides of roadways detracts from the city's beauty and causes public congestion. The most appropriate method of transportation management system for Madhesh Province is the development of highway refreshment centers on the East-West highway. The building of highway refreshment centers is the

only approach to provide the best service for vehicle management to everyone. With careful administration, the attractiveness of the city may be enhanced.

Deficiencies in the building of highway refreshment centers play a significant role in the province's growth setbacks. To manage the various vehicles, highway refreshment centers along Pathlaiya-Rupani on the East-West highway are required. These highway refreshment centers are the only means to handle traffic vehicles, and they don't have any other choice than to build these facilities. The planned highway refreshment centers will benefit the entire province as well as tourists.

On the one hand, the development of these highway refreshment centers is capital intensive, and on the other, it is fraught with technical obstacles. As a result, the bus park's construction needs meticulous planning and prioritizing, on the basis on which the decision-making process may be practical. A number of investigations must be conducted for this objective.

Nepal has huge natural and scenic splendor, as well as all-important attractions found in just a few nations throughout the globe. Natural, aesthetic, and recreational features, as well as historical, cultural, and religious qualities, are among them. These characteristics bode

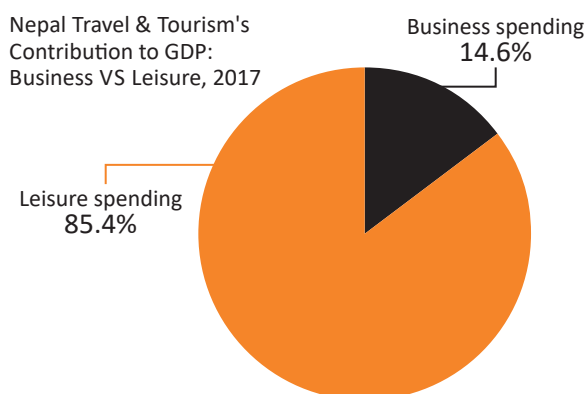
well for Nepal's tourism sector, and tourism projects should be seen as supporting infrastructure for attracting local and international visitors.

Entertainment is a component of several tourism settings and can be a strong incentive to visit particular places.⁴ The appeal of entertainment tourism has recently increased. The tourism industry relies heavily on the entertainment industry. Leisure tourists' recreational activities are an important part of the tourism experience. The pre dominant and most popular mode of travel is still heavily entertainment featured.⁵ Taylor and Francis's research 'Entertainment Tourism' is crucial since it enables tourism marketers to gain new insights and a better knowledge of travelers' experiences and satisfaction. One of the vital components of a tourism destination's offering is entertainment activities and offerings.⁶ It's also one of the most important variables in defining a destination's attractiveness and appeal, as well as contributing to tourist pleasure. Entertainment will become a more essential source of attracting tourists in the short term, as well as maintaining them for a longer length of time.

In 2017, leisure travel expenditure (including inbound and domestic) accounted for 85.4% of direct travel & tourism GDP (NPR 144.1 billion), compared to 14.6% for business travel spending (NPR 24.6bn).⁷ Leisure travel spending is predicted to increase by 4.2% pa to NPR 226.5 billion in 2028.

In the year 2019, approximately 1.2 million visitors visited Nepal. In the years 2016, 2017, 2018 and 2019, the number of visitor arrivals increased consistently, with significant growth rates of over 40%, 25%, 25% and 2.05%,⁹ respectively. Many Indian visitors who come to Nepal by land are not included in the number of entering tourists. In addition, domestic tourism is quickly

Fig 1: Leisure vs Business tourism spending



Source: World Travel & Tourism Council⁸

expanding. Domestic tourists, in particular, from major towns like Kathmandu, Biratnagar, Bhairahawa, and Pokhara, among others, are always looking for new and exciting travel and vacation experiences.

Nepal is well suited to being promoted as a top leisure tourist destination due to its pleasant climate and warm hospitality. It offers a tranquil and secure environment, as well as stunning and magnificent natural beauty and a unique combination of cultures. Given its accessibility and location as a transportation hub, Madhesh Province has the potential to grow into a regional center for leisure tourism for both local and foreign visitors visiting Nepal's eastern and south-eastern borders.

1.2 Entertainment Tourism in Nepal

Because of its snow-capped mountains, vast flora and wildlife, interesting trekking routes, and rich cultural and religious variety, Nepal has a lot of potential to become a top tourist destination. The tourism and entertainment industry has emerged as one of Nepal's most important drivers of growth in the services sector. Given the country's rich cultural and historical history, diversity in

- 4 Sage Journals, 2015, Entertaining international Tourists: An Empirical Study of an Iconic Site in China, <https://journals.sagepub.com/doi/abs/10.1177/1096348015598202?journalCode=jhtd>
- 5 Taylor & Francis online, 2018, Entertainment Tourism, <https://www.tandfonline.com/doi/abs/10.1080/02614367.2018.1454976?needAccess=true&journalCode=rlst20>
- 6 Entertainment planet, 2007, The tourism and entertainment industry, <http://entplanet.blogspot.com/2007/09/tourism-entertainment-industries.html>
- 7 World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from, <https://nepalindata.com/media/resources/items/12/bNepal2018.pdf>
- 8 World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from, <https://nepalindata.com/media/resources/items/12/bNepal2018.pdf>
- 9 Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_statics_2019.pdf

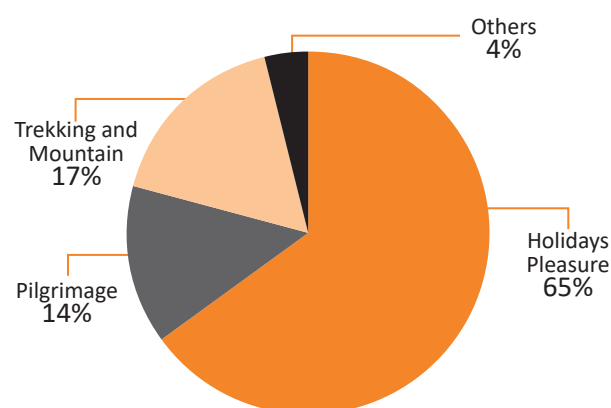
ecosystem, terrains, and natural beauty spots, tourism in Nepal has a lot of promise. Popular tourist activities in Nepal include pilgrimages/religious tours, climbing and adventure treks, luxury vacations, cultural visits, business and leisure activities.

In recent years, the number of tourists who visit Nepal has steadily increased. Since 2010, the number of tourists has climbed at a pace of 10.85% every year.¹⁰ The average duration of stay per guest in 2019 has remained stable at around 12.7 days. In the years 2016, 2017, and 2018, the number of visitor arrivals increased consistently, with significant growth rates of over 40%, 25%, and 25%¹¹, respectively. However, owing to the coronavirus epidemic, the growth rate in 2019 was 2.05%.

In the year 2020, the tourism sector in Nepal was severely impacted by the epidemic. This wasn't the industry's first issue at that level; in 2015, the sector was severely impacted by a devastating earthquake and trade difficulties along the southern border. Because of the severity of the coronavirus and its health consequences, the Nepalese government had to abandon "Visit Nepal 2020," an ambitious campaign aimed at attracting two million tourists to the nation. Many Indian visitors who come to Nepal by land are not included in the number of entering tourists. Although most visitors arrive by flight, a significant number also arrive by land. Kodari, on the Chinese border, and Bhairahawa, on the Indian border, are the two main entrance sites. Holidays/pleasure, pilgrimage, hiking and climbing, and other activities have been recognized as the main reasons for visitors visiting Nepal. The bulk of tourists come to Nepal for vacation purposes, as seen in the graph below:

Five nations account for over 53% of total tourist arrivals. India (21.2%), China (14.2%), the United States (7.8%), the United Kingdom (5.1%), and Sri Lanka (4.7%) are the nations with the highest proportion of visitors. Tourist arrivals follow a similar seasonal pattern as the previous year. The month of October had the most visitors, followed by November. In the year 2019, the age group 31-45 (32%) had the largest percentage of arrivals.

Fig 2: Purpose of visit 2019



Source: Nepal Tourism Statistics 2017¹²

In the year 2019, the age group 31-45 (32%) had the largest percentage of arrivals. International passengers traveled by air 83% of the time and by land 17% of the time.

Tourism has been one of the most severely impacted sectors because of the pandemic. While even amid the strictest prohibitory orders other sectors especially those dealing in essential supplies/services were allowed to operate partially or at a reduced capacity, enterprises within the tourism sector faced debilitating consequences as all international arrivals and flights were suspended. The Organization for Economic Co-operation and Development (OECD) predicts that international tourism has declined by 60 percent in 2020. The tourism sector in Nepal faced a loss of NRs. 34 billion by July 2020 as per the Ministry of Culture Tourism and Civil Aviation (MoCTCA) states that the loss by the end of August 2020 increased to NRs. 48 billion. Based on average tourism revenue of 2019, an NTB study estimates monthly tourism loss of Rs 10 billion in the wake of the pandemic.

However, the tourism sector in Nepal is bouncing back with almost 25% of Nepal's population vaccinated and over two-thirds of Nepal's population developing antibodies against the Covid-19 virus. NRB in its latest monetary policy 2021/22 has classified the tourism industry as highly affected sectors, hence, has provided

10 Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_stats_2019.pdf

11 Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_stats_2019.pdf

12 Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_stats_2019.pdf

relief packages and special provisions for the sector such as availability of working capital loans, concessional loans, reduction in interest rates, extension of loan repayment period and extension of tax payment period. NRB has also instructed commercial banks to extend at least 15% of total loans to MSMEs and at least 7% of total loans to highly affected sectors like tourism. The government since the Covid-19 pandemic has put extra emphasis on growing and promoting internal tourism, especially targeting civil servants. The government has also announced free visa for foreign visitors and no quarantine required for fully vaccinated visitors. The Nepal government has also been active in marketing and promoting positive news of Covid-19 reduction and that Nepal is safe to travel. This Sep-Oct tourist season saw a major bounce back in internal tourism as trekking routes, hotels and resorts in major tourist destinations of Nepal were operating at almost 100% capacity which has not happened since the Covid-19 pandemic started.

1.3 Domestic Tourism in Nepal

In 2018, tourism related activities contributed 7.9% to Nepal's GDP and accumulated a share of 25% in Nepal's total exports. According to the World Travel and Tourism Council's study on Travel and Tourism Economic Impact 2018 Nepal, domestic travel accounted for 57.0% of total expenditure produced through direct travel and tourism GDP in 2017, while foreign tourism accounted for 43.0%.¹³ This goes to show that the domestic tourist base is a reliable consumer segment of tourism related products and services and provides significant stability to the entire sector. Domestic travel spending is predicted to increase by 4.3% to NPR 100.4 billion in 2018, and by 3.4% each year to NPR 140.7 billion in 2028.

1.4 Highway Refreshment Centers Industry

Nepal is undergoing one of the most rapid economic transformations in South Asia. This economic progress is anticipated to result in more travel by Nepalese and foreigners, whether for business, enjoyment, or tourism. The majority of these motives for travel involve money and are thus potential income generators. Nepal has enhanced the quality of its road network in the past and continues to do so now. Roads have undoubtedly reached far into the countryside. Some of these routes go to tourist attractions and historical places. Despite

this progress, rest areas and other roadside amenities continue to fall short of providing passengers with reliable services and facilities.

In the United States, Canada, Australia, and portions of Europe, Africa, and Asia, highway rest stops are prevalent. Highways with significant quantities of traffic require rest stops for passengers as well as a job center for the surrounding community. This project considers the development of highway refreshment centers to be a one-stop shop for travelers, including facilities such as gas, vehicle service, EV charging stations, pharmacies, restaurants, bathrooms, parking, and, most often, a hotel or motel.

The present rest stops along the East-West Highway in Madhesh Province primarily provide food. There is no one-stop refreshment facility where tourists may refuel, service their vehicles, rest, eat, and acquire medicine, among other things. The majority of tourists go along routes with significant tourism potential. As a result, this initiative saw such installations as a natural progression toward tourism, business, biodiversity protection, and community development, among other things. Nepal is believed to rely heavily on tourism as a source of income. They also said that this industry has a significant impact on a country's GDP.

The majority of travel to the countryside in Nepal is via road. Road transit dominates inland travel in Nepal. It has the advantage of allowing you to observe the surroundings up close. Travelers, on the other hand, find it difficult to keep going without stopping. That is why this project was conceived.

Nepal's development of a robust road network is a step in the right direction. However, the lack of one-stop refreshment stations on roads to cater to passengers will always be a source of regret. Traveling necessitates the establishment of a well-organized refreshment station where passengers may refresh themselves.

1.5 Rationale of the Project

- We investigated the idea of constructing a one-stop refreshment center with international standards using landscape design and branding, based on the

13 World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from, <https://nepalindata.c4om/media/resources/items/12/bNepal2018.pdf>

unavailability of such a facility. A branded one-stop refreshment center was seen as a way to ensure that tourists had a positive experience. This project saw branding as involving signs that could make the entire region convey commerce; this, all combined, would be an innovation that would eventually brand Madhesh's tourism industry.

- Highway Refreshment Centers will provide extra job possibilities for local residents as well as those looking to start a new business from other areas of the country. Locals will be able to make stronger contacts with individuals from different places, as well as develop their businesses. Local residents will have easier access to vehicles in their own community. Highway Refreshment Centers will make the region more lively than it is presently.
- Where they are not available, provide well-managed Highway Refreshment Centers for various tourists buses and minibuses that travel along the East-West Highway.
- Solve the traffic congestion problem at the area's current bus parks.
- Local residents will have the option to work both during construction and throughout operation.
- Contribute significantly to the municipality's socioeconomic growth.
- New market regions are being established/developed.
- Creating convenient access points to other sites.
- Establishment/Development of new market areas.
- Establishment of easy access points to other locations.

1.6 Objectives

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives, including tourism projects. As a result, PPC has put together a prospective Highway Refreshment Centers, which includes touristic facilities and attractions. Finally, it aspires to present the proposal at the Investment Summit (2022) in order to attract investors. As a result, the following are some of the report's main goals:

1. To determine the demand for, as well as the feasibility of Highway Refreshment Centers.
2. To investigate the project's technical and financial feasibility at the chosen site.

1.7 Scope of Work

The purpose of the pre-feasibility study is to represent the current situation of Highway Refreshment Centers at the proposed site, as well as to record the project's technical and financial feasibility. Similarly, the study will aid in gaining a general understanding of investment opportunities in this particular sector and location. The following are some of the study's primary scopes:

1. To gather secondary data and other necessary information for the project's development.
2. Analyze the acquired data from the perspectives of elements such as technical, economical, social, and environmental concerns.
3. Develop the most appropriate investment model, such as private, Public Private Partnership, or blended finance.
4. Also, depending on the findings, provide recommendations.

1.8 Approach & Methodology

A professional team from Invest and Infra Pvt. Ltd. produced this pre-feasibility study. After a thorough examination of market demand and business development prospects, the project's components were determined. For the purposes of determining project features/components, input collected during consultations with Province Level Ministries and associated stakeholders was also taken into account. Secondary and primary sources were used to obtain the necessary data, information, and facts to meet the study's goals.

Primary data was acquired by telephone and e-mail conversations, as well as a field-based research, which included a field visit. Producers, marketers, entrepreneurs, and government officials from the province. Provincial Ministries, Rural/Municipalities and others participated in stakeholder consultations and group discussions.

Secondary data was gathered from numerous publications issued by Nepalese government agencies, other similar nature projects in Nepal, and academic research papers published by various organizations and experts. An appropriate investment plan was recommended based on the conclusions of a technological, social, and environmental investigation. In addition, a thorough financial study was carried out to discover some of the key financial metrics that assure the project's financial feasibility.

2

PROJECT DETAILS

2.1 Project Background and Description

Madhesh Province lacks a world standard Highway Refreshment Centers along the East-West Highway, traffic volume is fast increasing, and therefore urban space in the key market region is shrinking, necessitating the building of Highway Refreshment Centers. Highway Refreshment Centers are necessary to alleviate traffic congestion caused by indiscriminate parking along the highway's edge. The key road network; the east-west highway, runs horizontally across Madhesh Province. The East-West Highway connects the eastern and western portions of the nation. The planned Highway Refreshment Centers will be utilized by inter-municipality buses as well as long-distance buses traveling along the East-West Highway. The project includes the construction of Highway Refreshment Centers along the Mahendra Highway, also known as the East-West Highway, which extends across Nepal's Terai area from the Mechi zone in the east to Mahakali zone in the west, cutting over the country's whole breadth. The roadway stretches for 1027.67 kilometers. Mechinagar, Bhadrapur, Itahari, Janakpur, Bharatpur, Butwal, Siddharthanagar, Nepalganj, and Bhim Dutta are the key locations along and surrounding the route. Birtamod, Damak, Inaruwa, Lahan, Narayangadh, Bardibas, and Chisapani are among the towns along the Mahendra Highway. The establishment of three Highway Refreshment Centers on the East-West Highway,

at Pathlaiya, Dhalkebar, and Rupani, spanning a total distance of 195.3 kilometers, is critical. This highway serves as a thoroughfare for various tourist attractions in Nepal's eastern and western regions, where refreshment establishments play an important role. The Mahendra Highway, which runs longitudinally through the Province, connects Janakpurdham (27.7 kms), Rajbiraj (15.4 kms), Birgunj (23.4 kms), and Gaur (44.6 kilometers) to the south.

The major junctions of Mahendra Highway are:

1. Charali- Junction with Mechi Highway with Chandragadhi-Bhadrapur to the south & Ilam-Panchthar-Taplejung to the north.
2. Itahari- Junction with Koshi Highway with Jogbani- Biratnagar to the south and Dharan & Dhankuta to the north.
3. Bardibas- The starting point of BP Highway (also known as Banepa-Bardibas Highway), an alternative roadway to Kathmandu.
4. Hetauda- Major junction with Tribhuvan Highway with Birganj in the south & Kathmandu and Prithvi Highway to the north.
5. Bharatpur- Link to Mugling on the Prithvi Highway.
6. Butwal- Junction of Siddhartha Highway with Sunauli and Lumbini to the south & Tansen and

Pokhara to the north.

7. Lamahi- The starting point of Lamahi-Ghorahi-Tulsipur road.
8. Various minor district road junctions at all districts pass through.

There are several Nepal-India Border from west to east, that are located near from Mahendra Highway,

- (a) Banbasa (Uttarakhand, India)- Connected through Kanchanpur District, Sudurpaschim Province, Nepal, 9.1 kms south of Jhalaripipaladi in East-West Highway.
- (b) Rupaidiha (Uttar Pradesh, India)- Connected through Nepalganj in Banke District, Nepal, 18.3 kms south of Kohalpur in East-West Highway.
- (c) Sonauli (Uttar Pradesh, India)- connected through Siddharthanagar in Rupandehi District, Nepal, 22.1 kms south of Bhairahawa Road in East-West Highway.
- (d) Raxaul (Bihar, India)- Connected through Birgunj, Nepal (also known as "Gateway of Nepal"), 23.3 kms south of Pathlaiya in East-West Highway.
- (e) Bhitamora (Bihar, India)- Connected through Malibara, Jaleswar in Mahottari District, Nepal, 16.7 kms south of Bardibas in East-West Highway.
- (f) Jogbani (Bihar, India)- Connected through Biratnagar, Nepal, 28.6 kms south of Inaruwa in East-West Highway.
- (g) Panitanki (West Bengal, India)- connected through Kakarbhitta, Nepal on the East-West Highway.

Source: Distances are noted from Google Maps

According to an article published on September 24 by Himal Sanchar (a news site), every year the news of travelers being ill and paying large expenses as a result of consuming food on the highway is repeated. According to Yuvraj Shrestha, a member of the Hotel Association of Nepal (HAN), the distortion visible in hotels along the highway is better than it was previously, but it still exists. He says, "recently, chain restaurants have been extending their outlets on the highway owing to the huge volume of traffic on the highway," so those driving by private restaurants may eat at their preferred restaurant, while travelers traveling by public transportation continue to suffer the same fate."

Since the Covid-19 Pandemic, eating in a public area is increasingly riskier. Poor quality exists not just in the food industry, but also in the areas of health and sanitation. Clean toilets, wash basins, and drinking water are all crucial for a person's health and should never be taken for granted. It can also have a negative impact on a country's reputation as a tourist destination among foreign vacationers. As a result, the installation of decent refreshment facilities at multiple points along highways may be quite beneficial to travelers (both domestic & international).

2.2 Project Features

- Fuel stations
- Charging stations for EVs
- Convenience store
- Hotels and restaurants
- Souvenir shops for local handicraft and art
- Washrooms with amenities
- Mechanical workshops
- Smart lighting

2.3 Overview of the Area

The project includes Pathlaiya, which is located in Jeetpur Simara Sub-Metropolitan city and is part of the Bara district in Madhesh Province. Kalaiya is the district's headquarters. The district's total area is 1,190 square kilometers, split into two Sub-Metropolitan cities, five Urban Municipalities, and nine Rural Municipalities, which are further divided into 99 VDCs. It is located near the crossroads of the East-West Mahendra Highway and the North-South Tribhuvan Highway, making it a growing town. Bara district is known for the Gadhimai Temple, which hosts the Gadhimai Mela every five years and is only 12 minutes (7.4 kilometers) away from Pathlaiya through the North-South Tribhuvan Highway.

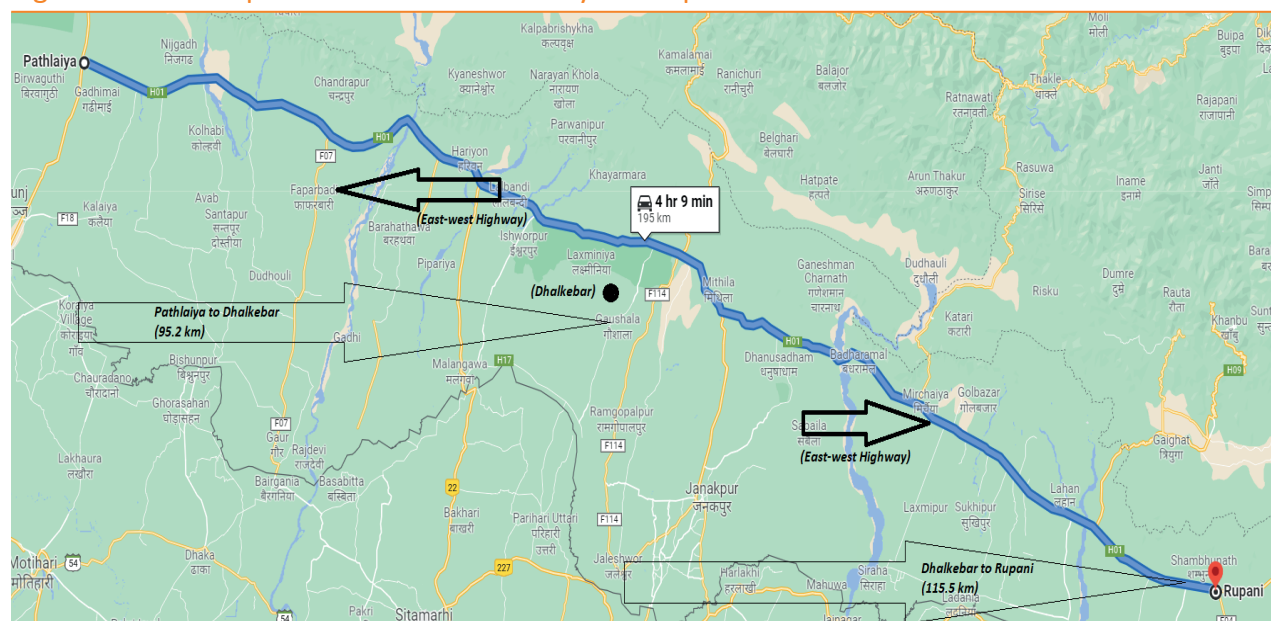
Rupani is a tiny rural municipality in Saptari District. Rajbiraj is the district headquarters. The district spans 1,363 square kilometers and is split into 18 municipalities, nine of which are urban and nine of which are rural. It is located in the middle of the East-West Mahendra Highway and Rajbiraj road, making it a growing town. The Shambhunath temple, located in Saptari district, is about 8 minutes (3.3 kilometers) away from Rupani through the East-West Mahendra Highway.

Dhalkebar is a town in Mithila Municipality, Dhanusa district. Janakpur is the district headquarters. It is further divided into 1 Sub-Metropolitan city, 11 Urban

Municipalities, and 6 Rural Municipalities. Dhalkebar is located on the East-West Highway. Pokhariya Lake & Uttreshwar Mahadev temple are well-known in Dhalkebar, and are located 30.6 kilometers north of Dhalkebar via the East-West Highway (about 57 minutes by vehicle).

longitudinally across the Province is its main connecting connection with Janakpurdham (27.7 kms), Rajbiraj (15.4 kms), Birgunj (23.4 kms) & Gaur (44.6 kms) south of Mahendra Highway. Although the Tribhuvan Highway does not cover as much ground as the Mahendra Highway, it is the most essential route since it links the province to Kathmandu and India. Birgunj, the starting point of the

Fig 3: Location map of distance from Pathlaiya to Rupani & Dhalkebar at center



Source: Google Map

Madhesh Province is located in Nepal's southeastern area. It is the smallest province in terms of land area, but the second biggest in terms of people. It is bordered on the east by Province No. 1, on the north by Bagmati Province, and on the south by India. It covers 9,661 square kilometers, or around 6.5 percent of the country's total area. As of 2019, the province has a total population of 6,158,649 people, making it Nepal's most densely populated province.¹⁴ From Saptari District in the east to Parsa District in the west, the province is divided into eight districts.

Despite the fact that Madhesh has no severe terrains, the region's transportation infrastructure is lacking owing to a lack of investment and negligence. In Nepal, however, Madhesh is the only province possessing a passenger train line. The Mahendra Highway, which runs

Tribhuvan Highway, is the province's and country's most significant international gateway and trade route, and is hence known as "The Gateway of Nepal." Birgunj custom point is the largest in terms of revenue generation.

In Madhesh, a few railway projects are in the works. Nepal Railways is responsible for all of these projects. The Nepalese government has suggested Janakpur as the main station for a 1024-kilometer East-West Metro Railway project that would eventually be extended to India and China, allowing Nepalese railways to link with Indian and Chinese railways for economic and tourism purposes. The province is served by three domestic airports, the busiest in the country. Rajbiraj Airport, Janakpur Airport, and Simara Airport are all located in Rajbiraj. Meanwhile, at Nijgadh, an international airport, Nijgadh International Airport, is being built.

14 <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh Province>

Table 2: Total population (District wise)¹⁵

District	Headquarters	Population (2019)
Sarlahi	Malangawa	881,413
Dhanusa	Janakpur	832,772
Bara	Kalaiya	814,084
Rautahat	Gaur	826,635
Saptari	Rajbiraj	703,219
Siraha	Siraha	696,657
Mahottari	Jaleshwar	700,871
Parsa	Birgunj	702,998

2.4 Developing a Business Case

Product Mix

The product mix for this project consists of the following components:

Component 1, Fuel Stations

Three fuel stations to be built on the Highway of Rupani, Patlaiya and Dhalkebar (one each) following the guidelines of Nepal Oil Corporation. There should be a sufficient area to avoid pedestrian traffic. Additionally, sufficient space is required to store large amounts of hazardous substances, especially flammable substances like petrol and diesel.

Component 2, Charging Station for EVs

Refreshment center includes charging stations for electric vehicles. Vehicles running through the highway can charge their vehicles effortlessly. Careful consideration should be taken to ensure safety against common accidents in electric vehicles like fire accidents.

Component 3, Convenience Store

Convenience store is generally for taking a break while traveling from one point to another. It's a small beacon of respite to refuel one's vehicle and body with refreshments. Highway users can benefit from the convenience store to purchase necessities products while traveling.

Component 4, Souvenir Shops for Local Handicraft and Art

With the increasing craving for the gifts, souvenirs and antics, it can be a good startup business in Madhesh Province. Souvenir shops will offer you the opportunity to sell a wide range of products including local handicraft and art. To sell the local handicraft, we have to consider the flow of tourists in that highway and there should be a good agreement with suppliers for supplying the local product.

Component 5, Washroom with Amenities

It would be convenient for highway users if washrooms of standard quality and amenities were built along the road. Consideration should be given to daily maintenance and cleanliness.

Component 6, Mechanical Workshop

A mechanical workshop should contain the expertise of well-maintained equipment to handle difficulties arising from breakdown of any vehicle.

Component 7, Smart Lighting

Smart lighting at night helps to increase visibility and reduce risk of accident and injuries. Smart lighting solutions using networked technology represent an interesting opportunity for cities or communities that want to get smarter with the benefit of reduction of energy and maintenance cost.

2.5 Market Assessment

In its annual "Best in Travel List," Lonely Planet, a popular travel guide, named Nepal as the best value destination for 2017. In recent years, the number of tourists who visit Nepal has steadily increased. Since 2010, the number of tourists has climbed at a steady pace of 10.85% every year.¹⁶ The average duration of stay per guest in 2019 has remained stable at around 12.7 days. In the year 2019, approximately 1.2 million visitors visited Nepal. In the years 2016, 2017, and 2018, the number of visitor arrivals increased consistently, with significant growth rates of over 40%, 25%, and 25%¹⁷, respectively. Many Indian

¹⁵ <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh Province>

¹⁶ Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_statics_2019.pdf

¹⁷ Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_statics_2019.pdf

visitors who come to Nepal by land are not included in the number of entering tourists.

65% of the visitors registered come to Nepal for vacation or enjoyment. In addition, domestic tourism is quickly expanding. Internal visitors from major towns like Kathmandu, Biratnagar, Bhairahawa, Pokhara, and others, in particular, are continuously seeking new and exciting travel and vacation experiences, thanks in part to rising disposable income. In addition, parents want their children to have fresh learning experiences. The same surge in demand may be noticed in Indian cities along Nepal's eastern and southern borders.

Travel bugs seem to have struck Nepalese in the recent past. A large number of Nepalese are going with their friends and family to various regions of the nation as well as other countries. Apart from Pokhara, domestic visitors go to places like Sauraha (which is outside the CNP but popular with locals), Lumbini, Muktinath, Rara, Mankamana, Bandipur, Pathivara, Swargadwari, Ilam, and others. Domestic tourism has been encouraged by adventure tourist destinations (such as bungee jumping, rafting, trekking, hiking, jungle safaris, and so on), natural beauty sightseeing, and historic/religious monuments.

Domestic travelers are rising in comparison to foreign tourists, according to tourism data. Domestic travelers have proven their worth in recent years, particularly in the aftermath of disastrous earthquakes and pandemics. The most important element that has boosted domestic tourism is social media. Because of Nepal's large user base, social media has proven to be a very efficient medium for promoting destinations and properties. When a post goes viral on social media, it immediately becomes a trending topic, and everyone wants to get there. This has made it critical for us to be social media knowledgeable in order to break into the local market.

Summary of Traffic Count¹⁸

Table 3: Average Annual Daily Traffic (AADT) of Pathlaiya East (2020/21)

BUS		
Big	Mini	Micro
394	296	35

Table 4: Average Annual Daily Traffic (AADT) of Dhalkebar East (2020/21)

BUS		
Big	Mini	Micro
435	90	653

Table 5: Average Annual Daily Traffic (AADT) of Rupani South (2020/21)

BUS		
Big	Mini	Micro
36	56	422

The highway refreshment centers have the potential to attract both locals and visitors from India. Domestic visitors will not only primarily come from nearby districts, but also from all over Nepal as Madhesh Province has the potential to be a major tourist attraction of Nepal. According to the Nepalese economic report for 2019, India accounted for 21.2 % of all tourist arrivals in Nepal.¹⁹ In 2019, Lumbini was visited by 1,779,086 travelers out of whom 78.76% were Nepalese while 11.51% Indians and 9.73 % from other countries. According to the data provided by the Ministry of Culture, Tourism, and Civil Aviation, there were 204,825 Indian visitors to Lumbini in 2019.²⁰ Our estimates suggest that roughly 150,000 visitors are likely to pass through the Highway Refreshment Centers using the aforementioned statistics as a proxy measure, with a 50% ceiling for drawing Indian travelers from adjacent Bihar. The fundamental assumption supporting the expected visitor arrival at the Highway

18 Ministry of Physical Infrastructure and Transport. 2021. Highway Management Information System (HMIS) Unit. Retrieved from http://ssrn.aviyaan.com/traffic_controller

19 Ministry of Finance. (2019). Economic Survey. Retrieved from, https://www.mof.gov.np/uploads/document/file/Economic%20Survey%202019_20201125024153.pdf

20 Ministry of Culture, Tourism and Civil Aviation. Nepal Tourism Statistics. (2019). Retrieved from, https://www.tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_statics_2019.pdf

Refreshment Centers is based on Janakpurdham's cultural, historical, and religious significance for Hindus living across the Indo-gangetic plain. In addition, there is a railway link between Dhanusha and Jainagar districts in Bihar, India, which provides for convenient cross-border travel. Many Indian pilgrims who visited the Janaki shrine are expected to pass through the Highway Refreshment Centers as well.

There are only a few Highway Refreshment Centers that can provide a one-stop solution for such a wide array of service experience for travelers. Almost majority of these are in Kathmandu or the surrounding areas. They are unable to meet the needs of the rapidly rising populations in eastern and southern cities. Furthermore, the absence of such amenities in the province has resulted in the province missing out on the opportunity to attract Indian visitors from nearby cities and towns.

2.6 SWOT Analysis

SWOT analysis allows for the discovery of elements that characterize a company or organization in the context of a certain goal, as well as the classification of those characteristics into four areas. As seen in the

table, two of them are positive, while the other two are negative.

2.7 Examination and Evaluation of Alternatives

Highway Refreshment Centers are an area that has been transformed into a tourist stop destination with additional amenities and activities. There are relatively few sites that can offer guests such enticing facilities and a one-stop solution for such a wide array of service experiences for travelers.

2.8 Relevant Case Studies

Case Study 1²¹

Project Type: Highway Refreshment Centers

Location: Fatehpur to Varanasi, National Highway, India

The four-lane national roads will soon be adorned with a slew of rest stops. The National Highway Authority of India (NHAI) has chosen to build refreshment facilities and hotels on the four-lane national highway between Fatehpur and Varanasi, which passes through Allahabad, as part of its current expansion plan.

SWOT Analysis for Highway Refreshment Centers

Strength	Weakness	Opportunities	Threats
- Will provide enormous socio economic advantages to the people in the surrounding area. - The project will be located in some of the highway's most vital sites; for example, Dhalkebar's six-lane route is connected to Kolkata. - Located on the East-west Highway. - A strong community support for the initiative. - Impact on the natural environment is minimal. - The site is the product of public land. - Flat topography of the Site. - Sufficient area for future expansion.	- Delay in legal proceedings for acquisition of land. - Unstable government. - No budget has been set aside. - The success of refreshment centers is unpredictable.	- This project will fill a significant market gap in high quality highway refreshment in the province. - The project will also stimulate economic activity in the vicinity of the project site. - Increment of opportunities of cost of land around the development area.	- A possible difficulty with the project is solid waste management. This, however, may be addressed in the province through long-term solid waste management programs. - May increase pollution. - Local community is near the project area. - If unchecked, the future urban development may be haphazard.

21 <https://www.hindustantimes.com/india/refreshment-centres-on-national-highways-soon/story-0h9aFX3Z1uedoIOLAJEpTP.html>

Refreshment facilities will be put up along the roadway, with 450 square meters and two hectares of land given for the purpose.

The NHAI has already set the requirements for establishing such facilities on all of the country's four-lane highway networks. The refreshment centers will be constructed by private groups. Every 50 kilometers, these facilities will be established.

The National Highways Authority of India has already authorized two locations between Fatehpur and Varanasi, one at Kaushambi near Muratganj along the Sasur Khaderi river and the other in Handia. The Authority owned both parcels of land. Previously, the land belonged to PWD, but it was later transferred to NHAI.

Meanwhile, the Uttar Pradesh Roadways Transport Corporation (UPSRTC) and Reliance have teamed up to provide hotels on the state's key roadways in order to give the best possible service to customers. This amenity will be available for the first time in Saini in Kaushambi, where a hotel will be available by September at the latest. The UPSRTC buses from Allahabad to Kanpur will stop at the Saini motel. Motels will be connected to the internet as well.

UPSRTC regional manager PR Belwariya stated that the corporation will keep passenger fares low while providing this information. However, no similar scheme exists on the Allahabad-Lucknow road, as buses on this route stop at the Tourism Department's restaurant near Rae Bareilly. Private land would be considered in places where the

NHAI does not control the land, according to AK Singh, project director of the NHAI.

The general facade of roadside dhabas has altered dramatically as the highway is built, particularly those situated on the Allahabad-Varanasi road, which are gradually becoming more consumer friendly.

Such a facility would aid in the provision of sanitary meals to travelers, as well as offering a space for them to rest. Passengers will have access to both air conditioned and non air conditioned amenities.

Another meeting will be convened shortly, and additional similar proposals will almost certainly be implemented.

Case Study 2

Project Name and Location: Aire De La Chaconne, Highway Rest Area Burgundy, France

This rest stop is on the A6 auto highway, which connects Paris and Lyon. By incorporating the program into the volume of a hill, designer Ora Ito aimed to create a "non architecture." A large green roof unifies the building and the environment.

1) Site Planning

This center, according to the planned arrangement, uses a combination of outward and inward orientation.

2) Facilities and Amenities

Restaurant, public restrooms, fuel station, parking, and a handy shop are among the facilities and services



available at this rest stop. In addition, this center has lovely vegetation and a seating space outdoors.

3) Strength and Weakness

The landscape is an inhabited shelter with a sleek curving program of eateries and sitting, as well as a prairie-like exterior that helps break up the monotony of automotive

traffic by providing a picnic and play area. The space's circular layout allows for maximum visibility and functionality, as well as a totem-like sprinkling of signs differentiated by form and color. When the bulk of the structure is lighted from the ground and trees at night, the fluidity of the shape stays pleasant, harmonic, and reassuring.

3

FINANCIAL ANALYSIS

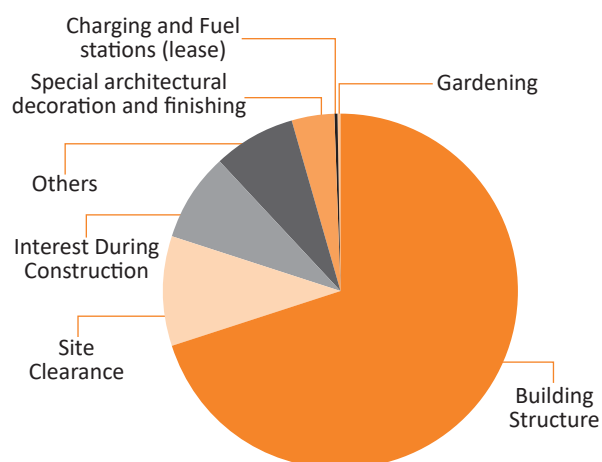
3.1 Pre-Feasibility Approaches & Assumptions

Project Cost

Total cost of the project amounted to NPR 1,124,135,301 excluding interest during construction. The total cost including interest amounted to NPR 1,248,858,112.86.

Particulars	Amount in NPR
Land	-
Building	875,000,000.00
Charging and fuel station(Lease)	50,000,000.00
Gardening	2,500,000.00
Site Clearance	1,537,439.00
Special Architectural decoration and finishing	92,903,744.00
Others	102,194,118.00
Interest During Construction	124,722,811.67
Total Project Cost	1,248,858,112.86

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.



Capital Structure

The project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of working capital would be financed by internal resources itself. Based on the structure, the total investment pattern has been tabulated below:

Component	Percentage	Amount in NPR
Equity	30.00%	374,657,433.86
Debt	70.00%	874,200,679.00
Total		1,248,858,112.86

Project Construction and Operation Period

The project is assumed to be built in the period of 3 Years. And the total operation period after the construction period would be 30 Years. The project would be handed over to the government after the completion of the operation period.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project is assumed at 25% on profit earned during the year. Further the loss carry forward has been taken for 12 years in due consonance with the provisions of Income Tax Act 2058. Further, the Staff bonus is assumed at 10% on taxable income earned during any year of the operation as required by the Bonus Act.

Also, the rate depreciation and basis of depreciation is in due adherence to the provisions of the Income Tax Act as follows:

Particulars	Depreciation Method	Rate of Depreciation
Building and Civil Structure	WDV	5%
Vehicle	WDV	20%
Others	SLM	20%

However, 1/3 of the additional depreciation has not been taken into consideration as facilitated by the Income Tax Act.

Direct Income and Direct Expense

The income has been classified majorly in three categories:

1. Rent From Building
2. Charging Station and Fuel Station(Lease)
3. From Vehicles

The total units, rates and associated direct cost percentage in 100% capacity has been detailed below:

Particulars	Rate	Quantity	Revenue/Year	Remarks
Rent from Building	Rs. 150/sq.ft/month	250,000	1,18,26,08,748.00	
Charging and Fuel Stations (lease)	Rs 100/sq.ft/month	20,000	1,20,00,000.00	
From Vehicles			3,24,00,000.00	360 days operation time
Total Revenue Generation			1,23,17,99,388.00	

The Operational Efficiency

The operational efficiency of each component in various years has been estimated as below:

From	To	Efficiency
0 year	3 years	0%
4 years	8 years	60%
9 years	20 years	70%
21 years	30 years	95%

Admin & Overhead Expenses

Total of the office overhead cost per annum and employee (USD 435,860.00) shall be apportioned throughout the project period on 100% operation capacity.

The details of overhead are as below.

Other Assumptions

Besides salary cost and overhead cost, the total operating expense is likely to incur at the rate of 2% of total project cost which is likely to increase at the inflation of 5% with the cap of 200%. As discussed in the earlier paragraph, the project would be financed by 70% debt. The interest rate that has been taken into calculation is 10% which would be repaid annually in the period of 30 years.

Also, the revenue has been estimated to be inflated at the rate of 2% per annum which is capped at 150%. The income tax rate for the project is 25% and the loss carryforward period for the project is 12 years.

It is assumed that the government would provide required land for the project. Total operation period of the project is assumed to be 30 years and 3 years is considered as the period of pre-operation.

S.No.	Particulars	Unit	Quantity	Rate	Amount	Remark
1	Land Lease	Katha	330.68			Waive for 15 Years
2	Site Clearance	sqm	1,11,813.78	13.75	15,37,439	-
3	Gardening	LS			25,00,000	Children Park, Film Shooting, Picnic Spots
4	Charging and Fuel Stations (lease)	Sqft.	20,000.00	2,500.00	5,00,00,000	To be leased out
5	Building Structure	Sqft.	2,50,000.00	3,500.00	87,50,00,000	Rs. 3,500 per sqft
6	Special Architectural Decorations and Finishing	LS			9,29,03,744	10% of above Superstructure
Sub-Total					1,02,19,41,183	
	Overhead Charges				10,21,94,118	10% of Sub-Total
Total Capital Cost					1,12,41,35,301	

Working Capital

It has been assumed that the overall working capital requirement would be financed by the equity holders. The working capital has been assumed on the following basis.

Receivable & Advance	30	Days
Payable and Liabilities	15	Days

Total number of working days has been assumed to be 360 days and 12 working months.

3.2 Financial Analysis

3.2.1 Financial Results

The cost of the highway refreshment centers was calculated using data from an IBN desk research report. All of the expenses are considered to be in line with the existing cost structure. The project development cost is also supposed to have been calculated using district rates and current market rates.

The project's overall cost is NPR 1,248,858,112.86, with an interest component of NPR 124,722,811.67 during construction. The overall project, excluding working capital, was financed by loan for 70% and equity for the remaining 30%.

The project's Internal Rate of Return (IRR) is assessed to be 13.77%, while the project's equity IRR is calculated to be 18.69%. The project's IRR and equity IRR prove the project's viability.

After the date of operation, the project has a simple payback term of 6.09 years and a discounted payback period of 11 years. The pay-back term appears to be enough, given the nature of the firm and the broader industry.

At 1.09 times of the project, the average debt service coverage ratio is determined. The project's equity net present value is 448,608,581. Furthermore, the project's cost-benefit ratio is multiplied by 1.30 whereas, the equity cost benefit ratio is multiplied by 2.20.

Major Financial Indicators

Particulars	Rate
Firm IRR	13.77%
Equity IRR	18.69%
NPV- Equity	448,608,581
Debt Equity Service Ratio (average)	1.09 Times
Project BCR	1.30
Equity BCR	2.20
Simple Payback Period	6.09 years
Discounted Payback Period	11 years

4

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

Before forming a corporation or conducting business in Nepal, foreign investors must first get clearance. Depending on the magnitude of the investment, an application should be filed to the Department of Industry or the Investment Board Nepal.

The relevant legal and policy provisions are as follows:

- Nepal Road Safety Action Plan (2013–2020), 2013
- National Transport Policy, 2002
- Nepal Road Standards, 2027 (Second Revision 2070)

- Road Boards Act, 2001
- Local Government Regulation Act, 2074
- Public Roads Act, 1993
- Vehicles and Transport Management Act, 1990
- Town Development Act, 1987
- Environmental Protection Act, 1997
- Environmental Protection Regulation, 1997

Consequently, a number of government agencies and local bodies are legally empowered to address the urban issues. The involvement of a large number of agencies should be taken as an opportunity rather than a hindrance for urban road development.

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The table below summarizes the results of a preliminary desktop-based environmental and social impact assessment. It highlights some of the potential repercussions that might occur throughout the project's pre-construction, construction, and operation stages,

as well as mitigation techniques for each impact. Later in the project cycle, a full evaluation will be done, if required by relevant regulations, through an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA).

Activity	Possible Environment Impact	Possible Mitigation Measure
Pre-construction Phase.	1. Distress to the micro-habitat and natural fauna due to tree felling.	1. Cutting of trees shall be avoided to the extent possible and natural vegetation present on the site shall be kept in mind while preparing the architectural and landscape designs of the project. Compensatory plantations should be carried out.
Construction Phase- Construction activities for the development of the project.	1. Air pollution due to earth work excavation and other construction activities	1. Frequent spraying of water at construction sites to suppress dust emission. Soil, muck and other construction materials should be covered during transport by vehicles.
	2. Soil contamination.	2. Preventive measures should be taken to minimize spillage of oil/ diesel from the construction equipment. Appropriate measures should be taken in case of accidental contamination.
	3. Water pollution/ contamination- Impact on lake.	3. It should be ensured that the water bodies- surface and groundwater, are not polluted due to the project. Appropriate measures should be taken in case of accidental contamination. Particular attention should be given to avoid pollution in the lake due to the project.
	4. Disposal of excess earth.	4. The excess earth should be transported to a designated place and shall be used for filling and covers.

Activity	Possible Environment Impact	Possible Mitigation Measure
	5. Disturbance to other services.	5. Any shifting of cable/utility lines should be attended to with a minimum period of disturbance.
	6. Safety of road users in the project area.	6. Provision of temporary crossings/bridges as well as warning signs wherever necessary to facilitate normal movement.
	7. Noise pollution due to the use of machinery and movement of traffic.	7. Use of less noise generating equipment and avoiding activities during night.
	8. Impacts due to hazardous waste	8. Hazardous waste will be managed as per applicable laws of Nepal.
	9. Impacts due to construction waste	9. Construction debris will be managed/disposed of properly.
	1. Impact on water resources supply to nearby residents due to possible extraction of ground-water	1. This will be a residual impact if water is sourced from well/ boring in the project area. However, possible mitigation measures can be recharging of the groundwater by installation of a well-designed rain-water harvesting system, which is already envisioned by the project as one of its components. Similarly, water saving features could be installed where feasible. In addition, wastewater treatment plants or biological treatment systems (reed-bed) could be installed, if feasible, to treat gray water with utilization of the treated water for watering plants, etc.
	2. Contribution to GHG emissions from use of machines and equipment (heating, air conditioning, etc) in the building, etc.	2. Efforts will be taken to offset carbon emissions by incorporating a green/sustainable building design, including installation of solar power and energy-efficient equipment, as well as ensuring that natural light is received for maximum duration.
	3. Increased solid waste generation, if not managed well can be a nuisance to surrounding communities and may create health hazard	3. Segregate wastes and ensure they are collected frequently by waste collection companies/facilities. Build a compost facility, if feasible, and use the compost in the green spaces/plants inside the project compound.
	4. Water contamination- Impacts on lake/river	4. Ensure that the water bodies\flowing adjacent are not contaminated. Appropriate measures should be taken in case of accidental contamination. Install a wastewater treatment plant if feasible.
Operation Phase		

The initiative will provide locals and other Nepalese with both short and long-term job opportunities. Through its spin-off economic impacts, it will help other current businesses as well as bring up new investment prospects.

6

PRELIMINARY RISK ANALYSIS

The following are some of the most significant risks linked with the PPP project:

1. Risks related to construction and project completion delays, which might lead to cost overruns.
2. This project may pose a business risk since the demand and market trend must be properly analyzed in order for the project to be financially and commercially viable.
3. According to relevant legislation, the project would need to complete either an Initial
- Environmental Examination (IEE) or an Environmental Impact Assessment (EIA), which would identify possible environmental and socioeconomic implications as well as necessary mitigation measures.
4. Changes in the legislative framework and political risk might be some of the additional risks linked with the project.
5. Financial risks to the project include changes in interest and currency exchange rates, as well as changes in tax regulations.

7

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnerships (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investments.²²

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

The PPP model is appropriate in the current context of Highway Refreshment Centers. According to the preliminary research done in these towns, the Local Government would give land for the construction of highway refreshment centers.

22. World Bank, 2072, Public Private Partnership Policy

8

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. The Highway Refreshment Centers will provide tourists with a variety of services and attractions, as well as acting as a one-stop solution for such a wide array of service experiences for travelers.
2. According to the study, Mahendra Highway is an attractive area for developing the Highway Refreshment Centers because of its climate, proximity to the border, accessibility, and other factors.
3. The project's business model was determined to be a Public Private Partnership.
4. With a total cost of NPR 1,248,858,112.86 (including interest component throughout the construction period) and an equity IRR of 18.69%, the project may be completed.
5. Normal payback period has been determined as 6.09 years.

8.2 Recommendations

The project appears to be technically and financially viable for a developer to invest, based on the findings. In the following step, however, environmental and social aspects, as well as a thorough examination of all other components, must be addressed.

Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.

9

ANNEX

9.1 Next Steps and Useful Contacts

As part of further development of the project, the potential developer who might be interested to develop this project will be identified. Afterwards, a

communication channel will be formulated for the effective execution of this project. The useful contacts of all the Municipalities incorporated in this are highlighted as follows;

Table 6: Useful contact information**Dhalkebar**

S.N.	District	Municipality	Chief Administrative Officer	Mayor
1	Danusha	Mithila Municipality	Nischal Raj Pandey	Hari Narayan Mahato

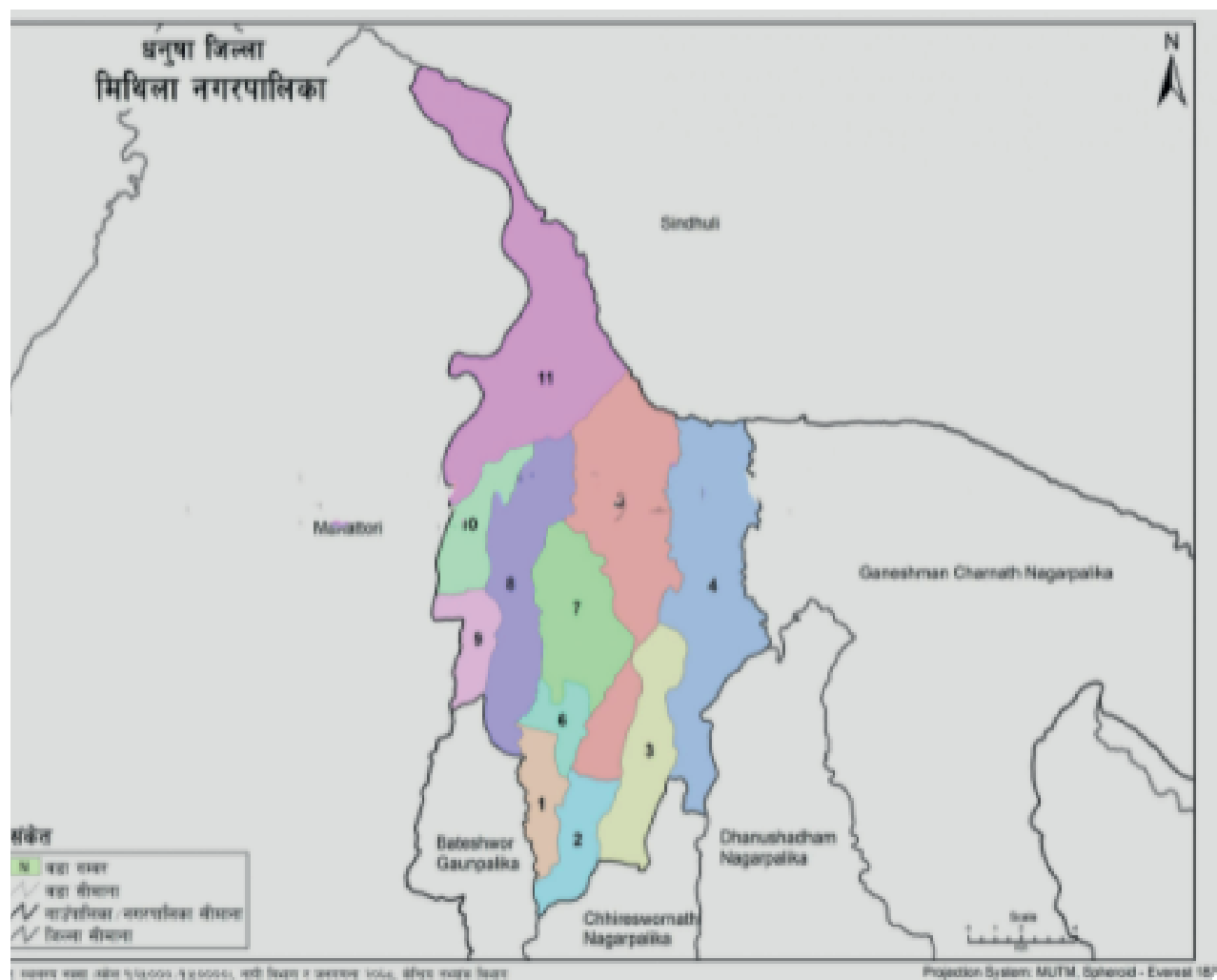
Pathlaiya

S.N.	District	Municipality	Chief Administrative Officer	Mayor
1	Bara	Jeetpur-Simara Sub-Metropolitan City	Cheytt Kumar Pokharel	Dr. Krishna Paudel

Rupani

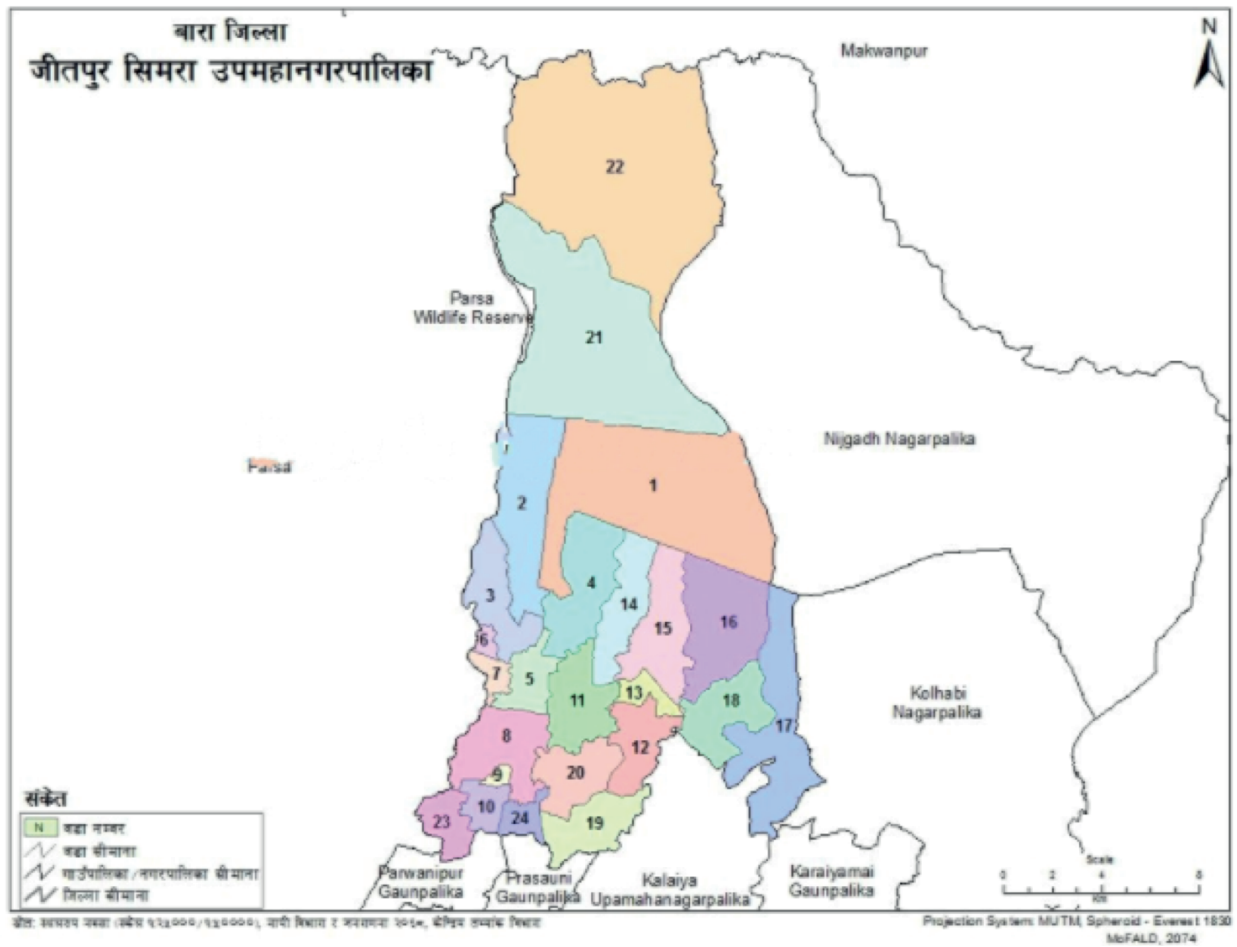
S.N.	District	Municipality	Chief Administrative Officer	Mayor
1	Saptari	Rupani Rural Municipality	Arbinda Kumar Chaudhary	Dr. Krishna Paudel

9.2 Map of Mithila Municipality (Dhalkebar)



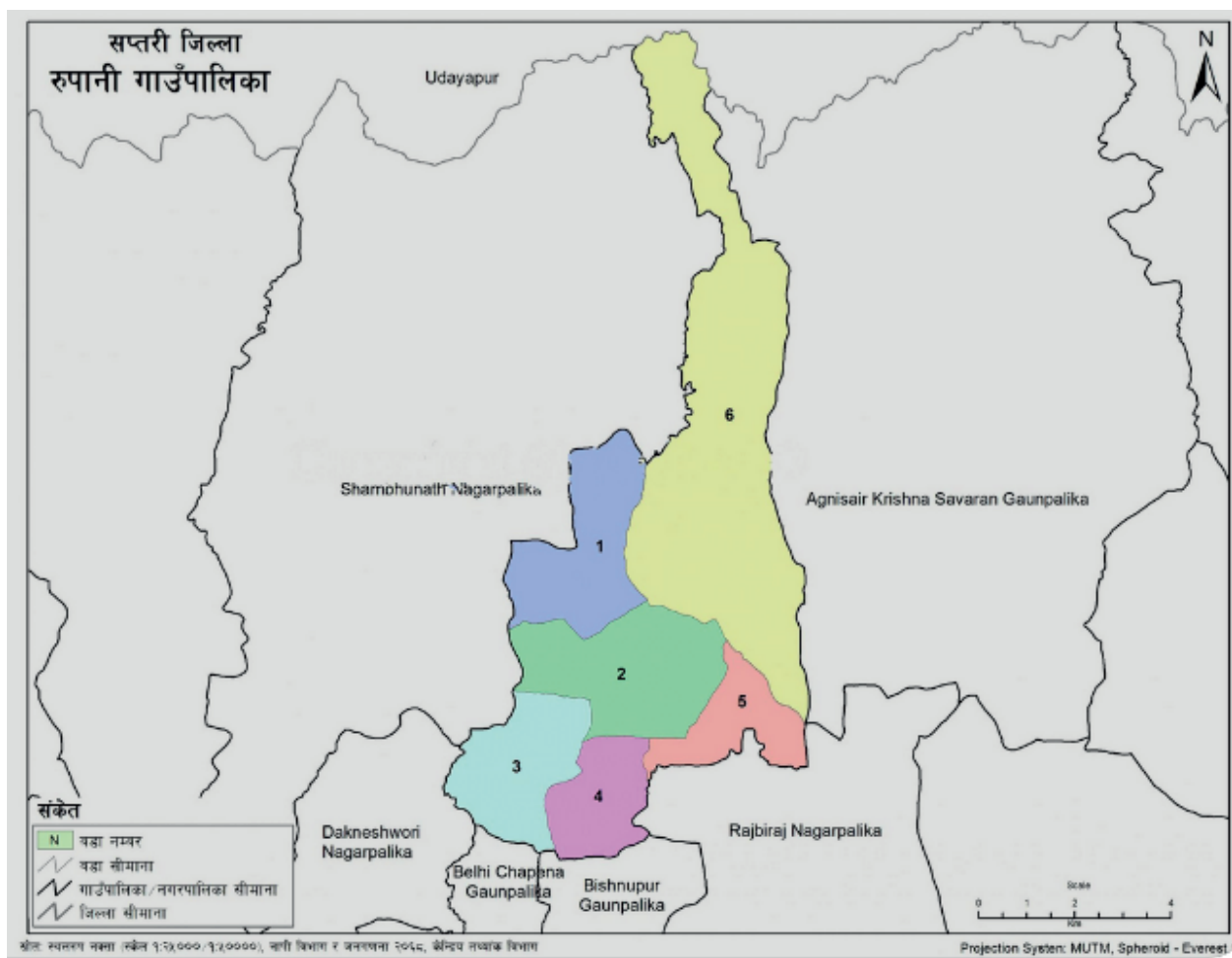
Source: Mithila Municipality

9.3 Map of Jeetpur-Simara Sub-Metropolitan City (Pathlaiya)



Source: Jeetpur - Simara Sub-Metropolitan City

9.4 Map of Rupani Rural Municipality



Source: Rupani Rural Municipality

9.5 Financial Report

Projected Profit and Loss Statement for Initial 10 years

Particulars	Amount in NPR									
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Revenue	192,000,000	195,840,000	199,756,800	203,751,936	207,826,975	24,7314,100	252,260,382	257,305,590	262,451,701	267,700,735
Total Income	192,000,000	195,840,000	199,756,800	203,751,936	207,826,975	247,314,100	252,260,382	257,305,590	262,451,701	267,700,735
Less: Direct Expenses	38,400,000	39,168,000	39,951,360	40,750,387	41,565,394.9	49,462,820	50,452,076.4	51,461,117.9	65,612,925	66,925,184
Total Direct cost	38,400,000	39,168,000	39,951,360	40,750,387	41,565,394.9	49,462,820	50,452,076	51,461,118	65,612,925	66,925,184
Gross Profit	153,600,000	156,672,000	159,805,440	163,001,549	166,261,580	197,851,280	201,808,306	205,844,472	196,838,776	200,775,552
Administrative Expense	-	-	-	-	-	-	-	-	-	-
Cash Admin Expenses	20,000,000	21,000,000	22,050,000	23,152,500	24,310,125	25,525,631	26,801,913	28,142,008	29,549,109	31,026,564
Land Lease Rental	0	0	0	0	0	0	0	0	0	0
Depreciation Expenses	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604	41,628,604
Operating Profit	91,971,396	94,043,396	96,126,836	98,220,445	100,322,851	130,697,045	133,377,789	136,073,859	125,661,063	128,120,383
Interest Expenses	87,420,068	81,934,861	75,901,134	69,264,034	61,963,224	53,932,333	45,098,352	35,380,974	24,691,858	12,933,830
Profit	4,551,328	12,108,535	20,225,702	28,956,411	38,359,627	76,764,712	88,279,437	100,692,885	100,969,205	115,186,553
Provision for Staff Bonus	413,757	1,100,776	1,838,700	2,632,401	3,487,239	6,978,610	8,025,403	9,153,899	9,179,019	10,471,505
Income Tax	1,034,393	2,751,940	4,596,751	6,581,003	8,718,097	17,446,526	20,063,508	22,884,747	22,947,547	26,178,762
Net profit	3,103,178	8,255,819	13,790,252	19,743,008	26,154,291	52,339,577	60,190,525	68,654,240	68,842,640	78,536,286

PRE-FEASIBILITY STUDY OF
SOLID WASTE MANAGEMENT:
JANAKPURDHAM, DHANUSHADHAM &
BARDIBAS PROJECT

EXECUTIVE SUMMARY

Solid waste management is a big issue for Nepalese municipalities. In recent years, rapid urbanization, population increase, modern throwaway culture, restricted landfill capacity, and rising disposal prices have made this a huge burden. In the next few years, this will only get worse. As a result, it is critical that we acknowledge this problem and plan for the future.

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives. The solid waste management industry has been designated as one of the important sectors for foreign investment. The major goal of the "Solid Waste Management Project (SWMP)" research is to represent the existing waste management scenario in suggested places such as Janakpurdham, Dhanushadham, and Bardibas in Madhesh Province, as well as to establish the project's technical and financial viability. Both primary and secondary data gathering approaches were used in the study. Primary data was acquired from field-based research, which included a field visit and stakeholder consultations and group discussions. Secondary data

was gathered from a variety of sources, including published papers, journal articles, and other verified and trustworthy online sources.

This project appears to be most suited for a Public Private Partnership (PPP) model, in which GoN will assist in obtaining the necessary property for the project, including land for the development of transfer stations, a processing facility, and a landfill site. The developer will then build all of the infrastructure required for the project's smooth execution and will run it for 20 years before handing it over to GoN in good working order.

The research examined the project's technical and financial features and determined that it is technically and financially feasible, with a total projected cost of roughly NPR 723,957,773 (including interest component throughout construction time). Furthermore, the project IRR is assessed to be 14.81%, which is higher than the project's needed rate of return. The project's equity IRR is 16.41%. The project's IRR and equity IRR prove the project's viability.

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SALIENT FEATURES OF THE PROJECT

Table 1: Salient features of the project

General information of the project		
1	Name of Project	Solid Waste Management Project in Janakpurdham, Dhanushadham & Bardibas
2	Project Location	Province: 2 District: Dhanusha and Mohattari Municipality/Rural Municipality: Janakpur Sub-Metropolitan, Dhanushadham Municipality, Bardibas Municipality
3	Project Implementation Modality	☐ Public ☒ PPP ☐ Private ☐ Others/Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Infrastructure
6	Type of Project (Sub Sector)	Sanitation
7	Implementing/Facilitating Agencies	Private sector, facilitated by the provincial Ministry of Industry, Tourism, Forest and Environment and Province Policy and Planning Commission.
8	Project Management (Implementation Mechanism)	Private sector will execute and manage the project with the support from the Federal, Provincial and Local Governments and local stakeholders.

Project specific information

1	Salient Features of Project	
	Collection of Waste	Household and commercial collection of waste in certain interval.
	Anaerobic Digestion	- Mesophilic (35-38 degree Celsius)/ Thermophilic (above 50 degree Celsius) - The methane gas will be compressed, bottled and sold to the local market - Organic fertilizer and pesticide will be generated
	Other features	- The project will reduce the adverse impacts of solid waste pollution on human health and the ecology. - Solid waste management will also be used for energy production.
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	People living in Janakpur, Dhanusha and Bardibas.
	Population and collection of wastage (calculated with base figure from 2011 Census)	Total Population: 2,99,654 Total Waste Generation: 67 tonnes/day Average Waste Composition: 60% organic, 25% reusable/recyclable, and 15% others (including hazardous waste)
	Land Requirement	About 10 Bighas
	Acquisition & Resettlement	The settlement issues shall be addressed after the identification of the landfill site. The provincial government will coordinate with the local government to ensure acceptance on the issue
	Materials and Ease of Access	The materials used for project construction are easily available and access to the project site is easy.
	Environmental and Social Management Plan (ESMP)	A solid waste management project of this scale would require an Environmental Impact Assessment.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desktop Study ☐ Feasibility Study ☐ Detailed Engineering/DPR
4	Estimated Cost to Complete the Project	NPR 723,957,773.00
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months Approval and Financial Closure: 6 months Construction Period: 2 years Concession Period: 20 years
6	Project Financing Options	Majority investment of the private sector; Government to contribute for required infrastructure development such as access to running water and electricity; Government to be given minority equity stake.
7	Project Technology/Components	Collection of wastage Household and commercial collection of waste in certain intervals.

		Anaerobic Digestion • Mesophilic (35-38 degree Centigrade)/ Thermophilic (above 50 degree centigrade). • The methane gas will be compressed, bottled and sold to the local market. • Organic fertilizer and pesticide will be generated. Incineration • Burning of waste at high temperature until the wastes turn into ashes. Pyrolysis • Solid waste is decomposed by heat without the presence of oxygen. • The solid wastes are changed into gases, solid residue of carbon and ash and small quantities of liquid.
8	Contribution to SDG and Green Growth	• Solid waste management helps to eliminate the uncontrolled dumping and open burning as this the first stepping stone to achieve environmentally sound solid waste management practices • Adequate solid waste management practices help to prevent emission of large amounts of greenhouse gases • Solid waste management technology can derive renewable energy from organic waste • The project will, in particular, help to attain the following Sustainable Development Goals: Goal No. 3: Good health and well being Goal No. 6: Clean water and sanitation Goal No. 9: Industry, innovation and infrastructure Goal No. 11: Sustainable cities and communities
9	Project Capacity (at 100%)	67 tonnes/day
10	Project IRR	14.81%
11	Benefit Cost Ratio	1.19 times
12	Private Sector's Roles	Planning, designing, building and financing the project.
13	Government's Roles	• Equity investment from Local Governments. • Support in site identification and land acquisition. • Conflict resolution and dispute settlements. • Land leasing for decomposition of waste.

Other project information		
1	Target Beneficiaries	Local people can benefit from a clean and healthy environment.
2	Market of Project's Service/Product	Local people and institutions
3	Key Risks and Opportunities of Project Development & Operation	
	Strengths and Opportunities	• Reduces environmental pollution. • Produces energy by processing organic wastes.
	Risk and Issues	• Risks associated with solid waste management projects are mainly occupational accidents, chemical risk, erGoNomic risk, and hazardous substances • Land required for the project should be away from the residential area • Resistance from the locals of the project site may be an issue. So, it will require strong contractual agreement before starting the project

1

BACKGROUND

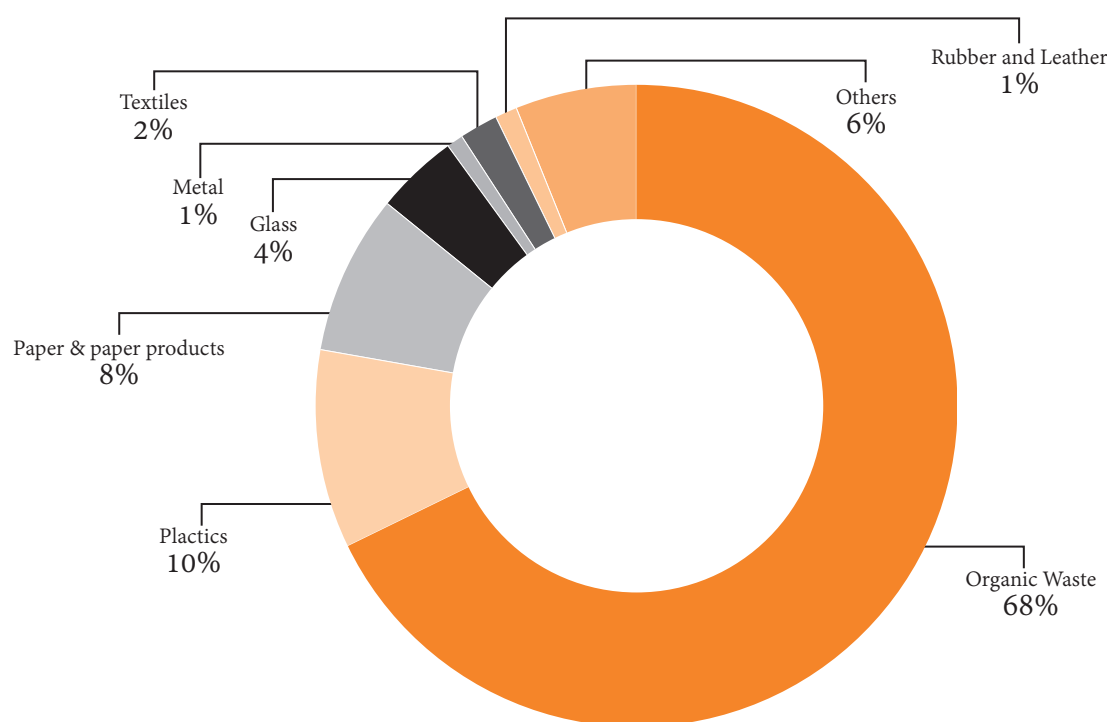
1.1 Introduction

In many developing nations, managing growing volumes of solid waste has become a big concern. Solid waste may be a beneficial resource when used properly, but if it is not adequately managed, it can have major negative consequences for each country's environment, public health, and societal sustainability. As a result, solid waste management is a vital component of urban sanitation, as well as one of the most significant and resource-intensive municipal services. Majority of the Local government undertake these tasks internally with their own resources but some local bodies manage it externally by outsourcing it to the private contractor. Rapid and uncontrolled urbanization, lack of public awareness, modern throwaway culture, and inadequate municipal administration have all exacerbated environmental issues in Nepalese cities, including unsanitary waste management and disposal.

According to a survey conducted by Nepal's Central Bureau of Statistics (CBS), the majority of city dwellers regard solid waste management to be the most pressing environmental issue in Nepal's urban areas. As a result, the Nepalese government has placed a significant focus on SWM.

1.2 Municipal Solid Waste Management in Nepal

Solid waste management is an important performance indicator and obligation for municipalities in Nepal. SWM has become a serious concern in most Nepalese cities, particularly the bigger ones, as a result of increased urbanization and changing consumption habits, putting enormous strain on municipalities. Cities like Kathmandu, Biratnagar, Birgunj, Nepalgunj, Butwal, Janakpur, and others are major urban centers with important industrial corridors and foreign commerce. As a result of the tremendous inflow of people and their changing lifestyles, massive waste creation will occur. Almost all municipalities' current waste management practices include open dumping and landfilling with no treatment. Despite the fact that certain big cities use a landfill system for waste management, the majority of areas lack sanitary waste management procedures. Municipalities in Nepal, on the other hand, lack the essential expertise and resources to properly manage trash. Currently, the majority of wastes generated in municipalities are not being adequately managed, posing a substantial health and environmental risk. This will ultimately open up investment opportunities in the waste management sector, as well as partnerships with neighboring towns. More waste indicates more technical components are used.

Figure 1: Average composition of household waste of 60 municipalities¹

Garbage creation in Nepalese municipalities is over 3023 tons per day, with an average per capita waste generation of 0.223 kg/person/day². According to the survey conducted by ADB³ organic waste accounted for 66 % of household waste, followed by plastics (12 %), and paper and paper products (9 %), according to an examination of household waste composition. Institutional wastes contained 45 % paper and paper products, 22 % organic wastes, and 21 % plastics. Commercial wastes were found to contain 43 % organic wastes, 23 % paper and paper products, and 22 % plastics. Municipal Solid Waste (MSW) is made up of 56 % organic waste, 16 % plastics, and 16 % paper and paper products when combined. This suggests that composting organic waste and reusing and recycling other materials has a lot of potential, with just around 10% of garbage ending up in landfills if resource recovery is maximized.

1.3 Rationale of the Project

- Increases overall waste diversion from final disposal, especially when bio degradable waste accounts for up to 80% of garbage in low and middle income nations.
- By eliminating organic debris from the waste stream, it improves recycling and incineration processes.
- Produces a beneficial soil amendment essential for long-term agriculture.
- Encourages ecologically friendly actions, such as lowering landfill methane emissions.
- Improves fertilizer application efficacy.
- It is possible to minimize the amount of garbage that must be transported.
- Addresses major health consequences of organic waste, such as eliminating sources of infection-carrying insects and animals.

1 ADB, 2013, Solid Waste Management in Nepal: Current status and Policy Recommendations

2 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

3 ADB, 2013, Solid Waste Management in Nepal: Current status and Policy Recommendations

- Provides a fantastic chance for a city's overall garbage collection to be improved.
- Seasonal waste changes, such as leaves and agriculture debris, are accommodated.
- Existing informal garbage collection, sorting, and recycling industries can be integrated.

1.4 Objectives

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives, including solid waste management projects (2022). As a result, based on their daily waste generation and other important criteria, PPC has created a feasible package for Solid Waste Management Project (SWMP) comprising three municipalities. Finally, it wants to present such packages at the Investment Summit (2022) in order to locate the right investors for the project. As a result, the following are some of the report's primary goals:

1. To get a better understanding of the existing state of solid waste management in the proposed municipalities, as well as their long-term plans
2. To investigate the project's technical and financial feasibility at the chosen site

1.5 Scope of Work

The goal of the pre-feasibility study is to represent the current waste management scenario in the proposed area as well as to demonstrate the technical and financial feasibility of the SWMP. Finally, the research will aid in gaining a general understanding of investment opportunities in this particular sector and location. The following are some of the study's primary scopes:

1. To gather main data, secondary data, and any other necessary information for the project's development.

2. Analyze the acquired data for many elements such as technical, economical, social, and environmental concerns.
3. Develop the most appropriate investment model, such as private, Public Private Partnership, or blended finance.
4. Also, depending on the findings, provide recommendations.

1.6 Approach & Methodology

A professional team from Invest and Infra Pvt. Ltd. produced this pre-feasibility study. After a thorough examination of market demand and business development prospects, the project's components were determined. For the purposes of determining project features/components, input collected during consultations with Province Level Ministries and associated stakeholders was also taken into account. Secondary and primary sources were used to obtain the necessary data, information, and facts to meet the study's goals.

Primary data was acquired by telephone and e-mail conversations, as well as a field-based research, which included a field visit. Producers, marketers, entrepreneurs, and government officials from Madhesh Province (Provincial Ministries, Rural/Municipalities, etc.) participated in stakeholder consultations and group discussions.

Secondary data was gathered from numerous publications issued by Nepalese government agencies, other similar nature projects in Nepal, and academic research papers published by various organizations and experts. An appropriate investment plan was recommended based on the conclusions of a technological, social, and environmental investigation. In addition, a thorough financial study was carried out to discover some of the key financial metrics that assure the project's financial feasibility.

PROJECT DETAILS

2.1 Project Background and Description

In many developing nations, like Nepal, Solid Waste Management (SWM) is one of the most pressing environmental concerns. Increased Municipal Solid Waste (MSW) creation is caused by urban population increase and economic development. Another issue to be concerned about is the usage of items that produce hazardous waste. Medical waste from hospitals and clinics that is not properly disposed of contributes to pollution and public health risks in the community. As a result, SWM has become a top priority for Nepalese municipalities.

The current solid waste management practice in the project region is very rudimentary, with municipalities or private contractors collecting rubbish and depositing it along river banks, low lying areas, and other open places, posing several health and environmental problems. As a result, the goal is to create an Integrated Solid Waste Management Strategy that includes source separation. Respective trash is transported to the transfer station and separated into recycling, non-recycling, and organic wastes, which are then processed using various technologies to produce commercial goods such as organic fertilizer, cooking gas, insecticide, and so on.

2.2 Project Features

Table 2: Project features

Municipality	Total Population ⁴	Daily Waste Generation (ton/day) ⁵
Janakpur Sub-Metropolitan City	177945	39.68
Dhanushadham Municipality	49094	10.94
Bardibas Municipality	72615	16.19
Total	299654	66.82
Average Waste Composition (% by weight) ⁶	Decomposable	60
	Recyclable	25
	Others (Including Hazardous Waste)	15
Project Components	Source Segregation	
	Collection	
	Transportation	
	Recycling	
	Processing	
	Disposal	

Fig. 2: Population of the municipalities included in the package⁷

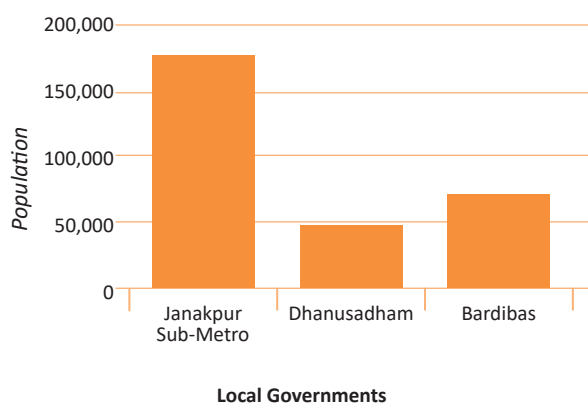
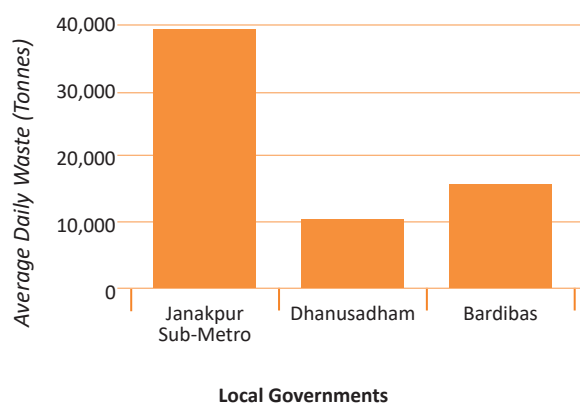


Fig. 3: Waste generation of the municipalities included in the package⁸



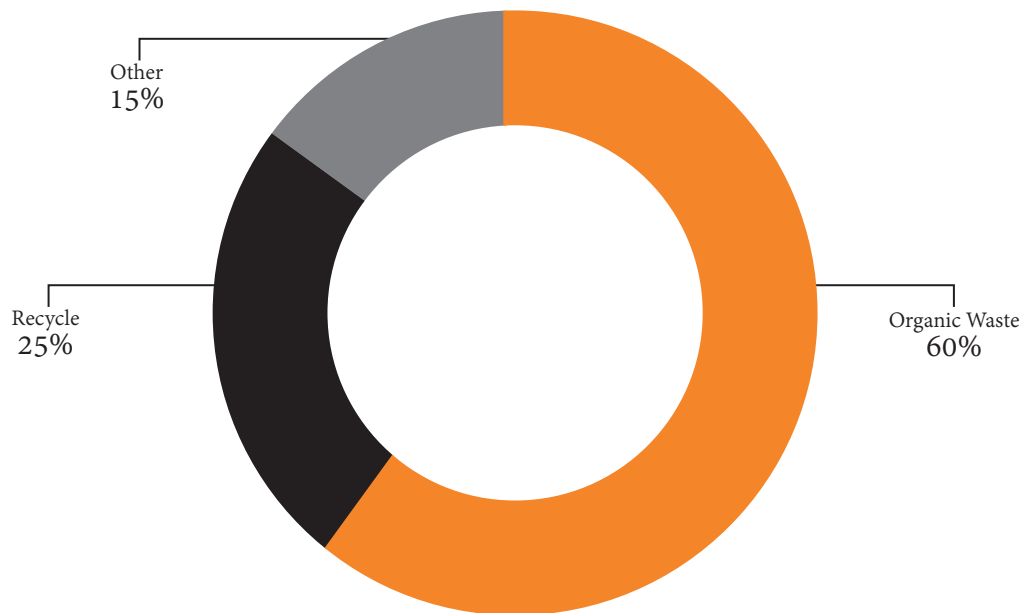
4 Health Management Information System 2074/75, MoHP, GoN

5 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

6 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

7 Health Management Information System 2074/75, MoHP, GoN

8 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

Fig. 4: Average waste composition of the municipalities included in the package⁹

2.3 Overview of the Area

Madhesh Province - Janakpur Sub-Metropolitan City, Dhanusadham Municipality, and Bardibas Municipality are all included in the project. Janakpur is the administrative center of the Dhanusa district, which is located in Nepal's southern region. The city that occupies an area of 91.97 square kilometers, is a hub for religious and cultural tourism. Janakpur is Nepal's largest Sub-Metropolitan city and one of the country's fastest growing cities. One Sub-Metropolitan city, eleven Urban Municipalities, and six rural municipalities make up the District. As previously noted, one Sub-Metropolitan city and two municipalities have been included in this bundle. Dhanushadham is a prominent hindu sacred place that spans 91.64 square kilometers. Bardibas, a large town in Madhesh Province, is located on the Mahendra Highway and has an area of 315 square kilometers. The town is at a three-way crossroads. Through Sindhuli, Khurkot, Nepalthok, and Dhulikhel, the BP Highway connects Bardibas with Kathmandu, Nepal's capital city. In addition, a railway route linking Janakpur is being built.

This package was created with the demands of the entire population, waste creation, connectivity, and specific municipalities in mind. The entrance of enormous numbers of religious visitors, poor sanitation, and a lack of a competent waste management system are the primary sources of pollution in the region.

The Sub-Metropolitan city and other municipalities included in this package are expected to have a total population of 299654¹⁰. The estimated population is based on Ministry of Health and Population data from 2074/75, which shows a 1.35 percent growth rate¹¹.

There is no effective waste management system in this project area. As a result, the planned project is extremely important for the area. According to the Maharjan and Lohani study issued in 2020, the majority of trash are organic in nature and must be composted or turned into biogas¹².

9 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. *Journal of the Institute of Engineering*, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

10 Health Management Information System 2074/75, MoHP, GoN

11 Central Bureau of Statistics (CBS), 2011, Population Monograph,

12 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. *Journal of the Institute of Engineering*, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

Fig. 5: Project area location map

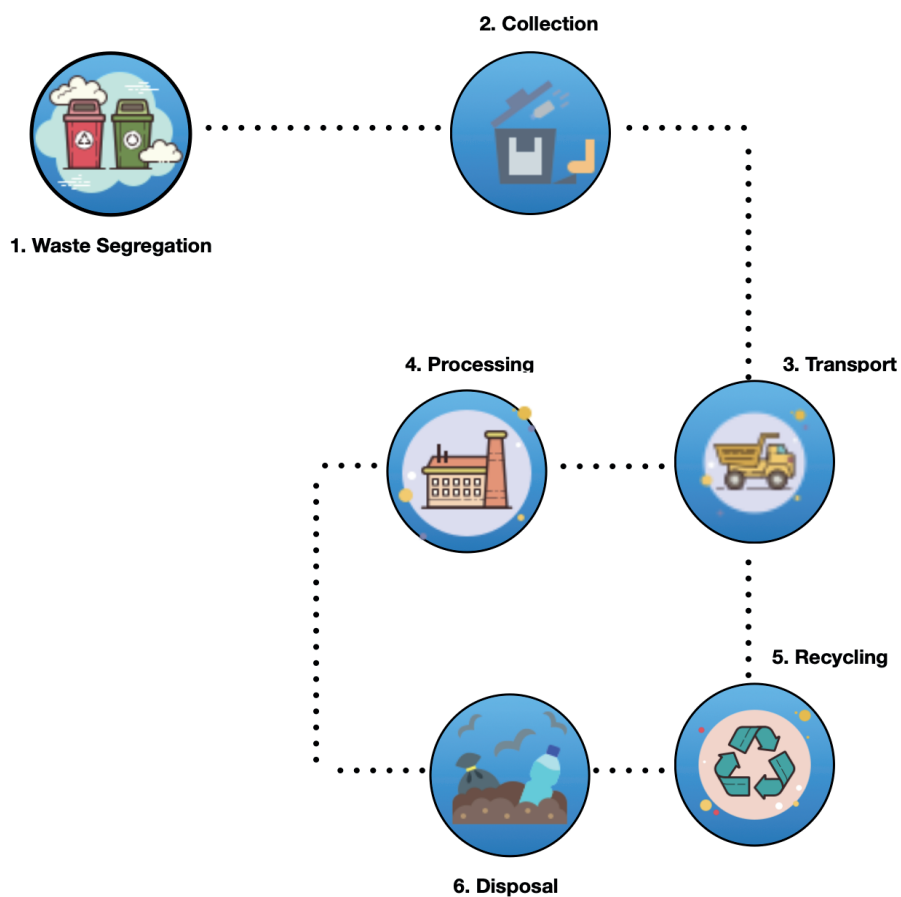


(Source: Google Maps)

2.4 Developing a Business Case

Product Mix

The following components make up the product mix for this package:



The developer should be in charge of collecting garbage that has been segregated at the source. The garbage will then be transported to a transfer station and subsequently to a processing facility, where recyclable items will be segregated and sold to a manufacturer, while organic waste will be converted into biogas, organic fertilizer, and perhaps insect repellent. The remainder of the garbage that cannot be recycled or processed is transferred to a sanitary landfill. Developers are only permitted to transfer a maximum of 20% of collected garbage to a dump site; the remainder must be transformed into one of the energy types specified above.

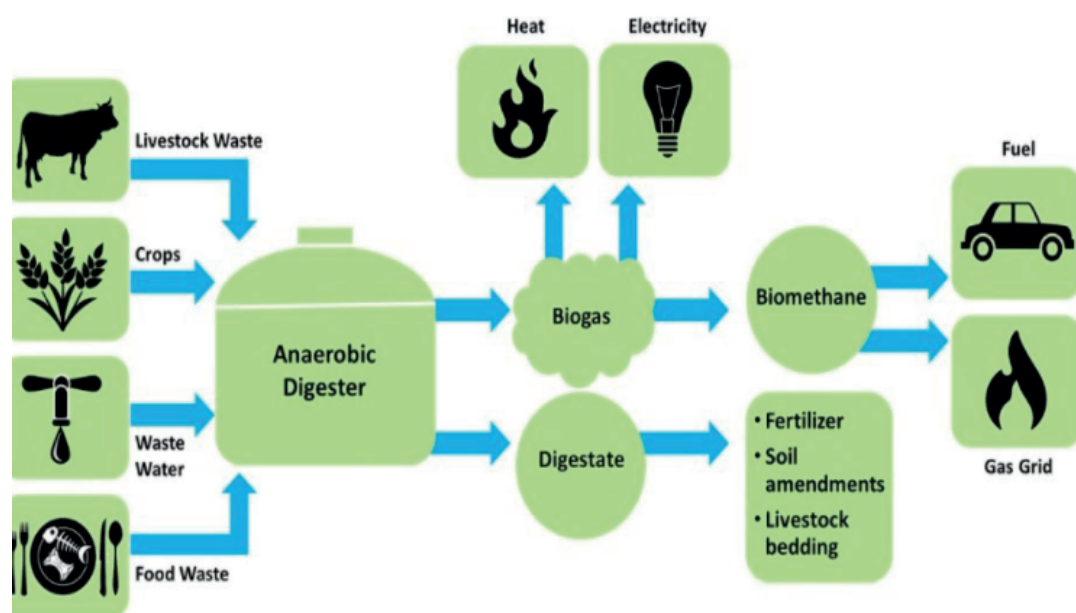
A Public Private Partnership (PPP) mechanism will be used to build this project. SWM-PPP's major goal is to foster long-term, self-sustaining partnerships between micro and small businesses and Local Governments that enhance the lives and livelihoods of impoverished people in low-income cities and municipalities. As a result, the GoN will assist in providing all necessary land for the project, including land for the development of a transfer station, processing plant, and landfill site, and the developer will develop all necessary infrastructure for the smooth delivery of all the project components listed above. The developer will own and administer the project for the next 20 years before handing it over to the GoN in excellent working order.

Anaerobic digestion is an appropriate technology for the proposed municipalities based on various factors such as overall level of waste management, waste composition, waste calorific value, appropriate quantities of waste, transportation time and distance to the main processing plant, availability of land, availability of workers and capacity, existing policies related to waste management, product marketing, and incentives for low carbon generation.

Anaerobic Digestion - Design and Technology

The planned facility would use anaerobic digestion in a Mesophilic (35-38 degrees Celsius) environment. Bio-organic materials will be fed into a digester, where anaerobic decomposition of the organic materials will create biogas as the main product and compost as a byproduct, similar to the regular biogas generating process. The gas produced will then be processed to enhance the concentration of methane. The enhanced biogas is then compressed and loaded into cylinders/cascades for distribution using a suitable compressor. Furthermore, when the feedstock is source isolated and non- organic waste, the digestate can be utilized as organic fertilizer. The basic components and applications of an anaerobic digestion plant are depicted in the diagram below.

Fig. 6: Components and end uses of an anaerobic digestion plant¹³



13 <https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy>

Total Land Required

According to a paper prepared by the Asian Development Bank in collaboration with the Australian Government Aid Program, an anaerobic digestion plant requires around 500 m²/ton of land (includes space for drying of slurry)¹⁴. As a result, the preliminary land area for our proposal to create the processing site is roughly 3341.421 m² (3.34 hectare). Only 80% of the bio-degradable garbage collected will be fed into the system to make biogas, according to our calculations.

2.5 Market Assessment

The waste composition of our proposed municipality is as follows;

The tentative land requirement for a sanitary landfill site (based on a comparison of total waste generation) for the proposed package is approximately 3.34 hectare, according to the ADB's Towards Sustainable Municipal Organic Waste Management in South Asia: A guide book for policymakers and practitioners, published in 2011.

2.6 SWOT Analysis

SWOT analysis allows for the discovery of elements that characterize a company or organization in the context of a certain goal, as well as the classification of those characteristics into four areas. As seen in the table, two of them are positive, while the other two are negative:

Table 3: Quantity and composition of waste

Municipality	Total Population ¹⁵	Total Waste Generation (Ton) ¹⁶	Organic Matters (Food waste, vegetable/fruit waste, green leaves, animal excreta, slaughter waste, straw, bamboo, woody waste, dry leaves, etc.) [71.53%] ¹⁷	Reusable/ Recyclables (Metal, paper, glass, plastic) [28.15%] ¹⁸	Others (including hazardous waste) [0.32%] ¹⁹
Janakpur Sub-Metropolitan City	177945	39.68174	23.80904	9.920434	5.95226
Dhanusadham	49094	10.9478	6.56878	2.7370	1.64212
Bardibas	72615	16.1931	9.71159	4.0483	2.4290
Total	299654	66.8228	40.0937	16.7057	10.0234

The main products of our plant at 100 % capacity will be as follows;

Table 4: Revenue sources from the project

Product	Quantity/Day	Approximate Rate (NPR./KG)	Possible Market /Area of Use
Compressed Biogas (kg)	1491.08	85	Restaurants, Hotels, etc.
Sale of fertilizer (kg)	631.88	15	Agro market
Pesticides (liter)	5343.69	8	Agro market
Reusable & recyclables (Kg)	46.91	8	Scrap collection center and industry

14 Towards sustainable municipal organic waste management in south Asia, A guide book for policy makers and practitioners, ADB, 2011

15 Health Management Information System 2074/75, MoHP, GoN,

16 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

17 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

18 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

19 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

SWOT Analysis for Integrated Solid Waste Management

Strength	Weakness	Opportunities	Threats
- Improved sanitation and hygiene. - Waste collection is done on a door-to-door basis. - The resident is required to pay a charge for rubbish pickup. - Developers must pay a royalty to the Sub-Metropolitan/ Municipality, which serves as a source of revenue for the Sub-Metropolitan/Municipality. - There will be no costs related with solid waste management for the concerned authorities. - In a sense, the partner municipalities can formally agree to the project's development. - Source separation - Land is available.	- There is a lack of waste separation at the source. - Unscientifically dumped. - There are no operational sanitary landfills or recycling facilities. - A lack of environmental awareness. - Technically, there is a deficiency. - Inadequate financing.	- Participation of the private sector in trash separation procedures. - Market for recycled materials that are suitable. - Effective integrated solid waste management requires an adequate regulatory framework. - Observance of environmental targets. - Cost recovery is linked to services connected to solid waste management. - Market for various end goods that is effective. - Integration possibilities of other nearby Municipalities and Rural Municipalities. - Financially viable .	- Waste handlers are at danger of a variety of illnesses. - Landfill space is limited. - Local opposition stems from a lack of awareness of the differences between processing and landfilling. - Ineffective management. - Strike by workers.

2.7 Examination and Evaluation of Alternatives

On the basis of numerous parameters such as the overall level of waste management, the composition of trash, the calorific value of garbage, appropriate waste volumes, current waste management rules, and so on. For the suggested package, anaerobic digestion is an acceptable method. However, we looked at the following possibilities:

Composting

Waste composting is a technique for digesting solid waste. Decomposition of organic waste into humus, also known as compost, which is a valuable fertilizer for plants, is part of the process. Bio-degradable yard trash (kept separate from municipal garbage) is permitted to break

down or decompose in a medium due to a lack of landfill capacity in larger towns. The result is a high-quality, nutrient-rich, and environmentally friendly manure that enhances soil conditions and fertility. Organic matter makes up a significant component of Nepal's municipal solid waste. Composting, one of the oldest methods of waste disposal, may be used to recycle this waste. The natural decomposition of organic waste produces manure or compost, which is extremely nutrient-dense. Composting is a biological process in which degradable organic waste is converted into a humus-like material by microorganisms, mostly fungus and bacteria. This completed product, which resembles dirt, is high in carbon and nitrogen, making it an ideal growth substrate for plants. Composting guarantees that garbage generated in the kitchen is not discarded carelessly

and allowed to deteriorate. It recycles nutrients and returns them as nutrients to the soil. Composting may considerably reduce the quantity of disposable rubbish, in addition to being clean, inexpensive, and safe. Organic fertilizer may be used instead of chemical fertilizers and is better for veggies in particular. It improves the soil's capacity to retain water while also making it easier to grow. It allows the soil to hold on to more plant nutrients.

Waste to Energy

The proposed system is based on the conversion of waste to biogas, which would then be processed to increase the methane concentration before being compressed and bottled. Other possibilities include: Waste to Energy (WTE) is a phrase that refers to a variety of technologies that transform non-recyclable waste into usable energy sources such as heat, fuels, and electricity. Gasification, pyrolysis, in-vessel composting, and other waste-to-energy technologies are only a few examples. Because our technique is based on the conversion of waste to biogas, it can be used as a fuel for combustion engines that convert it to mechanical energy, which can then be used to power an electric generator to generate electricity. An electric generator has a design that is comparable to that of an electric motor. Furthermore, compressed methane gas may be utilized as a car fuel.

2.8 Relevant Case Studies

Case Study 1

Project Type: Commercial Biogas Plant

Developer: Gandaki Urja Pvt. Ltd.

Location: Majuwa, Pokhara Lekhnath Metropolitan city, Ward No. 32, Kaski District.

Total Capital Investment: NPR. 166,650,038.54

Total Operation and Maintenance Cost:
NPR. 80,751,375.35

The planned Compressed Biogas Bottling and Fertilizer Plant will generate high-quality compressed biogas and organic fertilizer at a rate of 45 tons per day. To degrade the organic materials in anaerobic circumstances, a continuous flow stirred tank reactor digester was chosen.

The plant will use around 45 tonnes of substrate each day, comprising cow/buffalo dung, pig manure, and chicken litter, in order to produce 1600 kilograms of compressed biogas (CBG) and 11000 kilograms of organic fertilizer.

Majuwa, Pokhara Lekhnath Metropolitan City, Ward No. 32, Kaski District is the planned project location. The place is around 20 kilometers from Pokhara and 30 kilometers from Damauli, about 500 meters north of the Prithivi Highway. For the plant's construction, the developer has leased 15 ropanis of land. The suggested location is in a sunny region that receives plenty of light throughout the day. Furthermore, because there are only a few houses on one side of the proposed plant (the northwestern side), the project will have a minor social impact due to the low population density.

To design and run the plant, the developer has teamed with SLPP RE-NEW, a reputable technology supplier from India with 15 years of expertise in the industry. The technology supplier will offer Engineering, Procurement, and Construction (EPC) services, as well as be accountable for the plant and machinery's overall performance. The technology supplier will also train the plant's workers and operators to ensure a smooth transition when the project is handed over to the developers.

The plant's principal output will be compressed biogas, with organic fertilizers as a secondary output. The compressed biogas will be distributed to adjacent hotels, restaurants, and other businesses as an LPG alternative at a cost of around 10% less than the current LPG/kg pricing. Similarly, organic fertilizers will be sent to numerous farms in the area surrounding the facility, as well as across the country.

The essential financial metrics show that this idea is financially viable. The project's internal rate of return is 14.93%, and the payback period is 8 years.

Case Study 2²⁰

Project Type: Michigan Community Anaerobic Digester

Location: Fremont, Michigan, USA

Total Capital Investment: USD 22 million

20 Mass.gov. (2021). Anaerobic Digestion Case Studies. Retrieved from <https://www.mass.gov/info-details/anaerobic-digestion-case-studies>

The Fremont Community Digester facility in Fremont, Michigan, processes over 100,000 tons of food waste each year to provide biogas, power, and soil amendment. NOVI Energy created this system, which employs a full mix anaerobic wet digester capable of processing a wide range of feedstocks. Three one-million-gallon digester tanks collect trash from a range of sources, including food processing waste, dairy products, ethanol manufacturing byproducts, and industrial glycerin and alcohols, and process it in an oxygen-free environment for around 22 days. Local businesses like Gerber and McDonald's send garbage to the digester, which helps them manage their production waste effectively. Some source-separated organics producers have agreed to 20 or 30 years contracts with the developer, assuring the facility's long-term viability. This wet digester system can vary between thermophilic (115-160 degrees Fahrenheit) and mesophilic (86-104 degrees Fahrenheit) processes

as needed, however it operates at thermophilic temperatures on a regular basis. Thermophilic systems have higher reaction rates and shorter processing periods, but they are more susceptible to temperature fluctuations, which might impact methane generation. Biogas from the digester powers three 3 -MW generators, and all of the electricity generated is supplied to a local utility under a 20-year contract.

This \$22 million project, which was additionally backed by a \$12.8 million USDA Rural Development Loan Guarantee, was made possible by a Michigan state legislation mandating utility companies to purchase 10% of their electricity from in-state renewable sources by 2015. The operator intends to use excess heat from the facility's generators in the future to heat and pump hot water around the industrial park for use by other businesses.

3

FINANCIAL ANALYSIS

3.1 Pre-Feasibility Approaches & Assumptions

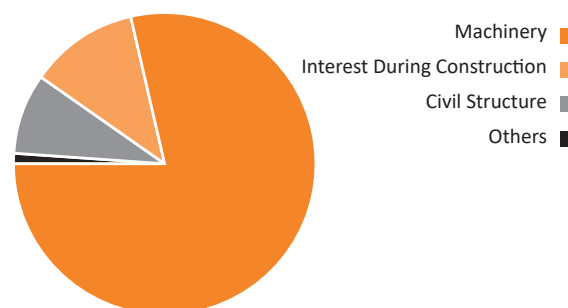
Project Cost

Total cost of the project amounted to NPR 639,550,655.00 excluding interest during construction. The Total cost including interest amounted to NPR 723,957,773.00, costs are assumed to occur evenly in the construction period.

Particulars	Amount in NPR
Land	-
Civil Structure	63,955,065.00
Machinery	569,200,083.35
Others	6,395,506.55
Interest During Construction	84,407,118.00
Total Project cost	723,957,773.00

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Cost Composition



Capital Structure

The project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of Working capital would be financed by internal resources itself. Based on the structure, The total investment pattern has been tabulated below:

Component	Percentage	Amount in NPR
Equity	30.00%	217,187,332
Debt	70.00%	506,770,441
Total		723,957,773

Solid Waste Emission & Composition

The overall Financial Analysis is based on the total emission of the solid waste on the various municipalities. The areas that has been included in Integrated Solid Waste Management Project (ISWMP), Janakpur are listed below:

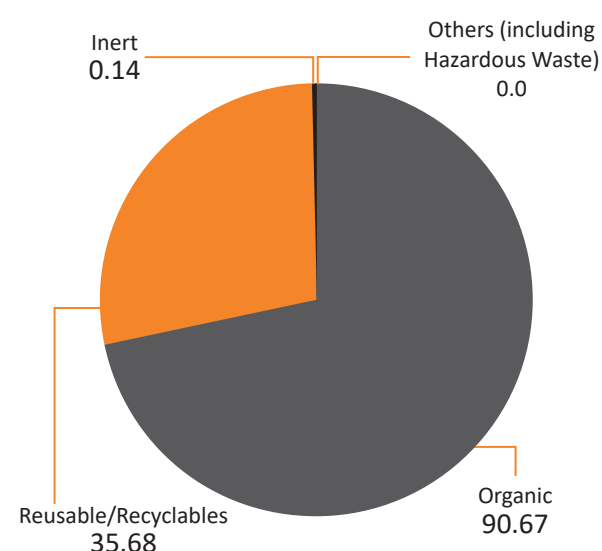
Areas Included

Janakpur Sub metropolitan, Dhanusadham Municipality and Bardibas Municipality

Total waste collection in Janakpur Package has been calculated to be 66.82 Tons per day. Based on the information and data, composition of the total Solid waste collection of Janakpur Package is tabled below:

Composition of the Waste (At 100% capacity)	In Tons	% of Composition
Organic	91	71.53%
Reusable/Recyclables	36	28.15%
Inert	0.4	0.32%
Others (Including Hazardous Waste)	0	0%
Total	127	

Waste composition in tons (100%)



Collection Efficiency

Based on the various studies conducted by international agencies and prevailing market tendency, collection of the solid waste has been assumed as follows

Household collection efficiency

From	To	Efficiency
0 year	3 years	0%
4 years	13 years	50%
14 years	23 years	60%

Out of the total collected solid waste component, It has been estimated that the following output could be realized from the project. Details of output quantity has been computed based on the efficiency as elaborated in table above.

The output is assumed to increase at the rate of 1.35% per annum, which is based on the population growth rate.

Output	Per day Output in KGS
Output- Gas	3,373.00
Output - organic Fertilizer	1,450.72
Output- Reusable/Recycles	30,328.00
Output – Pesticide	12,084.50

Project Construction and Operation Period

The project is assumed to be built in the period of 3 years. And the total operation period after the construction period would be 20 years. The project would be handed over to the government after the completion of the operation period.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project is assumed at 25% on profit earned during the year. Further the loss carryforward has been taken for 12 years in due consonance with the provision of Income Tax Act 2058. Further, the staff bonus is assumed at 10% on taxable income earned during any year of the operation as required by The Bonus Act.

Also, the rate depreciation and basis of depreciation is in due adherence to the provisions of the Income Tax Act as follows:

Particulars	Depreciation Method	Rate of Depreciation
Land	SLM	5
Civil Structure	WDV	5%
Machinery	WDV	15%
Others	SLM	20%

However, 1/3 of the additional depreciation has not been taken into consideration as facilitated by Income Tax Act.

Basis of Revenue and Inflation

The project has mainly two streams of Revenue Module:

1. Collection from household &
2. Revenue from sale of output from organic digestion.

Followings are the rates of sales of the output generated from Organic & Reusable Solid wastes collected.

Particulars	Sales Rate in Dollars/KG	Sales Rate in NPR
Gas	0.75	85
Organic Fertilizer	0.13	15
Reusable/Recycles	0.07	8
Pesticide	0.07	8

Further, each household is charged at the rate of NPR 300 as monthly charges. Total number of households in the beginning of the period 54,900 is families. The increase rate of the number of families is based on the growth rate in population and output as discussed above. The sales inflation rate is assumed to increase at the rate of 3% Per annum and which would be capped at 180%.

Other Cost of Operations

The project is estimated to have a total operating cost of 7% based on the project initial. The operations cost are inclusive of all staff salary, vehicle maintenance but don't include Interest cost and depreciation cost component. It is further assumed that the total operating expense is likely to increase at the rate of 4% With the cap of 200%. As discussed in earlier paragraph, the project would be financed by 70% debt. The Interest rate that has been taken into the calculation is 12% which would be repaid in four equal installment in the period of 12 years.

Working Capital and other Assumptions Used

It has been assumed that the overall working capital requirement would be financed by the equity holders. The working capital has been assumed on the following basis.

Receivable & Advance	30	Days
Payable and Liabilities	15	Days

Total number of working days has been assumed to be 330 days and 12 working months. The total population living in the project area of Janakpur Package is 399,868 persons.

3.2 Financial Analysis

3.2.1 Financial Results

The cost of the Solid Waste Management Project (SWMP) in Janakpur was derived from an IBN desk research report. All costs are assumed to be in accordance with the current cost structure. The project development cost is also supposed to have been calculated using district rates and current market rates.

The overall cost of the project is NPR 723,957,773 with an interest component of NPR 84,407,118 throughout construction. The overall project, excluding working capital, was financed by loan for 70% and equity for the remaining 30%.

Projections are created utilizing several methodologies in the examination of the project's pre-feasibility. The project's Net Present Value (NPV) was found to be NPR 122,456,936.40 based on the analysis.

Furthermore, the project IRR is assessed to be 14.81%, which is higher than the project's needed rate of return. The project's equity IRR is 16.41%. The project's IRR and equity IRR prove the project's viability. The Benefit Cost Ratio (BCR) for a project is 1.19 times, whereas the BCR for equity is 1.56 times.

The project payback period is 6.51 years, while the equity payback period is 13.12 years. The pay-back term appears to be enough, given the nature of the firm and the broader industry.

Indicators	Results
Firm IRR	14.81%
Equity IRR	16.41%
NPV Equity	122,456,936.40
Debt Equity Service Coverage Ratio (Average)	1.42 times
Project BCR	1.19
Equity BCR	1.56
Simple Payback Period	6.51 years
Discounted Payback Period	13.12 years

The average DSCR is calculated to be 1.42 times. Although the DSCR was initially low, it has steadily grown.

3.2.2 Sensitivity Analysis

Sensitivity Analysis has been carried out on three different components: Interest Rate, O & M Cost and Project cost.

Interest Rate Increase/Decrease by 5%

Percentage of Change Project Cost	Impact on Project IRR	% of Change
0.00%	16.41%	-
5.00%	15.91%	-3.05%
-5.00%	16.92%	3.06%

O & M Increase/Decrease by 5%

O & M Cost	Impact on Project IRR	% of Change
0.00%	16.41%	-
5.00%	15.90%	-3.11%
-5.00%	16.93%	3.13%

Project Cost Increase/Decrease by 5%

Project Cost	Impact on Project IRR	% of Change
0.00%	16.41%	-
5.00%	14.96%	-8.85%
-5.00%	18.00%	9.64%

Based on the analysis, It seems that the project cost is highly sensitive as compared with O & M Expenses and Interest rates. The special focus to provide to project cost ensuring the cost remains as the as projected.

The Financial Statement of the first 10 years of operation has been separately annexed in the report.

4

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

There are a lot of laws that govern solid waste management and all of the activities that go along with it. The most important ones are listed below:

1. Solid Waste Management National Policy, 1996

To address the rising solid waste management difficulties caused by urbanization, the first Solid Waste Management National Policy was created in 2053 BS (1996 AD). Waste management in municipal and urban regions was stressed in the policy. This policy remains in effect.

2. Solid Waste Management Act, 2011

The Nepalese government passed the Solid Waste Management Act of 2011, which took effect on June 15, 2011. The act's goals include keeping the environment clean and healthy by reducing the negative impacts of solid waste on public health and the ecosystem. Municipalities, for example, have been given responsibility for the building, operation, and administration of MSW collection, treatment, and final disposal infrastructure. Local Governments are required to make the appropriate efforts to encourage reduce, reuse, and recycle (3R), including MSW segregation at the source, under the legislation. Through competitive bidding, it also allows the private sector, Community Based Organizations

(CBOs), and Non-Governmental Organizations (NGOs) to participate in SWM. Bidding procedures, the selection of the winning bidder, and the bidder's power to collect tipping fees (tariffs) against SWM services are all outlined. The legislation also enables the imposition and collection of service fees against SWM services, as well as the grounds for determining such costs and the processes for collecting and using them. It also allows Local Governments, with the agreement of the municipal board, to create regulations, bylaws, and guidelines.

3. The Local Government Operations (LGO) Act, 2018

The Local Government Operations Act of 2017 has established and delimited distinct duties and procedures for SWM throughout Local Governments, in keeping with Nepal's 2015 constitution's power segregation. Local Governments are required under the legislation to work with the private sector to carry out solid waste management-related duties. Local Governments have been given regulatory and monitoring powers, as well as the ability to facilitate garbage disposal from families, slaughterhouses, and even healthcare facilities. In order to reduce carbon emissions, the LGO Act 2017 promotes Local Governments to use environmentally friendly technology. Local Governments are also responsible for the building and operation of sanitary landfills according

to established standards, as well as the competitive contracting and licensing of private sector actors and Non-Governmental Organizations (NGOs) for SWM services. Similarly, Local Governments can charge a fee for waste management services provided via it.

4. Solid Waste Management Regulation, 2013

Under the rights of the Solid Waste Management Act, 2068, the Nepalese government produced the Solid Waste Management Regulation in 2013. This rule emphasizes the separation of hazardous waste at the source and states that the producers are responsible for the correct disposal and management of separated hazardous waste. The legislation also prioritizes waste separation and reduction at the point of generation. As a result, the need of Local Governments in raising public awareness about proper garbage management has been highlighted.

5. Environmental Protection Act, 2019

The Environmental Protection Act of 2076, which amends and consolidates existing environmental legislation, went into effect recently. The Act aims to:

- Protect each citizen's fundamental right to live in a clean and healthy environment.
- Compensate victims for damages caused by pollution or degradation of the environment.
- Maintain a proper balance between environment and development.
- Mitigate negative environmental impacts on the environment and biodiversity.
- Face the challenges posed by climate change.

6. Sustainable Development Goals (SDGs), 2016-2030

The SDG No. 11 objective 6 calls for cities to decrease their negative per capita environmental effect by focusing on air quality and municipal and other waste management. Nepal has established two objectives and indicators in municipal waste management in compliance with SDG No. 11, target 6. The number of municipalities with sewage systems reaching 100% by 2020, and the percentage of private hospitals separating waste reaching 100% by 2017.

7. Investment Board Act, 2068 (2011)

OIBN has been supporting investment in solid waste management projects in urban areas under section 9 (1) (C) of the Investment Board Act, 2011 (2068 BS). "Regardless of any condition made in existing laws, the investment necessary for the implementation of any project for Solid Waste Management and Treatment in urban areas should be mobilized based on this Act," the law adds. As a result, every project of this sort should be approved by the Investment Board before it is implemented.

Solid waste management has been given a low priority in many Nepalese municipalities, owing to the larger demand for other public services. Due to a shortage of SWM baseline information and data relevant to the functional parts of SWM, Local Governments are having difficulty formulating management plans. When creating and executing comprehensive waste management strategies that incorporate resource recovery through suitable means, it is critical to determine the quantity and composition of Municipal Solid Waste (MSW).

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Environmental assessments of waste processing and management facilities must be completed with the goal of providing services to the local community. According to Nepalese legislation, depending on the scope, length, and size of environmental consequences, an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) must be conducted. The following projects, as stated in the Environment Protection Rules (EPR), need IEE:

In the case of municipal waste,

1. Every year, one thousand to five thousand tons of rubbish are dumped on the ground.
2. Transfer stations and resource recovery sites take up between 5 and 10 hectares of land.
3. In an area of 5 to 10 hectares, selecting, picking, discarding, and recycling garbage using chemical, mechanical, or biological processes.
4. Activities using compost plants in a 5 to 10 hectare area.
5. Sewerage scheme operations total more than USD 5 million.

Similarly, the following projects should complete an Environmental Impact Assessment, if necessary,

1. Waste management operations with the goal of serving a population of more than 10,000 people.

2. The activities listed below are related to garbage generated from homes and residential areas.
3. Every year, more than 5,000 tons of rubbish are dumped on the ground.
4. The activities related to the transfer station and the resource recovery zones encompass more than 10 hectares.
5. In an area of more than 10 hectares, selecting, choosing, discarding, and recycling trash using chemical, mechanical, or biological processes.
6. Compost plant activity covered an area of more than 10 hectares.
7. Waste discharged from a city with a population of at least 10,000 people is buried.

The project is intended to have significant environmental and social advantages for the regions and nearby rural municipalities where a modern system for collecting and disposing of municipal solid waste will be implemented, preventing garbage dumping and burning.

During the project's execution, the following particular benefits might be realized:

- Improved waste collection and transportation in the area and neighboring municipalities with heavily inhabited areas.

- Environmental conditions and the appearance of residential areas and their surroundings will be improved.
- Waste disposal that is both sound and safe, as well as a single sanitary landfill.
- Employees of the garbage collection unit have better working conditions.
- Cleaner yards and streets, as well as improved health and safety for women and children.
- Improved environmental awareness, education, public engagement, and background for all age groups to have better waste management practices.

- Improved attractiveness of the region for tourists.
- Business growth and capacity building on a local level.
- Improved waste management system, governance and transparency.

The project's environmental and socioeconomic advantages are projected to have a long-term impact on the surrounding areas and towns, as well as serve as a model for Madhesh Province and Nepal as a whole.

PRELIMINARY RISK ANALYSIS

Due diligence and transparency at the time of original project development, selection of plant location, and undertaking environmental and social impact assessments are all risk considerations that cross all technologies. When the above issues are not handled effectively at the right point of project evolution, several plants throughout the world have shut down. The following are some of the most significant risks:

- The community is opposed to a sanitary landfill site.
- From the standpoint of the plant operator, municipal solid waste that is to be processed

and so obtain value addition must be viewed as "feedstock" rather than "waste." As a result, a shortage of garbage might cause the facility to operate inefficiently.

- The community might not accept the tariff rate.
- Land for a processing plant and a hygienic landfill site is scarce.

The municipality and the Provincial Government should split the risk. While developing the project development agreement, the detailed framework should be chosen.

Risk Matrix

Severity		Score					
	Catastrophic	10	10A	10B	10C	10D	10E
		9	9A	9B	9C	9D	9E
	Hazardous	8	8A	8B	8C	8D	8E
		7	7A	7B	7C	7D	7E
	Major	6	6A	6B	6C	6D	6E
		5	5A	5B	5C	5D	5E
	Minor	4	4A	4B	4C	4D	4E
		3	3A	3B	3C	3D	3E
	Negligible	2	2A	2B	2C	2D	2E
		1	1A	1B	1C	1D	1E
		Extremely Impossible	Impossible	Remote	Occasional	Frequent	
		A	B	C	D	E	
		Likelihood					
		ACCEPTABLE (LOW)					
		REVIEW (MEDIUM)					
		NEED OF CRITICAL ANALYSIS (HIGH)					

The risk matrix above was created and color-coded based on the severity and likelihood of the risk factor. The severity scale ranges from negligible to catastrophic on a scale of one to ten, while the likelihood is graded on a scale of exceedingly seldom to frequent, with letters ranging from A to E. A risk factor with a score of 4B, for example, is viewed as small on a severity scale and

unattainable in terms of probability. This will be in the green zone, indicating that the risk is at a low tolerable level, however if the risk factor has a score of 10E, it indicates that the severity is catastrophic, with a high possibility of occurring frequently, and it will be in the red zone. This means that prior to the project's execution, this risk element must be thoroughly examined.

Table 5: Risk factor analysis

S.N.	Possible Risks	Description	Risk Score	Risk Bearing in %		Possible Mitigation	Remarks
				Govt.	Developer		
1	MoU Signing	Understanding between Two Parties	5C	50%	50%	- Regular engagement with all the stakeholders - Transparent and agreeable document	
2	Land Acquisition	Land Availability	5C	100%	0%	- There are land available but not committed for the project yet - Early communication with the municipalities to find the appropriate land and get an early commitment	
3	Local Opposition (Landfill Site)	Local Community Opposition	6D	90%	10%	- Finding land away from the local settlement - Following international practices for the landfill design - Developing effective compensation package for the affected people	
4	Financial Closure	Developer should have all the necessary financial documents	5C	0%	100%	- Regular communication with the developer - Making sure all the financial documentation are correct and verifiable	
5	Infrastructure Development (Time)	Time of Construction	6C	0%	100%	- Sticking to the original plan - Contingency plan should be incorporate in the overall planning	
6	Recruitment and Management of Workforce	Staffs and Labor Issues	5D	0%	100%	- Structured Training and development plan should be in place - Provide incentive to the existing workforce for retaining them	
7	Collection and Segregation	Source Segregation	1C	0%	100%	Ensure education and outreach program in place for awareness raising prior to the beginning of the project	
8	Tariff Rate	Finalizing the Rate	5D	50%	50%	- Develop a scientific method for calculating the tariff rate - Regular communication with all the relevant stakeholders	

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnerships (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investment²¹.

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

The PPP model is appropriate in the current environment of Janakpur Sub-Metropolitan and its neighboring municipalities. According to the preliminary research done in these towns, the local government would give land for the construction of integrated solid waste management projects.

21 World Bank, 2072, Public Private Partnership Policy

8

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. Based on their daily waste output and other important criteria, the project includes Janakpur Sub-Metropolitan City, Dhanusadham Municipality, and Bardibas Municipality in Madhesh Province.
2. Anaerobic digestion is the most suitable and relevant waste to energy plants that has been considered, according to the study, since the methane gas will be compressed, bottled, and sold to the local market. Additionally, 2% of organic input can be used as fertilizer, and 16.66% of organic input can be used as a bio-pesticide.
3. The project's business model was determined to be a Public Private Partnership.
4. With a total cost of NPR 723,957,773.00 (including interest component during construction term). Furthermore, the Project IRR is assessed to be 14.81%, which is higher than the project's needed rate of return. The project's equity IRR is 16.41%. The project's IRR and equity IRR prove the project's viability.
5. The project payback period is 6.51 years, while the discounted payback period is 13.14 years.

8.2 Recommendations

The project appears to be technically and financially viable for a developer to invest, based on the findings. In the following step, however, environmental and social aspects, as well as a thorough examination of all other components, must be addressed.

Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.

9

ANNEX

9.1 Next Steps and Useful Contacts

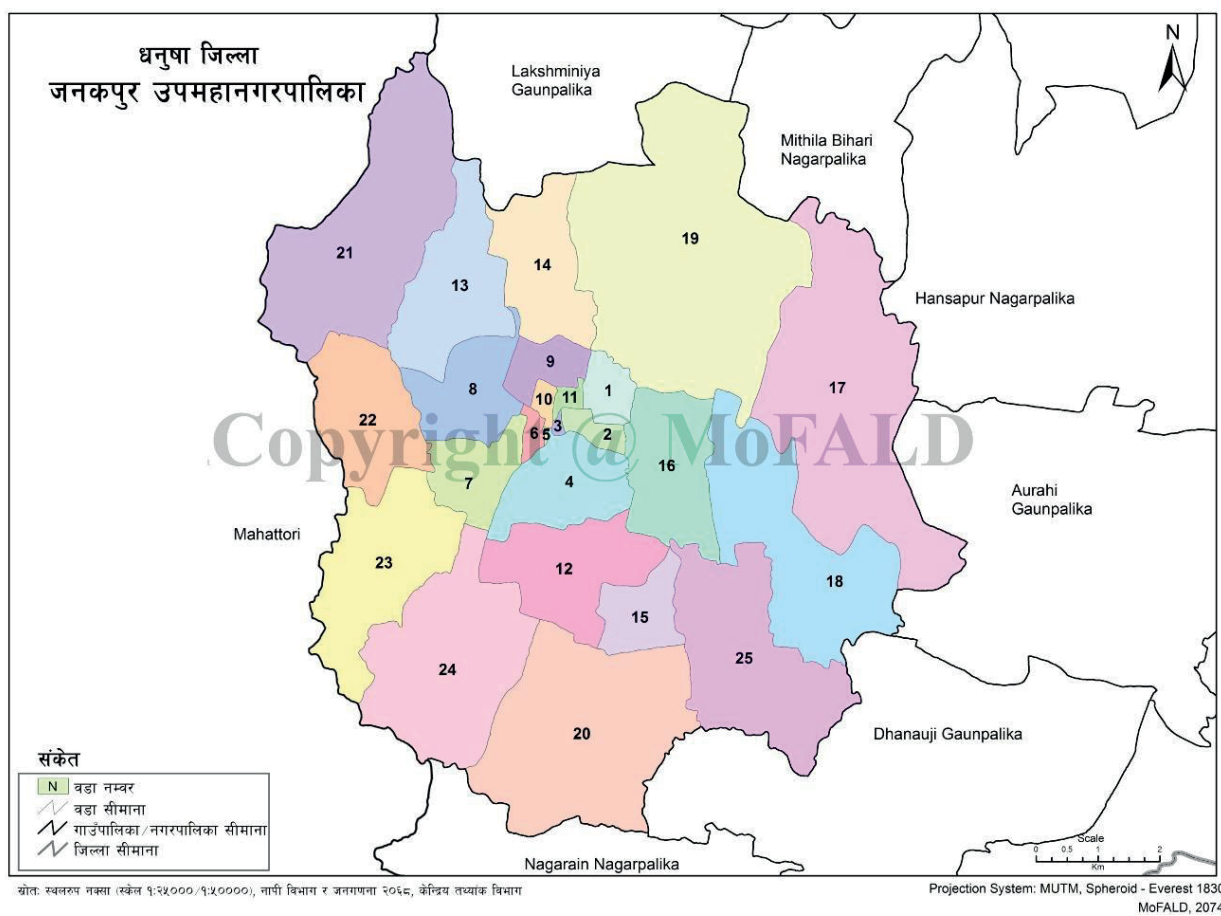
As part of further development of the project, the potential developer who might be interested to develop this project will be identified. Afterwards, a

communication channel will be formulated for the effective execution of this project. The useful contacts of all the municipalities incorporated in this are highlighted as follows;

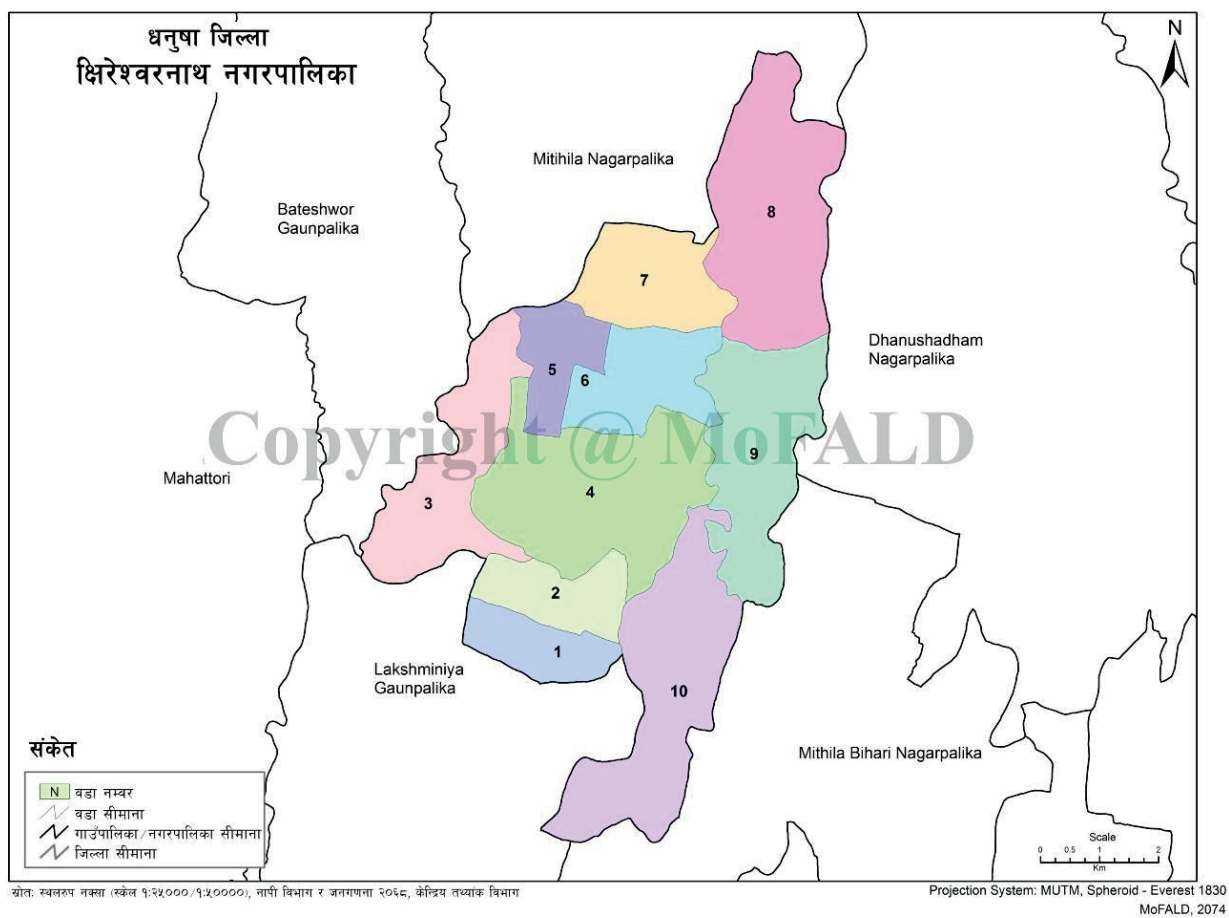
Table 6: Useful contact information

S.No.	District	Municipality	Chief Administrative Officer	Mayor
1	Dhanusa	Janakpur Sub-Metropolitan City	Pradhumna Prasad Upadhyaya	Lal Kishor Sah
4	Mahottari	Bardibas	Rewati Prasad Parajuli	Bidur Kumar Karkee
5	Dhanusa	Dhanusadham	Ganeshraj Karki	Baleshwor Mandal

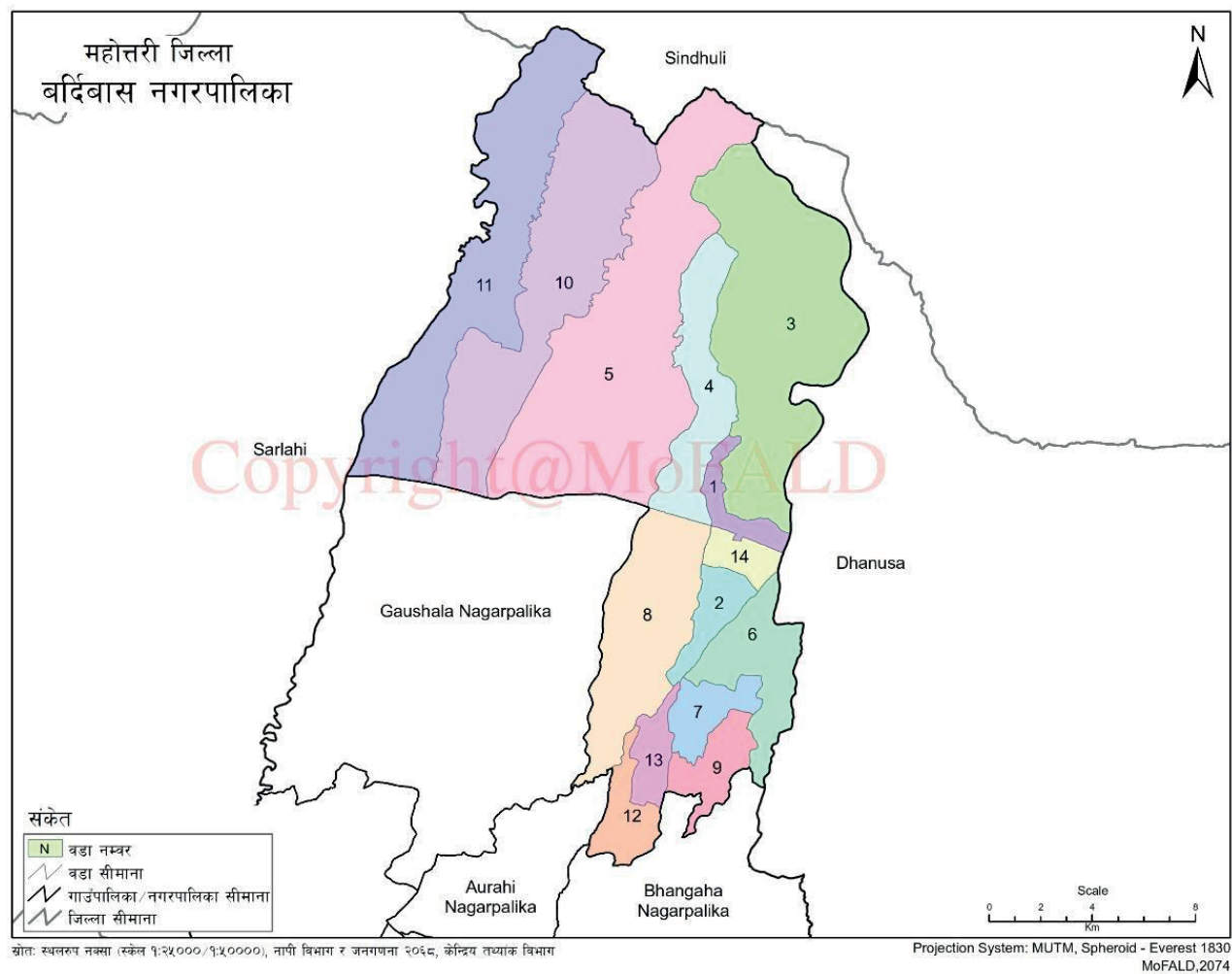
9.2 Map of Janakpur Sub-Metropolitan City



9.3 Map of Dhanushadham Municipality



9.4 Map of Bardibas Municipality



9.5 Financial Report

Projected Profit and Loss Statement for Initial 10 years

Particulars	Amount in NPR									
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Household Collection Fees	21,960,000	23615634	24651921	25729131	26848788	28012467	29,258,699	30554494	31901704	33,302,248
Output- Gas	47,944,960	53,243,686	56,486,226	59,926,237	63,575,745	67,447,508	71,555,061	75,912,764	80,535,852	85,440,485
Output - Organic Fertilizer	3698248	4041175.4	4287283	4548378.5	4825374.8	5119240.1	5431001.8	5761749.8	6112640.4	6484900.2
Output- Reusable/Recycles	40573405	45057449	47801448	50712556	53800951	57077429	60553444	64241149	68153435	72303979
Output - Pesticide	16166886	17953599	19046973	20206934	21437536	22,743,082	24,128,135	25,597,539	27,156,429	28,810,256
Total Income	130,343,499	143,911,543	152,273,851	161,123,237	170,488,394	180,399,725	190,926,342	202,067,696	213,860,060	226,341,868
Operating Expenses	-									
Depreciation	101,716,067	87,037,823	74,543,217	63,905,608	54,847,306	45,684,316	39,111,761	33,511,084	28,737,205	24,666,768
O & M Expenses	52,704,126	54,812,291	57,004,783	59,284,974	61,656,373	64,122,628	66,687,533	69,355,034	72,129,236	75,014,405
Operating Profit	-24,076,694	2,061,429	20,725,851	37,932,655	53,984,715	70,592,782	85,127,048	99,201,578	112,993,620	126,660,694
Interest Expenses	59,921,177	57,372,569	54,504,088	51,275,588	47,641,882	43,552,115	38,949,046	33,768,251	27,937,220	21,374,344
Profit	-83,997,871	-55,311,140	-33,778,237	-13,342,933	6,342,833	27,040,667	46,178,002	65,433,327	85,056,399	105,286,350
Provision for Staff Bonus	0	0	0	0	576,621	2,458,242	4,198,000	5,948,484	7,732,400	9,571,486
Income Tax	0	0	0	0	0	0	0	0	5,676,825	23,928,716
Net profit	-83,997,871	-55,311,140	-33,778,237	-13,342,933	5,766,212	24,582,424	41,980,002	59,484,843	71,647,174	71,786,148

Projected Balance Sheet for Initial 10 years of Operation

Amount in NPR

Particulars	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Sources of Fund	-									
Shareholders Fund	-									
Share Capital	217187332	217187332	217187332	217187332	217187332	217187332	217187332	217187332	217187332	217187332
Reserve and Surplus	-83997871	-139309010.5	-173087247.4	-186430180	-180663968.4	-156081544	-114101542	-54616699	17030476	88816623
Loan Fund	-									
Term Loan	486,464,234	463,609,419	437,886,124	408,934,328	376,348,827	339,673,559	298,395,221	251,936,088	199,645,924	140,792,884
Short Term Loan	-									
Total	619,653,696	541,487,741	481,986,209	439,691,480	412,872,191	400,779,347	401,481,011	414,506,721	433,863,732	446,796,840
Fixed Assets (Net)	622,241,706	535,203,883	460,660,666	396,755,058	341,907,752	296,223,437	257,111,676	223,600,592	194,863,387	170,196,618
Investment	-									
Current Assets	-392,005	8,567,703	23,700,742	45,406,629	73,533,454	107,227,686	147,147,982	193,795,922	242,005,730	279,725,822
Sundry Debtors	11,849,409	13,082,868	13,843,077	14,647,567	15,498,945	16,399,975	17,356,940	18,369,791	19,441,824	20,576,533
Advances	0	0	0	0	0	0	0	0	0	0
Cash & Bank Balance	-12,241,414	-4,515,164	9,857,665	30,759,062	58,034,509	90,827,711	129,791,042	175,426,131	222,563,906	259,149,288
Less: Current Liabilities	2,196,005	2,283,845	2,375,199	2,470,207	2,569,016	2,671,776	2,778,647	2,889,793	3,005,385	3,125,600
Net Current Assets	-2,588,010	6,283,858	21,325,543	42,936,422	70,964,438	104,555,910	144,369,335	190,906,129	239,000,345	276,600,221
Total	619,653,696	541,487,741	481,986,209	439,691,480	412,872,191	400,779,347	401,481,011	414,506,721	433,863,732	446,796,840

The cash balance is seen as negative in initial years, the amount has to be injected by the equity holders.

Cash Flow Statement For Initial 10 years of Operation

Amount in NPR

Particulars	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Cash Flow from Operating Activity										
Net Profit before Interest and Tax	-83,997,871	-55,311,140	-33,778,237	-13,342,933	5,766,212	24,582,424	41,980,002	59,484,843	77,324,000	95,714,864
Add: Depreciation	101716067	87037823.29	74543217.07	63905607.79	54847305.6	45684315.61	39111761	33511084	28737205	24666768
Add: Interest	59921177	57372568.71	54504088.09	51275587.89	47641882.46	43552114.99	38949046	33768251	27937220	21374344
Operating Cash Flow before Working Capital Change	77639373	89099252	95269068.34	101838262.8	108255399.9	113,818,855	120,040,809	126,764,178	133,998,425	141,755,976
Increase/Decrease in Current Assets	-11,849,409	-1,233,459	-760,210	-804,490	-851,378	-901,030	-956,965	-1,012,850	-1,072,033	-1,134,710
Increase/Decrease in Current Liabilities	2,196,005	87,840	91,354	95,008	98,808	102,761	106,871	111,146	-2,722,821	-9,005,730
Payment of Tax	0	0	0	0	0	0	0	0	-2,838,413	-14,802,771
Net Cash Flow from Operating Activity	67,985,969	87,953,634	94,600,212	101,128,781	107,502,830	113,020,586	119,190,714	125,862,473	127,365,158	116,812,766
Cash Flow from Investing Activity										
Purchase of Fixed Assets	-723,957,773	0	0	0	0	0	0	0	0	0
Increase/Decrease in Investment	-	-	-	-	-	-	-	-	-	-
Less: Payment of Dividend	-	-	-	-	-	-	-	-	-	-
Net Cash Flow from Investing Activity	-723,957,773	0	0	0	0	0	0	0	0	0
Cash Flow from Financing Activity										
Increase in Share Capital	217,187,332	0	0	0	0	0	0	0	0	0
Increase in Borrowing Fund) (Long Term Loan	506,770,441	-	-	-	-	-	-	-	-	-

Particulars	Amount in NPR											
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years		
Increase in short Term Loan	-											
Less: Repayment of Long Term Loan	-20,306,207	-22,854,815	-25,723,295	-28,951,796	-32,585,501	-36,675,269	-41,278,338	-46,459,133	-52,290,163	-58,853,040		
Less: Payment of interest on Short Term Loan	-											
Less: Payment of Interest on Long Term Loan	-59,921,177	-57,372,569	-54,504,088	-51,275,588	-47,641,882	-43,552,115	-38,949,046	-33,768,251	-27,937,220	-21,374,344		
Net Cash Flow from Financing Activity	643,730,390	-80,227,384	-80,227,384	-80,227,384	-80,227,384	-80,227,384	-80,227,384	-80,227,384	-80,227,384	-80,227,384		
Increase/Decrease in Cash and Cash Equivalent	-12,241,414	7,726,250	14,372,829	20,901,398	27,275,447	32,793,202	38,963,331	45,635,090	47,137,775	36,585,382		
Cash & Bank Balance at the Beginning of the Period	0	-12,241,414	-4,515,164	9,857,665	30,759,062	58,034,509	90,827,711	129,791,042	175,426,131	222,563,906		
Cash Balance At the End of the Period	-12,241,414	-4,515,164	9,857,665	30,759,062	58,034,509	90,827,711	129,791,042	175,426,131	222,563,906	259,149,288		

The Equity shareholders need to inject additional cash for serving Working capital in initial years as assumed in the report Earlier.

PRE-FEASIBILITY STUDY OF
**SOLID WASTE MANAGEMENT: BIRGUNJ,
JEETPUR AND SIMARA PROJECT**

EXECUTIVE SUMMARY

Solid waste management is a big issue for Nepalese municipalities. In recent years, rapid urbanization, population increase, modern throwaway culture, restricted landfill capacity, and rising disposal prices have made this a huge burden. In the next few years, this will only get worse. As a result, it is critical that we acknowledge this problem and plan for the future.

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives. The solid waste management industry has been designated as one of the important sectors for foreign investment. The major goal of the "Solid Waste Management Project (SWMP)" research is to represent the existing waste management scenario in suggested places such as Janakpurdham, Dhanushadham, and Bardibas in Madhesh Province, as well as to establish the project's technical and financial viability. Both primary and secondary data gathering approaches were used in the study. Primary data was acquired from field-based research, which included a field visit and stakeholder consultations and group discussions. Secondary data was gathered from a

variety of sources, including published papers, journal articles, and other verified and trustworthy online sources.

This project appears to be most suited for a Public Private Partnership (PPP) model, in which GoN will assist in obtaining the necessary property for the project, including land for the development of transfer stations, a processing facility, and a landfill site. The developer will then build all of the infrastructure required for the project's smooth execution and will run it for 20 years before handing it over to GoN in good working order.

The research examined the project's technical and financial features and determined that it is technically and financially feasible, with a total projected cost of roughly NPR 723,957,773 (including interest component throughout construction time). Furthermore, the Project IRR is assessed to be 14.81%, which is higher than the project's needed rate of return. The project's equity IRR is 16.41%. The project's IRR and equity IRR prove the project's viability.

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SALIENT FEATURES OF THE PROJECT

Table 1: Salient features of the project

General information of the project		
1	Name of Project	Solid Waste Management Project: Birgunj, Jeetpur, Simara
2	Project Location	Province: 2 District: Parsa and Bara Municipality/Rural Municipality: Birgunj Metropolitan City, Jeetpur-Simara Sub-Metropolitan City and Gadhimai Municipality.
3	Project Implementation Modality	Proposed project development modality. ☐ Public ☒ PPP ☐ Private ☐ Others/Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Infrastructure
6	Type of Project (Sub Sector)	Sanitation
7	Implementing/Facilitating Agencies	Private sector, facilitated by the provincial Ministry of Industry, Tourism, Forest and Environment and Province Policy and Planning Commission.
8	Project Management (Implementation Mechanism)	Private sector will execute and manage the project with the support from the Federal, Provincial and Local Governments and other local stakeholders.

Project specific information

1	Salient Features of Project	
	Collection of Waste	Household and commercial collection of waste in certain interval.
	Anaerobic Digestion	- Mesophilic (35-38 degree Celsius)/ Thermophilic (above 50 degree Celsius). - The methane gas will be compressed, bottled and sold to the local market. - Organic fertilizer and pesticide will be generated.
	Other Features	- The project will reduce the adverse impacts of solid waste pollution on human health and the ecology. - Solid waste management will also be used for energy production.
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	People living in the area of Birgunj, Simara, Jeetpur, and Gadhimai
	Population and Collection of Wastage (Census collection with per 2011)	Total Population: 4,13,370 Total Waste Collection: 131 tonnes/day Average Waste Composition: 74% organic, 20% reusable/recyclable, and 6% others (including hazardous waste).
	Land Requirement	About 15 Bighas
	Acquisition & Resettlement	The settlement issues shall be addressed after the identification of the landfill site. The Provincial Government will coordinate with the Local Government to ensure acceptance on the issue
	Materials and Ease of Access	The materials used for project construction are easily available and access to the project site is easy.
	Environmental and Social Management Plan (ESMP)	A solid waste management project of this scale would require an Environmental Impact Assessment.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desk Study ☐ Feasibility Study ☐ Detailed Engineering/DPR
4	Estimated Cost to Complete the Project	NPR 940,022,504
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months Approval and Financial Closure: 6 months Construction Period: 2 years Concession Period: 20 years
6	Project Financing Options	Majority investment of the private sector; Government to contribute for required infrastructure development such as access to running water and electricity; Government to be given minority equity stake.
7	Project Technology/Components	Collection of wastage Household and commercial collection of waste on certain intervals.

		Anaerobic Digestion • Mesophilic (35-38 degree Centigrade)/ Thermophilic (above 50 degree centigrade). • The methane gas will be compressed, bottled and sold to the local market. • Organic fertilizer and pesticide will be generated. Incineration • Burning of waste at high temperature until the wastes turn into ashes. Pyrolysis • Solid waste is decomposed by heat without the presence of oxygen. • The solid wastes are changed into gases, solid residue of carbon and ash and small quantities of liquid.
8	Contribution to SDG and Green Growth	• Solid waste management helps to eliminate the uncontrolled dumping and open burning as this the first stepping stone to achieve environmentally sound solid waste management practices. • Adequate solid waste management practices help to prevent emission of large amounts of greenhouse gases. • Solid waste management technology can derive renewable energy from organic waste. • The project will, in particular, help to attain the following Sustainable Development Goals: Goal No. 3: Good health and well being Goal No. 6: Clean water and sanitation Goal No. 9: Industry, innovation and infrastructure Goal No.11: Sustainable cities and communities
9	Project Capacity (at 100%)	131 tonnes/day
10	Project IRR	12.97%
11	Benefit Cost Ratio	1.06 times
12	Private Sector's Roles	Planning, designing, building and financing the project.
13	Government's Roles	• Equity investment from Local Governments. • Support in site identification and land acquisition. • Conflict resolution and dispute settlements. • Land leasing for decomposition of waste.

Other project information		
1	Target Beneficiaries	Local people can benefit from a clean and healthy environment.
2	Market of Project's Service/Product	Local people
3	Key Risks and Opportunities of Project Development & Operation	
	Strengths and Opportunities	• Reduces the environment pollution. • Produces energy by producing organic wastes.
	Risk and Issues	• Risks associated with solid waste management projects are mainly occupational accidents, chemical risk, ergonomic risk, and hazardous substances. • Land required for the project should be away from the residential area. • Resistance from the locals of the project site may be an issue. So, it will require strong contractual agreement before starting the project.

1

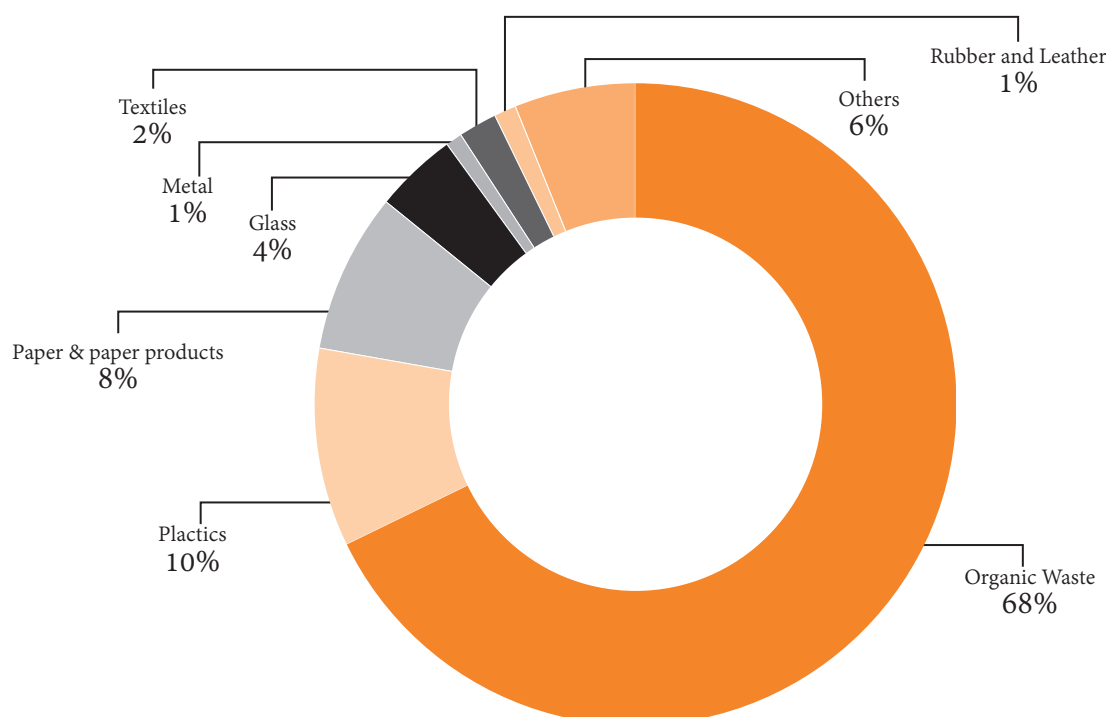
BACKGROUND

1.1 Introduction

In many developing nations, managing growing volumes of solid waste has become a big concern. Solid waste may be a beneficial resource when used properly, but if it is not adequately managed, it can have major negative consequences for each country's environment, public health, and societal sustainability. As a result, solid waste management is a vital component of urban sanitation, as well as one of the most significant and resource-intensive municipal services. Majority of the Local Government undertake these tasks internally with their own resources but some local bodies manage it externally by outsourcing it to the private contractor. Rapid and uncontrolled urbanization, lack of public awareness, modern throwaway culture, and inadequate municipal administration have all exacerbated environmental issues in Nepalese cities, including unsanitary waste management and disposal. According to a survey conducted by Nepal's Central Bureau of Statistics (CBS), the majority of city dwellers regard solid waste management to be the most pressing environmental issue in Nepal's urban areas. As a result, the Nepalese government has placed a significant focus on SWM.

1.2 Municipal Solid Waste Management in Nepal

Solid waste management is an important performance indicator and obligation for municipalities in Nepal. SWM has become a serious concern in most Nepalese cities, particularly the bigger ones, as a result of increased urbanization and changing consumption habits, putting enormous strain on municipalities. Cities like Kathmandu, Biratnagar, Birgunj, Nepalgunj, Butwal, Janakpur, and others are major urban centers with important industrial corridors and foreign commerce. As a result of the tremendous inflow of people and their changing lifestyles, massive waste creation will occur. Almost all municipalities' current waste management practices include open dumping and landfilling with no treatment. Despite the fact that certain big cities use a landfill system for waste management, the majority of areas lack sanitary waste management procedures. Municipalities in Nepal, on the other hand, lack the essential expertise and resources to properly manage trash. Currently, the majority of wastes generated in municipalities are not being adequately managed, posing a substantial health and environmental risk. This will ultimately open up investment opportunities in the waste management sector, as well as partnerships with neighboring towns. More waste indicates more technical components are used.

Figure 1: Average composition of household waste of 60 municipalities¹

Garbage creation in Nepalese municipalities is over 3023 tons per day, with an average per capita waste generation of 0.223 kg/person/day². According to the survey conducted by ADB³ organic waste accounted for 66 % of household waste, followed by plastics (12 %), and paper and paper products (9 %), according to an examination of household waste composition. Institutional wastes contained 45 % paper and paper products, 22 % organic wastes, and 21 % plastics. Commercial wastes were found to contain 43 % organic wastes, 23 % paper and paper products, and 22 % plastics. Municipal Solid Waste (MSW) is made up of 56 % organic waste, 16 % plastics, and 16 % paper and paper products when combined. This suggests that composting organic waste and reusing and recycling other materials has a lot of potential, with just around 10% of garbage ending up in landfills if resource recovery is maximized.

1.3 Rationale of the Project

- Increases overall waste diversion from final disposal, especially when biodegradable waste accounts for up to 80% of garbage in low and middle income nations.
- By eliminating organic debris from the waste stream, it improves recycling and incineration processes.
- Produces a beneficial soil amendment—essential for long-term agriculture.
- Encourages ecologically friendly actions, such as lowering landfill methane emissions.
- Improves fertilizer application efficacy.
- It is possible to minimize the amount of garbage that must be transported.
- Addresses major health consequences of organic waste, such as eliminating sources of infection-carrying insects and animals.

1 ADB, 2013, Solid Waste Management in Nepal: Current status and Policy Recommendations

2 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. *Journal of the Institute of Engineering*, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

3 ADB, 2013, Solid Waste Management in Nepal: Current status and Policy Recommendations

- Provides a fantastic chance for a city's overall garbage collection to be improved.
- Seasonal waste changes, such as leaves and agriculture debris, are accommodated.
- Existing informal garbage collection, sorting, and recycling industries can be integrated.

1.4 Objectives

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives, including solid waste management projects (2022). As a result, based on their daily waste generation and other important criteria, PPC has created a feasible package for Solid Waste Management Project (SWMP) comprising three municipalities. Finally, it wants to present such packages at the Investment Summit (2022) in order to locate the right investors for the project. As a result, the following are some of the report's primary goals:

- To get a better understanding of the existing state of solid waste management in the proposed municipalities, as well as their long-term plans.
- To investigate the project's technical and financial feasibility at the chosen site.

1.5 Scope of Work

The goal of the pre-feasibility study is to represent the current waste management scenario in the proposed area as well as to demonstrate the technical and financial feasibility of the SWMP. Finally, the research will aid in gaining a general understanding of investment opportunities in this particular sector and location. The following are some of the study's primary scopes:

- To gather main data, secondary data, and any other necessary information for the project's development.

- Analyze the acquired data for many elements such as technical, economical, social, and environmental concerns.
- Develop the most appropriate investment model, such as private, Public Private Partnership, or blended finance.
- Also, depending on the findings, provide recommendations.

1.6 Approach & Methodology

A professional team from Invest and Infra Pvt. Ltd. produced this pre-feasibility Study. After a thorough examination of market demand and business development prospects, the project's components were determined. For the purposes of determining project features/components, input collected during consultations with province-level ministries and associated stakeholders was also taken into account. Secondary and primary sources were used to obtain the necessary data, information, and facts to meet the study's goals.

Primary data was acquired by telephone and e-mail conversations, as well as a field-based research, which included a field visit. Producers, marketers, entrepreneurs, and government officials from Madesh Province (Provincial Ministries, Rural/Municipalities, etc.) participated in stakeholder consultations and group discussions.

Secondary data was gathered from numerous publications issued by Nepalese government agencies, other similar nature projects in Nepal, and academic research papers published by various organizations and experts. An appropriate investment plan was recommended based on the conclusions of a technological, social, and environmental investigation. In addition, a thorough financial study was carried out to discover some of the key financial metrics that assure the project's financial feasibility.

PROJECT DETAILS

2.1 Project Background and Description

In many developing nations, like Nepal, Solid Waste Management (SWM) is one of the most pressing environmental concerns. Increased Municipal Solid Waste (MSW) creation is caused by urban population increase and economic development. Another issue to be concerned about is the usage of items that produce hazardous waste. Medical waste from hospitals and clinics that is not properly disposed of contributes to pollution and public health risks in the community. As a result, SWM has become a top priority for Nepalese municipalities.

The current solid waste management practice in the project region is very rudimentary, with municipalities or private contractors collecting rubbish and depositing it along river banks, low lying areas, and other open places, posing several health and environmental problems. As a result, the goal is to create an integrated solid waste management strategy that includes source separation. Respective trash is transported to the transfer station and separated into recycling, non-recycling, and organic wastes, which are then processed using various technologies to produce commercial goods such as organic fertilizer, cooking gas, insecticide, and so on.

2.2 Project Features

Table 2: Project features

Municipality	Total Population ⁴	Daily Waste Generation (ton/day) ⁵
Birgunj	275454	61.4262
Jeetpur Simara	137916	30.75526
Total	413370	92.18151
Average Waste Composition (% by weight) ⁶	Decomposable	60
	Recyclable	25
	Others (Including Hazardous Waste)	15
	Source Segregation	
Project Components	Collection	
	Transportation	
	Recycling	
	Processing	
	Disposal	

The way we constructed this project, the potential developer will get more than 60 tons of waste every day, and the cities will be within a 50-kilometer radius. Furthermore, the cities we have picked have large populations and are Nepal's fastest-growing cities, with enormous development potential.

Figure 2: Population of the municipalities included in the package⁷

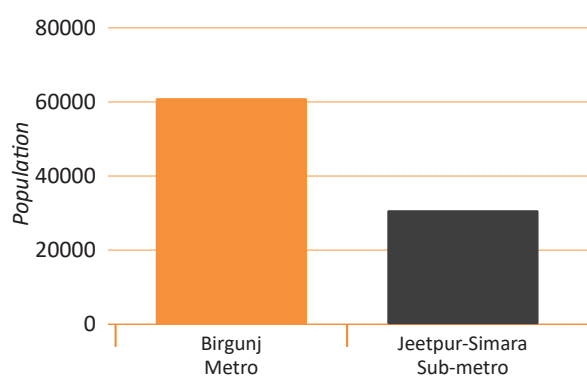
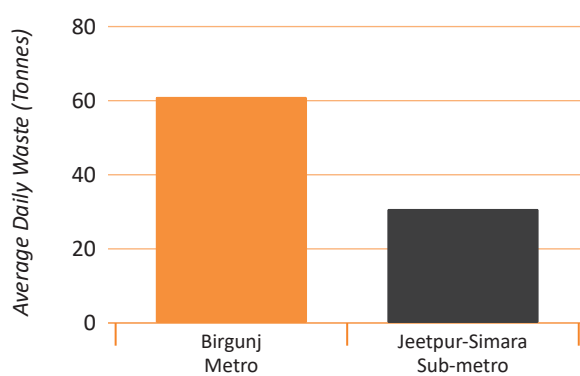


Figure 3: Waste generation of the municipalities included in the package⁸



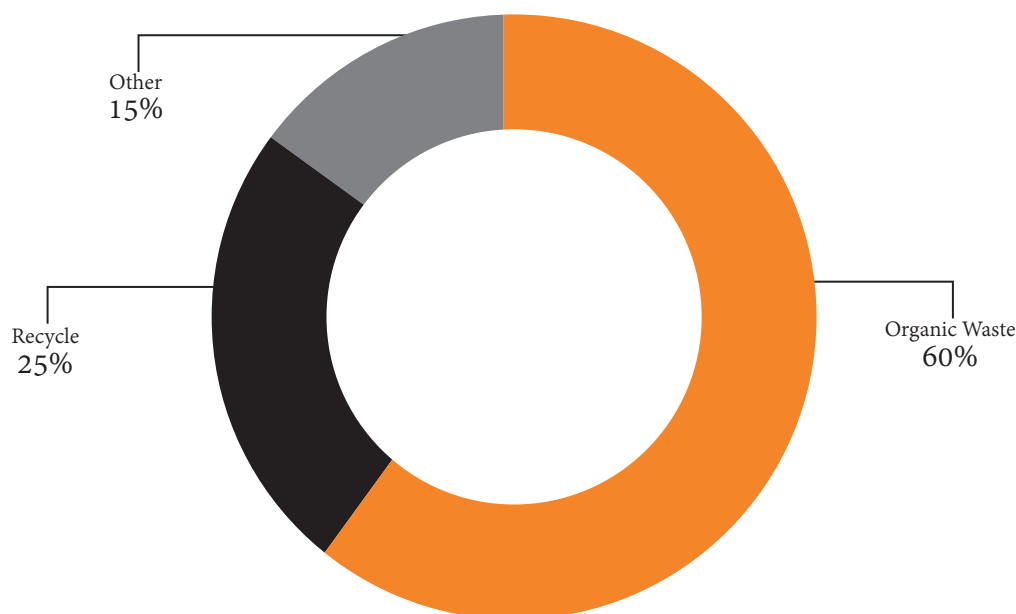
⁴ Health Management Information System 2074/75, MoHP, GoN

⁵ Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

⁶ Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

⁷ Health Management Information System 2074/75, MoHP, GoN

⁸ Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. Journal of the Institute of Engineering, 15(3), 222–226.doi:10.3126/jie.v15i3.32185

Figure 4: Average waste composition of the municipalities included in the package⁹

2.3 Overview of the Area

The project incorporates Birgunj Metropolitan city and Jeetpur Simara Sub-Metropolitan city of Madesh Province. Birgunj is a metropolitan city in Parsa district in Madesh Province of southern Nepal. It covers an area of 132.07 square kilometers. It lies 135 km south of the capital Kathmandu, attached in the north to Raxaul on the border of the Indian state of Bihar. As mentioned earlier, Jitpur Simara covers an area of 311.67 square kilometers. It is regarded as the youngest Sub-Metropolitan city in the country that lies in the Terai region of Nepal.

This package was created with the demands of the entire population, waste creation, connectivity, and specific municipalities in mind. The entrance of enormous

numbers of religious visitors, poor sanitation, and a lack of a competent waste management system are the primary sources of pollution in the region.

The Sub-Metropolitan city and other municipalities included in this package are expected to have a total population of 41337010¹⁰. The estimated population is based on Ministry of Health and Population data from 2074/75, which shows a 1.35 per cent growth rate¹¹.

There is no effective waste management system in this project area. As a result, the planned project is extremely important for the area. According to the Maharjan and Lohani study issued in 2020, the majority of trash are organic in nature and must be composted or turned into biogas¹².

9 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. *Journal of the Institute of Engineering*, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

10 Health Management Information System 2074/75, MoHP, GoN

11 Central Bureau of Statistics (CBS), 2011, Population Monograph,

12 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges. *Journal of the Institute of Engineering*, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

Figure 5: Project area location map

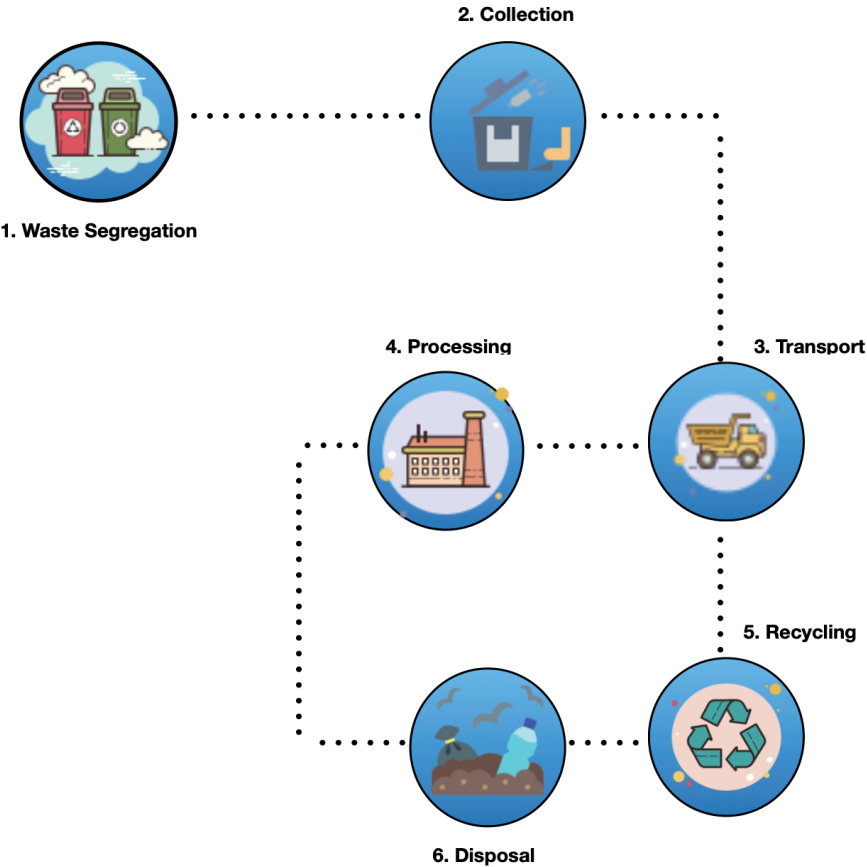


(Source: Google Maps)

2.4 Developing a Business Case

Product Mix

The following components make up the product mix for this package:



The developer should be in charge of collecting garbage that has been segregated at the source. The garbage will then be transported to a transfer station and subsequently to a processing facility, where recyclable items will be segregated and sold to a manufacturer, while organic waste will be converted into biogas, organic fertilizer, and perhaps insect repellent. The remainder of the garbage that cannot be recycled or processed is transferred to a sanitary landfill. Developers are only permitted to transfer a maximum of 20% of collected garbage to a dump site; the remainder must be transformed into one of the energy types specified above.

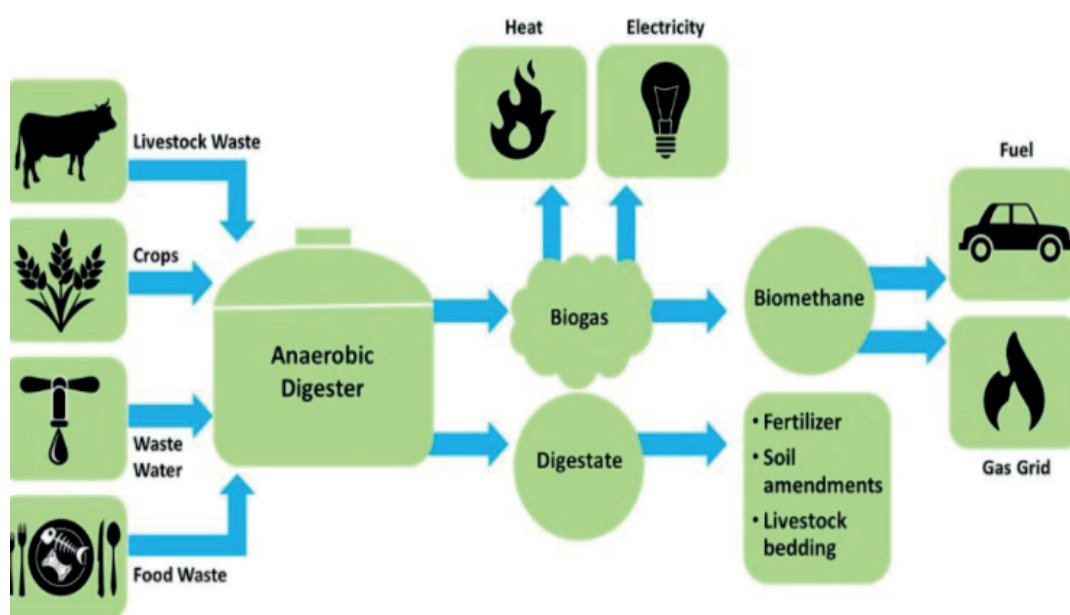
A Public Private Partnership (PPP) mechanism will be used to build this project. SWM-PPP's major goal is to foster long-term, self-sustaining partnerships between micro and small businesses and Local Governments that enhance the lives and livelihoods of impoverished people in low income cities and municipalities. As a result, the GoN will assist in providing all necessary land for the project, including land for the development of a transfer station, processing plant, and landfill site, and the developer will develop all necessary infrastructure for the smooth delivery of all the project components listed above. The developer will own and administer the project for the next 20 years before handing it over to the GoN in excellent working order.

Anaerobic digestion is an appropriate technology for the proposed municipalities based on various factors such as overall level of waste management, waste composition, waste calorific value, appropriate quantities of waste, transportation time and distance to the main processing plant, availability of land, availability of workers and capacity, existing policies related to waste management, product marketing, and incentives for low carbon generation.

Anaerobic Digestion - Design and Technology

The planned facility would use anaerobic digestion in a Mesophilic (35-38 degrees Celsius) environment. Bio-organic materials will be fed into a digester, where anaerobic decomposition of the organic materials will create biogas as the main product and compost as a byproduct, similar to the regular biogas generating process. The gas produced will then be processed to enhance the concentration of methane. The enhanced biogas is then compressed and loaded into cylinders/cascades for distribution using a suitable compressor. Furthermore, when the feedstock is source isolated and non-contaminated organic waste, the digestate can be utilized as organic fertilizer. The basic components and applications of an anaerobic digestion plant are depicted in the diagram below.

Figure 6: Components and end uses of an anaerobic digestion plant¹³



13 <https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy>

Total Land Required

According to a paper prepared by the Asian Development Bank in collaboration with the Australian Government Aid Program, an anaerobic digestion plant requires around 500 m²/ton of land (includes space for drying of slurry)¹⁴. As a result, the preliminary land area for our proposal to create the processing site is roughly 3341.421 m² (3.34 hectare). Only 80% of the biodegradable garbage collected will be fed into the system to make biogas, according to our calculations.

2.5 Market Assessment

The waste composition of our proposed municipality is as follows;

The tentative land requirement for a sanitary landfill site (based on a comparison of total waste generation) for the proposed package is approximately 3.34 hectare, according to the ADB's Towards Sustainable Municipal Organic Waste Management in South Asia: A guide book for policymakers and practitioners, published in 2011.

2.6 SWOT Analysis

SWOT analysis allows for the discovery of elements that characterize a company or organization in the context of a certain goal, as well as the classification of those characteristics into four areas. As seen in the table, two of them are positive, while the other two are negative:

Table 3: Quantity and composition of waste

Municipality	Total Population ¹⁵	Total Waste Generation (Ton) ¹⁶	Organic Matters (Food waste, vegetable/fruit waste, green leaves, animal excreta, slaughter waste, Straw, bamboo, woody waste, dry leaves, etc.) [71.53%] ¹⁷	Reusable/ Recyclables (Metal, paper, glass, plastic) [28.15%] ¹⁸	Others (including hazardous waste) [0.32%] ¹⁹
Birgunj Metropolitan City	275454	61.4262	36.8557	15.3566	9.21394
Jeetpursimara Sub-Metropolitan City	137916	30.7553	18.4532	7.6888	4.6133
Total	413370	92.18151	55.30891	23.04538	13.8272

The main products of our plant at 100 % capacity will be as follows;

Table 4: Revenue sources from the project

Product	Quantity/Day	Approximate Rate (NPR./KG)	Possible Market /Area of Use
Compressed Biogas (Kg)	2056.94	85	Restaurants, hotels, etc.
Sale of Fertilizer (Kg)	871.67	15	Agro market
Pesticides (liter)	7371.57	8	Agro market
Reusable & Recyclables (Kg)	64.71	8	Scrap collection center and industry

14 Towards sustainable municipal organic waste management in south Asia, A guide book for policy makers and practitioners, ADB, 2011

15 Health Management Information System 2074/75, MoHP, GoN,

16 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

17 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

18 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

19 Maharjan, M. K., & Lohani, S. P. (2020). Municipal Solid Waste Management in Nepal: Opportunities and Challenges, Journal of the Institute of Engineering, 15(3), 222–226. doi:10.3126/jie.v15i3.32185

SWOT Analysis for Integrated Solid Waste Management

Strength	Weakness	Opportunities	Threats
- Improved sanitation and hygiene. - Waste collection is done on a door-to-door basis. - The resident is required to pay a charge for rubbish pickup. - Developers must pay a royalty to the Sub-Metropolitan/ Municipality, which serves as a source of revenue for the Sub-Metropolitan/Municipality. - There will be no costs related with solid waste management for the concerned authorities. - In a sense, the partner municipalities can formally agree to the project's development. - Source separation - Land is available.	- There is a lack of waste separation at the source. - Unscientifically dumped. - There are no operational sanitary landfills or recycling facilities. - A lack of environmental awareness. - Technically, there is a deficiency. - Inadequate financing.	- Participation of the private sector in trash separation procedures. - Market for recycled materials that are suitable. - Effective integrated solid waste management requires an adequate regulatory framework. - Observance of environmental targets. - Cost recovery is linked to services connected to solid waste management. - Market for various end goods that is effective. - Integration Possibilities of Other Nearby Municipalities and Rural Municipalities. - Financially viable.	- Waste handlers are at danger of a variety of illnesses. - Landfill space is limited. - Local opposition stems from a lack of awareness of the differences between processing and landfilling. - Ineffective management - Strike by workers.

2.7 Examination and Evaluation of Alternatives

On the basis of numerous parameters such as the overall level of waste management, the composition of trash, the calorific value of garbage, appropriate waste volumes, current waste management rules, and so on. For the suggested package, anaerobic digestion is an acceptable method. However, we looked at the following possibilities:

Composting

Waste composting is a technique for digesting solid waste. Decomposition of organic waste into humus, also known as compost, which is a valuable fertilizer for plants, is part of the process. Biodegradable yard trash (kept separate from municipal garbage) is permitted to break down or decompose in a medium due to a lack of landfill capacity

in larger towns. The result is a high-quality, nutrient-rich, and environmentally friendly manure that enhances soil conditions and fertility. Organic matter makes up a significant component of Nepal's municipal solid waste. Composting, one of the oldest methods of waste disposal, may be used to recycle this waste. The natural decomposition of organic waste produces manure or compost, which is extremely nutrient-dense. Composting is a biological process in which degradable organic waste is converted into a humus like material by micro organisms, mostly fungus and bacteria. This completed product, which resembles dirt, is high in carbon and nitrogen, making it an ideal growth substrate for plants. Composting guarantees that garbage generated in the kitchen is not discarded carelessly and allowed to deteriorate. It recycles nutrients and returns them as nutrients to the soil. Composting may considerably

reduce the quantity of disposable rubbish, in addition to being clean, inexpensive, and safe. Organic fertilizer may be used instead of chemical fertilizers and is better for veggies in particular. It improves the soil's capacity to retain water while also making it easier to grow. It allows the soil to hold on to more plant nutrients.

Waste to Energy

The proposed system is based on the conversion of waste to biogas, which would then be processed to increase the methane concentration before being compressed and bottled. Other possibilities include: Waste to Energy (WTE) is a phrase that refers to a variety of technologies that transform non-recyclable waste into usable energy sources such as heat, fuels, and electricity. Gasification, pyrolysis, in-vessel composting, and other waste-to-energy technologies are only a few examples. Because our technique is based on the conversion of waste to biogas, it can be used as a fuel for combustion engines that convert it to mechanical energy, which can then be used to power an electric generator to generate electricity. An electric generator has a design that is comparable to that of an electric motor. Furthermore, compressed methane gas may be utilized as a car fuel.

2.8 Relevant Case Studies

Case Study 1

Project Type: Waste to Energy Project through Anaerobic Digestion (Biogas) Technology

Developer: Venture Waste to Energy P. Ltd. (Vw2E)

Location: Panmara, Ward-6, Dharan Sub-Metropolitan City
Total Capital Investment: NPR. 24,85,02000

Venture Waste to Energy P. Ltd. (Vw2E) is a private limited corporation dedicated to the development of waste-to-energy projects using anaerobic digestion. Bio-methane gas is one of the project's main products, which they want to sell to home and industrial customers in Nepal.

The project's goal is to manage Dharan Municipality's municipal solid trash and use organic waste as an energy source through anaerobic digestion. The facility has a capacity of 30TDP (Ton Per Day) and is located in Panmara, Ward-6 of Dharan Sub-Metropolitan City, Sunsari District, Province 1.

The SERI Organic Fuels Technology, a multi-stage variable hydraulic and solid retention, microbe incubated Bio-Reaction system, is being used in this research. This technology employs "Microbe Incubated Bio-Reactors (MIBR) with stabilized incubation system and laboratory cultured feed specific microorganisms and related biotechnology and fast breeder media," as well as "Microbe Incubated Bio-Reactors (MIBR) with stabilized incubation system and laboratory cultured feed specific microorganisms and related biotechnology and fast breeder media." Any organic feedstock, such as fruits and vegetable waste, may be processed using this method. It not only processes organic feedstock, but also agricultural waste, oil effluents, poultry and fish waste, and so on. One of the most significant advantages of this technology is that it processes 100% of the trash.

Biogas, organic fertilizer, bug repellent, and recycling trash are all products of this operation. Based on their major financial parameters, the project is technically and financially viable.

The data shown here is taken from Venture Waste to Energy P. Ltd's Detail Project Report, which was submitted to the Office of Investment Board.

Case Study 2²⁰

Project Type: Michigan Community Anaerobic Digester

Location: Fremont, Michigan, USA

Total Capital Investment: USD 22 million

The Fremont Community Digester facility in Fremont, Michigan, processes over 100,000 tons of food waste each year to provide biogas, power, and soil amendment. NOVI Energy created this system, which employs a full mix anaerobic wet digester capable of processing a wide range of feedstocks. Three one-million-gallon digester tanks collect trash from a range of sources, including food processing waste, dairy products, ethanol manufacturing byproducts, and industrial glycerin and alcohols, and process it in an oxygen-free environment for around 22 days. Local businesses like Gerber and McDonald's send garbage to the digester, which helps them manage their production waste effectively. Some source-separated organics producers have agreed to 20 or 30 year contracts with the developer, assuring the

20 Mass.gov. (2021). Anaerobic Digestion Case Studies. Retrieved from <https://www.mass.gov/info-details/anaerobic-digestion-case-studies>

facility's long-term viability. This wet digester system can vary between thermophilic (115-160 degrees Fahrenheit) and mesophilic (86-104 degrees Fahrenheit) processes as needed, however it operates at thermophilic temperatures on a regular basis. Thermophilic systems have higher reaction rates and shorter processing periods, but they are more susceptible to temperature fluctuations, which might impact methane generation. Biogas from the digester powers 3 MW generators, and all of the electricity generated is supplied to a local utility under a 20 years contract.

This \$22 million project, which was additionally backed by a \$12.8 million USD Rural Development Loan Guarantee, was made possible by a Michigan state legislation mandating utility companies to purchase 10% of their electricity from in-state renewable sources by 2015. The operator intends to use excess heat from the facility's generators in the future to heat and pump hot water around the industrial park for use by other businesses.

3

FINANCIAL ANALYSIS

3.1 Pre-Feasibility Approaches & Assumptions

Project Cost

Total cost of the Project amounted to NPR 830,424,136 excluding interest during construction. The Total cost including interest amounted to NPR 940,022,504 costs are assumed to occur evenly in the construction period.

Particulars	Amount in NPR
Land	-
Civil Structure	83,042,414
Machinery	739,077,481
Others	8,304,241
Interest During Construction	109,598,368
Total Project Cost	940,022,504

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Capital Structure

The Project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of

working capital would be financed by internal resources itself. Based on the structure, The total investment pattern has been tabulated below:

Component	Percentage	Amount in NPR
Equity	30.00%	282,006,751
Debt	70.00%	658,015,753
Total		940,022,504

Solid Waste Emission & Composition

The overall financial analysis is based on the total emission of solid waste in the various municipalities. The areas that have been included in Integrated Solid Waste Management Project (ISWMP), Birgunj and Jeetpur-Simara are listed below:

Areas Included

Birgunj Metropolitan City, Jeetpur-Simara Sub-Metropolitan city and Gadhimai Municipality

Total waste collection in packages has been calculated to be 92.18151 tons per day. Based on the information and data, composition of the total solid waste collection of Janakpur Package is tabled below:

Composition of the Waste (At 100% capacity)	In Tons
Organic	55.31
Reusable/Recyclables	23.05
Inert	0
Others (Including Hazardous Waste)	13.83
Total	92.19 tons

Collection Efficiency

Based on the various studies conducted by international agencies and prevailing market tendency, collection of the solid waste has been assumed as follows:

Household Collection Efficiency

From	To	Efficiency
0 year	3 years	0%
4 years	13 years	50%
14 years	23 years	60%

Out of the total collected solid waste component, It has been estimated that the following output could be realized from the project. Details of output quantity has been computed based on the efficiency as elaborated in table above.

The output is assumed to increase at the rate of 1.35% per annum, which is based on the population growth rate.

Output	Per day Output in KGS
Output- Gas	2056.94
Output - Organic Fertilizer	871.67
Output- Reusable/Recycles	64.71
Output – Pesticide	7371.57

Project Construction and Operation Period

The project is assumed to be built in the period of 3 years. And the total operation period after the construction period would be 20 Years. The project would be handed over to the government after the completion of the operation period.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project is assumed at 25% on profit earned during the year. Further the loss carryforward

has been taken for 12 years in due consonance with the provision of Income Tax Act 2058. Further, the Staff bonus is assumed at 10% on taxable income earned during any year of the operation as required by the Bonus Act.

Also, the rate depreciation and basis of depreciation is in due adherence to the provisions of the Income Tax Act as follows:

Particulars	Depreciation Method	Rate of Depreciation
Land	-	-
Civil Structure	WDV	5%
Machinery	WDV	15%
Others	SLM	20%

However, 1/3 of the additional depreciation has not been taken into consideration as facilitated by Income Tax Act.

Basis of Revenue and Inflation

The Project has mainly two streams of Revenue Module:

1. Collection from Household &
2. Revenue from sale of output from organic digestion.

Followings are the rates of sales of the output generated from organic & reusable solid wastes collected.

Particulars	Sales Rate in Dollars/KG	Sales Rate in NPR
Gas	0.75	85
Organic Fertilizer	0.13	15
Reusable/Recycles	0.07	8
Pesticide	0.07	8

Further, each household is charged at the rate of NPR 50 as monthly charges. Total number of households at the beginning of the period is 67400 families. The increase rate of the number of families is based on the growth rate in population and output as discussed above. The sales inflation rate is assumed to increase at the rate of 3% per annum and which would be capped at 180%.

Other Cost of Operations

The project is estimated to have a total operating cost of 7% based on the initial project. The operations costs are Inclusive of all staff salary, vehicle maintenance but don't include interest cost and depreciation cost component

It is further assumed that the total operating expense is likely to increase at the rate of 4% With the cap of 200%. As discussed in an earlier paragraph, the project would be financed by 70% debt. The interest rate that has been taken into the calculation is 12% which would be repaid in four equal installments in the period of 12 years.

Working Capital and Other Assumptions Used

It has been assumed that the overall working capital requirement would be financed by the equity holders. The working capital has been assumed on the following basis.

Receivable & Advance	30 Days
Payable and Liabilities	15 Days

Total number of working days has been assumed to be 330 days and 12 working months. The total population living in the project area of Birgunj and Jeetpur-Simara is 413,370 persons.

3.2 Financial Analysis

3.2.1 Financial Results

The cost of the Solid Waste Management Project (SWMP) in Birgunj and Jeetpur-Simara Package was derived from an IBN desk research report. All costs are assumed to be in accordance with the current cost structure. The project development cost is also supposed to have been calculated using district rates and current market rates.

The overall cost of the project is NPR 940,022,504 with an interest component of NPR 109,598,368 throughout construction. The overall project, excluding working capital, was financed by loan for 70% and equity for the remaining 30%.

Projections are created utilizing several methodologies in the examination of the project's pre-feasibility. The project's Net Present Value (NPV) was found to be NPR 37,856,614.32 based on the analysis.

Furthermore, the project IRR is assessed to be 12.97%, which is higher than the project's needed rate of return. The project's equity IRR is 13.14%. The project's IRR and equity IRR prove the project's viability. The Benefit Cost Ratio (BCR) for a project is 1.06 times, whereas the BCR for equity is 1.13 times.

The project payback period is 7.21 years, while the equity payback period is 17.03 years. The pay-back term appears to be enough, given the nature of the firm and the broader industry.

The average DSCR is calculated to be 1.25. Although the DSCR was initially low, it has steadily grown.

Indicators	Results
Firm IRR	12.97%
Equity IRR	13.14%
NPV Equity	37856614.32
Debt Equity Service Coverage Ratio(Average)	1.25
Project BCR	1.06
Equity BCR	1.13
Simple Payback Period	7.21
Discounted Payback Period	17.03

3.2.2 Sensitivity Analysis

Sensitivity Analysis has been carried out on three different components: Interest Rate, O & M Cost and Project cost.

Interest Rate Increase/Decrease by 5%

Percentage of Change Project Cost	Impact on Project IRR	% of Change
0.00%	13.14%	-
5.00%	12.63%	-3.88%
-5.00%	12.66%	3.93%

O & M Increase/Decrease by 5%

O&M Cost	Impact on Project IRR	% of Change
0.00%	13.14%	-
5.00%	12.59%	-4.23%
-5.00%	13.70%	4.27%

Project Cost Increase/Decrease by 5%

Project Cost	Impact on Project IRR	% of Change
0.00%	13.14%	
5.00%	11.70%	10.96%
-5.00%	14.72%	-12.02%

Based on the analysis, It seems that the project cost is highly sensitive as compared with O & M Expenses and Interest rates. The special focus to provide to project cost ensures the cost remains as projected.

The Financial Statement of the first 10 years of operation has been separately annexed in the report.

4

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

There are a lot of laws that govern solid waste management and all of the activities that go along with it. The most important ones are listed below:

Solid Waste Management National Policy, 1996

To address the rising solid waste management difficulties caused by urbanization, the first Solid Waste Management National Policy was created in 2053 BS (1996AD). Waste management in municipal and urban regions was stressed in the policy. This policy remains in effect.

Solid Waste Management Act, 2011

The Nepalese government passed the Solid Waste Management Act of 2011, which took effect on June 15, 2011. The act's goals include keeping the environment clean and healthy by reducing the negative impacts of solid waste on public health and the ecosystem. Municipalities, for example, have been given responsibility for the building, operation, and administration of MSW collection, treatment, and final disposal infrastructure. Local Governments are required to make the appropriate efforts to encourage reduce, reuse, and recycle (3R), including MSW segregation at the source, under the legislation. Through competitive bidding, it also allows the private sector, Community-

Based Organizations (CBOs), and Non-Governmental Organizations (NGOs) to participate in SWM. Bidding procedures, the selection of the winning bidder, and the bidder's power to collect tipping fees (tariffs) against SWM services are all outlined. The legislation also enables the imposition and collection of service fees against SWM services, as well as the grounds for determining such costs and the processes for collecting and using them. It also allows Local Governments, with the agreement of the municipal board, to create regulations, bylaws, and guidelines.

The Local Government Operations (LGO) Act, 2018

The Local Government Operations Act of 2017 has established and delimited distinct duties and procedures for SWM throughout Local Governments, in keeping with Nepal's 2015 constitution's power segregation. Local Governments are required under the legislation to work with the private sector to carry out solid waste management-related duties. Local Governments have been given regulatory and monitoring powers, as well as the ability to facilitate garbage disposal from families, slaughterhouses, and even healthcare facilities. In order to reduce carbon emissions, the LGO Act 2017 promotes Local Governments to use environmentally friendly technology. Local Governments are also responsible for

the building and operation of sanitary landfills according to established standards, as well as the competitive contracting and licensing of private sector actors and Non-Governmental Organizations (NGOs) for SWM services. Similarly, Local Governments can charge a fee for waste management services provided via it.

Solid Waste Management Regulation, 2013

Under the rights of the Solid Waste Management Act, 2068, the Nepalese government produced the Solid Waste Management Regulation in 2013. This rule emphasizes the separation of hazardous waste at the source and states that the producers are responsible for the correct disposal and management of separated hazardous waste. The legislation also prioritizes waste separation and reduction at the point of generation. As a result, the need of Local Governments in raising public awareness about proper garbage management has been highlighted.

Environmental Protection Act, 2019

The Environmental Protection Act of 2076, which amends and consolidates existing environmental legislation, went into effect recently.

The Act aims to:

- Protect each citizen's fundamental right to live in a clean and healthy environment.
- Compensate victims for damages caused by pollution or degradation of the environment.
- Maintain a proper balance between environment and development.
- Mitigate negative environmental impacts on the environment and biodiversity.
- Face the challenges posed by climate change.

Sustainable Development Goals (SDGs), 2016-2030

The SDG-11 objective 6 calls for cities to decrease their negative per capita environmental effect by focusing on air quality and municipal and other waste management. Nepal has established two objectives and indicators in municipal waste management in compliance with SDG No.: 11, target 6. The number of municipalities with sewage systems reaching 100% by 2020, and the percentage of private hospitals separating waste reaching 100% by 2017.

Investment Board Act, 2068 (2011)

OIBN has been supporting investment in solid waste management projects in urban areas under section 9 (1) (C) of the Investment Board Act, 2011 (2068 BS). "Regardless of any condition made in existing laws, the investment necessary for the implementation of any project for solid waste management and treatment in urban areas should be mobilized based on this Act," the law adds. As a result, every project of this sort should be approved by the Investment Board before it is implemented.

Solid waste management has been given a low priority in many Nepalese municipalities, owing to the larger demand for other public services. Due to a shortage of SWM baseline information and data relevant to the functional parts of SWM, Local Governments are having difficulty formulating management plans. When creating and executing comprehensive waste management strategies that incorporate resource recovery through suitable means, it is critical to determine the quantity and composition of Municipal Solid Waste (MSW).

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Environmental assessments of waste processing and management facilities must be completed with the goal of providing services to the local community. According to Nepalese legislation, depending on the scope, length, and size of environmental consequences, an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) must be conducted. The following projects, as stated in the Environment Protection Rules (EPR), need IEE:

In the case of municipal waste,

1. Every year, one thousand to five thousand tons of rubbish are dumped on the ground.
2. Transfer stations and resource recovery sites take up between 5 and 10 hectares of land.
3. In an area of 5 to 10 hectares, selecting, picking, discarding, and recycling garbage using chemical, mechanical, or biological processes.
4. Activities using compost plants in a 5 to 10 hectare area.
5. Sewerage scheme operations total more than USD 5 million.

Similarly, the following projects should complete an Environmental Impact Assessment, if necessary,

1. Waste management operations with the goal of serving a population of more than 10,000 people.

2. The activities listed below are related to garbage generated from homes and residential areas.
3. Every year, more than 5,000 tons of rubbish are dumped on the ground.
4. The activities related to the transfer station and the resource recovery zones encompass more than 10 hectares.
5. In an area of more than 10 hectares, selecting, choosing, discarding, and recycling trash using chemical, mechanical, or biological processes.
6. Compost plant activity covered an area of more than 10 hectares.
7. Waste discharged from a city with a population of at least 10,000 people is buried.

The project is intended to have significant environmental and social advantages for the regions and nearby Rural Municipalities where a modern system for collecting and disposing of municipal solid waste will be implemented, preventing garbage dumping and burning.

During the project's execution, the following particular benefits might be realized:

- Improved waste collection and transportation in the area and neighboring municipalities with heavily inhabited areas.

- Environmental conditions and the appearance of residential areas and their surroundings will be improved.
- Waste disposal that is both sound and safe, as well as a single sanitary landfill.
- Employees of the garbage collection unit have better working conditions.
- Cleaner yards and streets, as well as improved health and safety for women and children.
- Improved environmental awareness, education, public engagement, and background for all age groups to have better waste management practices.

- Improved attractiveness of the region for tourists.
- Business growth and capacity building on a local level.
- Improved waste management system, governance and transparency.

The project's environmental and socioeconomic advantages are projected to have a long-term impact on the surrounding areas and towns, as well as serve as a model for Madesh Province and Nepal as a whole.

6

PRELIMINARY RISK ANALYSIS

Due diligence and transparency at the time of original project development, selection of plant location, and undertaking environmental and social impact assessments are all risk considerations that cross all technologies. When the above issues are not handled effectively at the right point of project evolution, several plants throughout the world have shut down. The following are some of the most significant risks:

- The community is opposed to a sanitary landfill site.
- From the standpoint of the plant operator, municipal solid waste that is to be processed

and so obtain value addition must be viewed as "feedstock" rather than "waste." As a result, a shortage of garbage might cause the facility to operate inefficiently.

- The community might not accept the tariff rate.
- Land for a processing plant and a hygienic landfill site is scarce.

The municipality and the Provincial Government should split the risk. While developing the project development agreement, the detailed framework should be chosen.

Risk Matrix:

Risk Matrix

Severity		Score					
	Catastrophic	10	10A	10B	10C	10D	10E
		9	9A	9B	9C	9D	9E
	Hazardous	8	8A	8B	8C	8D	8E
		7	7A	7B	7C	7D	7E
	Major	6	6A	6B	6C	6D	6E
		5	5A	5B	5C	5D	5E
	Minor	4	4A	4B	4C	4D	4E
		3	3A	3B	3C	3D	3E
	Negligible	2	2A	2B	2C	2D	2E
		1	1A	1B	1C	1D	1E
		Extremely Impossible	Impossible	Remote	Occasional	Frequent	
		A	B	C	D	E	
		Likelihood					
		ACCEPTABLE (LOW)					
		REVIEW (MEDIUM)					
		NEED OF CRITICAL ANALYSIS (HIGH)					

The risk matrix above was created and color-coded based on the severity and likelihood of the risk factor. The severity scale ranges from negligible to catastrophic on a scale of one to ten, while the likelihood is graded on a scale of exceedingly seldom to frequent, with letters ranging from A to E. A risk factor with a score of 4B, for example, is viewed as small on a severity scale and

unattainable in terms of probability. This will be in the green zone, indicating that the risk is at a low tolerable level, however if the risk factor has a score of 10E, it indicates that the severity is catastrophic, with a high possibility of occurring frequently, and it will be in the red zone. This means that prior to the project's execution, this risk element must be thoroughly examined.

Table 5: Risk factor analysis

S.N.	Possible Risks	Description	Risk Score	Risk Baring in %		Possible Mitigation	Remarks
				Govt.	Developer		
1	MoU Signing	Understanding between two parties	5C	50%	50%	- Regular engagement with all the stakeholders - Transparent and agreeable document	
2	Land Acquisition	Land availability	5C	100%	0%	- There are land available but not committed for the project yet - Early communication with the municipalities to find the appropriate land and get an early commitment	
3	Local Opposition (Landfill Site)	Local community opposition	6D	90%	10%	- Finding land away from the local settlement - Following international practices for the landfill design - Developing effective compensation package for the affected people	
4	Financial Closure	Developer should have all the necessary financial documents	5C	0%	100%	- Regular communication with the developer - Making sure all the financial documentation are correct and verifiable	
5	Infrastructure Development (Time)	Time of construction	6C	0%	100%	- Sticking to the original plan - Contingency plan should be incorporate in the overall planning	
6	Recruitment and Management of Workforce	Staffs and labor issues	5D	0%	100%	- Structured Training and development plan should be in place - Provide incentive to the existing workforce for retaining them	
7	Collection and Segregation	Source segregation	1C	0%	100%	Ensure education and outreach program in place for awareness raising prior to the beginning of the project	
8	Tariff Rate	Finalizing the rate	5D	50%	50%	- Develop a scientific method for calculating the tariff rate - Regular communication with all the relevant stakeholders	

7

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnerships (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investment²¹.

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

The PPP model is appropriate in the current environment of Birgunj Metropolitan and its neighboring Sub-Metropolitan. According to the preliminary research done in these towns, Local Governments would give land for the construction of integrated solid waste management projects.

21 World Bank, 2072, Public Private Partnership Policy

8

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. Based on their daily waste output and other important criteria, the project includes Janakpur Sub-Metropolitan City, Dhanusadham Municipality, and Bardibas Municipality in Madesh Province.
2. Anaerobic digestion is the most suitable and relevant waste to energy plants that has been considered, according to the study, since the methane gas will be compressed, bottled, and sold to the local market. Additionally, 2% of organic input can be used as fertilizer, and 16.66% of organic input can be used as a bio-pesticide.
3. The project's business model was determined to be a Public Private Partnership.
4. With a total cost of NPR 940,022,504 (including interest component during construction term). Furthermore, the project IRR is assessed to be 12.97%, which is higher than the project's needed rate of return. The project's equity IRR is 13.14%.
5. The project pay-back period is 7.21 years, while the discounted pay-back period is 17.03 years. The pay-back term appears to be enough, given the nature of the firm and the broader industry.

8.2 Recommendations

The project appears to be technically and financially viable for a developer to invest, based on the findings. In the following step, however, environmental and social aspects, as well as a thorough examination of all other components, must be addressed.

Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.

9

ANNEX

9.1 Next Steps and Useful Contacts

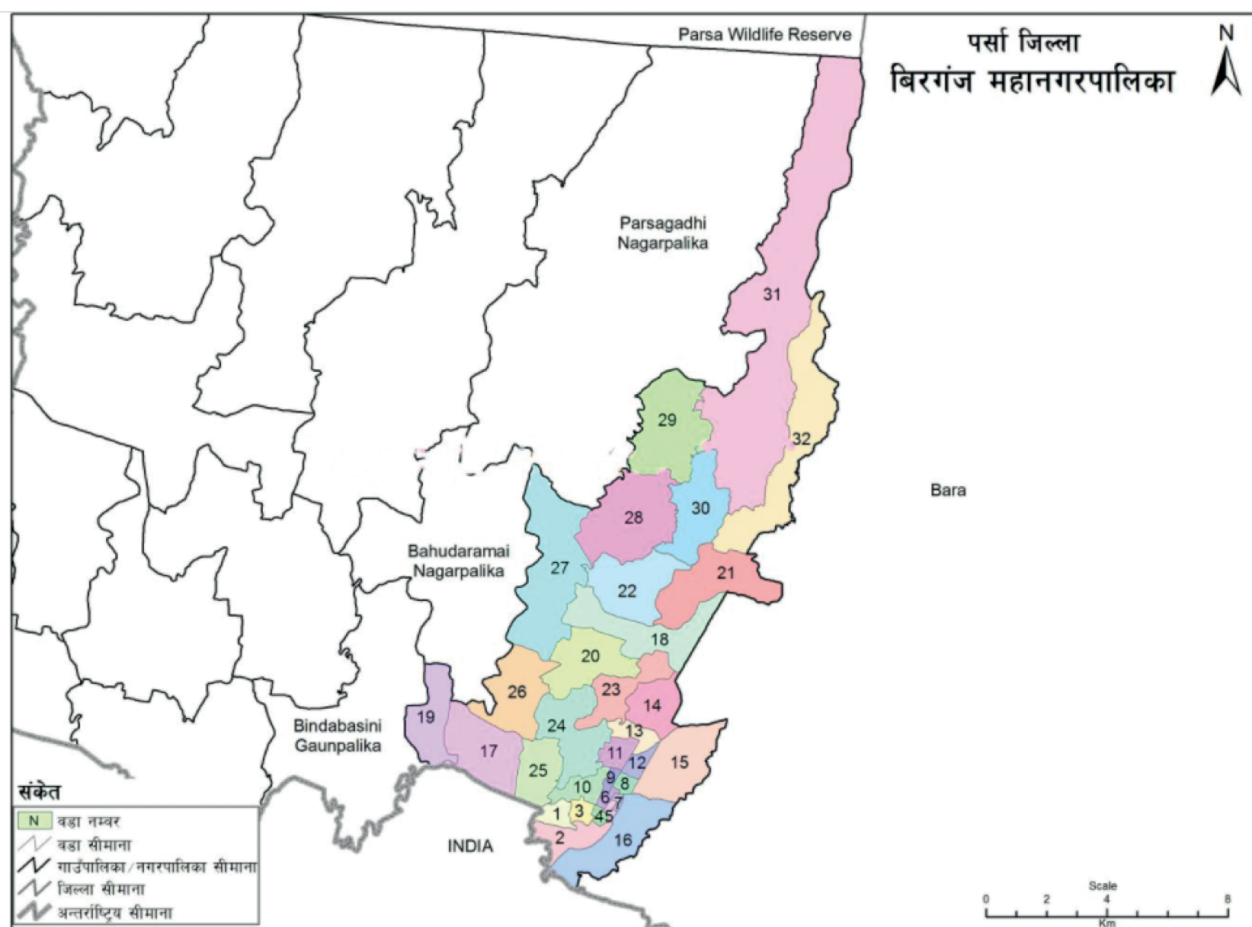
As part of further development of the project, the potential developer who might be interested to develop this project will be identified. Afterwards, a

communication channel will be formulated for the effective execution of this project. The useful contacts of all the municipalities incorporated in this are highlighted as follows;

Table 6: Useful contact information

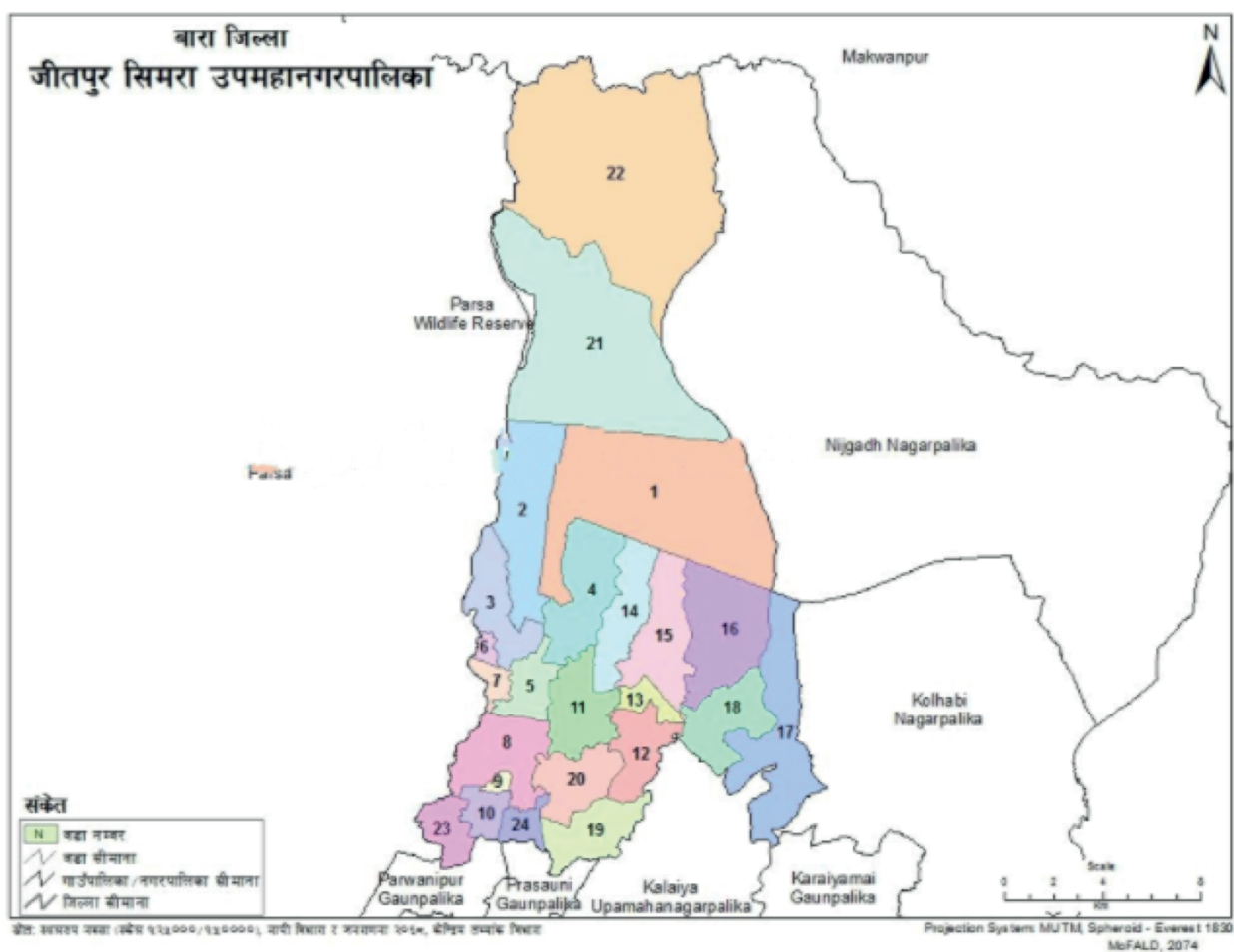
S.No.	District	Municipality	Chief Administrative Officer	Mayor
1	Parsa	Birgunj Metropolitan City	Nischal Raj Pandey	Vijay Sarawagi
2	Bara	Jeetpur-Simara Sub-Metropolitan City	Cheyth Kumar Pokharel	Dr. Krishna Paudel

9.2 Map of Birgunj Metropolitan City



Source: Birgunj Metropolitan City

9.3 Map of Jeetpur-Simara Sub-Metropolitan City



Source: Jeetpur Simara Sub-Metropolitan city

9.4 Financial Report

Projected Profit and Loss Statement for Initial 10 years

Particulars	Amount in NPR									
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Household Collection Fees	121,320,000	130,427,046	136,110,075	142,016,702	148,155,227	154,749,178	161,605,426	168,733,775	176,144,380	183,847,761
Output- Gas	29,238,039	32,469,335	34,446,717	36,544,522	38,770,084	41,131,182	43,636,071	46,293,508	49,112,782	52,103,751
Output - Organic Fertilizer	2,222,105	2,428,154	2,576,028	2,732,909	2,899,343	3,075,913	3,263,236	3,461,967	3,672,801	3,896,474
Output- Reusable/Recycles	86,570	96,138	101,993	108,204	114,794	121,785	129,201	137,070	145,417	154,273
Output - Pesticide	9,861,834	10,951,732	11,618,693	12,326,271	13,076,941	13,873,327	14,718,213	15,614,552	16,565,478	17,574,316
Total Income	162,728,548	176,372,405	184,853,506	193,728,608	203,016,388	212,951,384	223,352,146	234,240,871	245,640,858	257,576,574
Operating Expenses	-	-	-	-	-	-	-	-	-	-
Depreciation	132,073,162	113,014,206	96,790,592	82,978,195	71,216,449	59,318,770	50,784,640	43,512,446	37,313,805	32,028,550
O & M Expenses	68,433,638	71,170,984	74,017,823	76,978,536	80,057,678	83,259,985	86,590,384	90,053,999	93,656,159	97,402,406
Operating Profit	(37,778,252)	(7,812,784)	14,045,091	33,771,877	51,742,262	70,372,629	85,977,122	100,674,425	114,670,893	128,145,619
Interest Expenses	77,804,613	74,495,375	70,770,798	66,578,754	61,860,572	56,550,216	50,573,363	43,846,363	36,275,065	27,753,503
Profit	(115,582,865)	(82,308,159)	(56,725,707)	(32,806,877)	(10,118,310)	13,822,413	35,403,759	56,828,062	78,395,828	100,392,116
Provision for Staff Bonus	-	-	-	-	-	1,256,583	3,218,524	5,166,187	7,126,893	9,126,556
Income Tax	-	-	-	-	-	-	-	-	-	-
Net profit	(115,582,865)	(82,308,159)	(56,725,707)	(32,806,877)	(10,118,310)	12,565,830	32,185,235	51,661,875	71,268,934	91,265,560

Amount in NPR

Particulars	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Shareholders Fund	-									
Share Capital	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751
Reserve and Surplus	(115,582,865)	(197,891,024)	(254,616,731)	(287,423,609)	(297,541,918)	(284,976,088)	(252,790,853)	(201,128,978)	(129,860,044)	(38,594,484)
Loan Fund	-									
Term Loan	631,649,171	601,973,352	568,572,955	530,980,515	488,669,892	441,048,913	387,451,082	327,126,251	259,230,121	182,812,430
Short Term Loan	-									
Total	798,073,058	686,089,079	595,962,975	525,563,657	473,134,725	438,079,576	416,666,980	408,004,024	411,376,829	426,224,697
Fixed Assets (Net)	807,949,342	694,935,137	598,144,544	515,166,349	443,949,901	384,631,130	333,846,490	290,334,044	253,020,239	220,991,689
Investment	-									
Current Assets	(7,024,883)	(5,880,600)	902,507	13,604,747	32,520,561	56,917,612	86,428,423	121,422,229	162,258,930	209,291,441
Sundry Debtors	14,793,504	16,033,855	16,804,864	17,611,692	18,456,035	19,359,217	20,304,741	21,294,625	22,330,987	23,416,052
Advances	-									
Cash & Bank Balance	(21,818,387)	(21,914,455)	(15,902,357)	(4,006,944)	14,064,526	37,558,395	66,123,682	100,127,605	139,927,943	185,875,389
Less: Current Liabilities	2,851,402	2,965,458	3,084,076	3,207,439	3,335,737	3,469,166	3,607,933	3,752,250	3,902,340	4,058,434
Net Current Assets	(9,876,285)	(8,846,058)	(2,181,569)	10,397,308	29,184,824	53,448,446	82,820,490	117,669,979	158,356,590	205,233,008
Total	786,874,693	677,293,336	600,852,065	555,980,591	541,511,583	555,383,966	593,131,759	654,600,733	739,797,029	848,866,013

Projected Balance Sheet for Initial 10 years

Amount in NPR

Particulars	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Shareholders Fund	-									
Share Capital	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751	282,006,751
Reserve and Surplus	(115,582,865)	(197,891,024)	(254,616,731)	(287,423,609)	(297,541,918)	(284,976,088)	(252,790,853)	(201,128,978)	(129,860,044)	(38,594,484)
Loan Fund	-									
Term Loan	631,649,171	601,973,352	568,572,955	530,980,515	488,669,892	441,048,913	387,451,082	327,126,251	259,230,121	182,812,430
Short Term Loan	-									
Total	798,073,058	686,089,079	595,962,975	525,563,657	473,134,725	438,079,576	416,666,980	408,004,024	411,376,829	426,224,697
Fixed Assets (Net)	807,949,342	694,935,137	598,144,544	515,166,349	443,949,901	384,631,130	333,846,490	290,334,044	253,020,239	220,991,689
Investment	-									
Current Assets	(7,024,883)	(5,880,600)	902,507	13,604,747	32,520,561	56,917,612	86,428,423	121,422,229	162,258,930	209,291,441
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Advances	-									
Cash & Bank Balance	(21,818,387)	(21,914,455)	(15,902,357)	(4,006,944)	14,064,526	37,558,395	66,123,682	100,127,605	139,927,943	185,875,389
Less: Current Liabilities	2,851,402	2,965,458	3,084,076	3,207,439	3,335,737	3,469,166	3,607,933	3,752,250	3,902,340	4,058,434
Net Current Assets	(9,876,285)	(8,846,058)	(2,181,569)	10,397,308	29,184,824	53,448,446	82,820,490	117,669,979	158,356,590	205,233,008
Total	786,874,693	677,293,336	600,852,065	555,980,591	541,511,583	555,383,966	593,131,759	654,600,733	739,797,029	848,866,013

The cash balance is seen as negative in initial years, the amount has to be injected by the equity holders

Projected Cash Flow for Initial 10 years

Particulars	Amount in NPR									
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years
Cash Flow from Operating Activity	-	-	-	-	-	-	-	-	-	-
Net profit before Interest and Tax	(115,582,865)	(82,308,159)	(56,725,707)	(32,806,877)	(10,118,310)	12,565,830	32,185,235	51,661,875	71,268,934	91,265,560
Add: Depreciation	132,073,162	113,014,206	96,790,592	82,978,195	71,216,449	59,318,770	50,784,640	43,512,446	37,313,805	32,028,550
Add: Interest	77,804,613	74,495,375	70,770,798	66,578,754	61,860,572	56,550,216	50,573,363	43,846,363	36,275,065	27,753,503
Operating Cash Flow before Working Capital Change	94,294,910	105,201,421	110,835,683	116,750,072	122,958,711	128,434,816	133,543,239	139,020,684	144,857,805	151,047,612
Increase/Decrease in Current Assets	(14,793,504)	(1,240,351)	(771,009)	(806,827)	(844,344)	(903,181)	(945,524)	(989,884)	(1,036,362)	(1,085,065)
Increase/Decrease in Current Liabilities	2,851,402	114,056	118,618	123,363	128,298	133,429	138,767	144,317	150,090	156,094
Payment of Tax	-	-	-	-	-	-	-	-	-	-
Net Cash flow from Operating Activity	82,352,807	104,075,127	110,183,292	116,066,607	122,242,664	127,665,064	132,736,482	138,175,117	143,971,532	150,118,641
Cash Flow from Investing Activity	-	-	-	-	-	-	-	-	-	-
Purchase of Fixed Assets	(940,022,504)	-	-	0	-	-	-	-	-	(0)
Increase/Decrease in Investment	-	-	-	-	-	-	-	-	-	-
Less: Payment of Dividend	-	-	-	-	-	-	-	-	-	-
Net Cash flow from Investing Activity	(940,022,504)	-	-	0	-	-	-	-	-	(0)
Cash Flow from Financing Activity	-	-	-	-	-	-	-	-	-	-
Increase in Share Capital	282,006,751	-	-	-	-	-	-	-	-	-
Increase in Borrowing Fund (Long Term Loan)	658,015,753	-	-	-	-	-	-	-	-	-
Increase in short Term Loan	-	-	-	-	-	-	-	-	-	-
Less: Repayment of Long Term Loan	(26,366,581)	(29,675,820)	(33,400,396)	(37,592,440)	(42,310,623)	(47,620,979)	(53,597,831)	(60,324,831)	(67,896,129)	(76,417,691)

Particulars	Amount in NPR											
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years		
Less: Payment of Interest on Short Term Loan												
Less: Payment of Interest on Long Term Loan												
Net Cash Flow from Financing Activity	835,851,309	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)	(104,171,194)		
Increase/Decrease in Cash and Cash Equivalent	(21,818,387)	(96,068)	6,012,098	11,895,413	18,071,470	23,493,870	28,565,287	34,003,923	39,800,338	45,947,446		
Cash & Bank Balance at the Beginning of the Period	-	(21,818,387)	(21,914,455)	(15,902,357)	(4,006,944)	14,064,526	37,558,395	66,123,682	100,127,605	139,927,943		
Balance at the End of Period	(21,818,387)	(21,914,455)	(15,902,357)	(4,006,944)	14,064,526	37,558,395	66,123,682	100,127,605	139,927,943	185,875,389		

PRE-FEASIBILITY STUDY OF
SOLAR PROJECT IN MADHESH PROVINCE

EXECUTIVE SUMMARY

Nepal's solar energy system offers a lot of promise. With around 300 days of sun each year, Nepal receives 3.6 to 6.2 kWh of solar radiation per square meter per day, making it ideal for solar energy¹. For energy security, the White Paper of 2018 envisions renewable energy in the national energy mix, with 5-10% renewable energy sources in the power generating mix. It intends to achieve distributed generation in each of the 753 local units - "Providing Energy Access to All Settlement". In terms of the idea of "One Province, One Mega Projects" 'According to the white paper, solar power generation in Madhesh Province should be at least 200 MW. Renewable energy is depicted as a mainstream energy source in the 15th periodic plan. The energy mixing strategy and generating enough power to fulfill the demand for development and electricity services have been prioritized by both public and private investment. Under the idea of "Every Home, Energy Home," the 15th plan states that energy efficiency programs and initiatives to link rooftop solar energy plants to the grid based on net metering and net payment would be pushed. The plan also calls for renewable energy to expand from 7% to 12% of total

energy consumption, and per capita electricity usage to reach 700 kilowatts per hour. It proposes the creation of a solar energy system and its integration into the national grid in order to meet its goal, as well as the collecting and verification of field data on solar energy sources. It also wants to create and run Special Economic Zones (SEZs), Industrial Zones, and Industrial Villages.

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives, including renewable energy projects. Solar projects in Madhesh Province (Madhesh Pradesh) is one of the primary sites designated for investment. The research on the solar projects in Madhesh Province is primarily intended to document the project's technical and financial feasibility. Both primary and secondary data gathering approaches were used in the study. Primary data was acquired from field-based research, which included a field visit and stakeholder consultations and group discussions. Secondary data was gathered from a variety of sources, including published papers, journal

1 Nepal Renewable Energy Programme. 2021. Pre-Feasibility Study Report of Grid Connected Solar PV project In Rajgadh Rural Municipality, Madhesh Province. Retrieved from https://rajgadhmun.gov.np/sites/belhichapenamun.gov.np/files/PFS_Rajgadh%20RM_V1.pdf

articles, and other verified and trustworthy online sources.

This project appears to be best suited for a Public Private Partnership (PPP) approach, in which GoN will assist in obtaining the necessary land for the project. The developer will then build all of the infrastructure required for the project's smooth execution and will run it for 25 years before handing it over to GoN in good working order.

The research examined the project's technical and financial elements and determined that it is technically and financially feasible, with a total anticipated cost of roughly NPR 422.17 million for each (including interest component throughout construction period). The project's Internal Rate of Return (IRR) is assessed to be 14.61%, while the project's equity IRR is calculated to be 18.53%. The project's IRR and equity IRR prove the project's viability.

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SALIENT FEATURES OF THE PROJECT

Table 1: Salient features of the project

General information of the project		
1	Name of Project	5 MW Solar Project in 4 Different Locations
2	Project Location	Madhesh Province
3	Project Implementation Modality	Proposed project development modality ☐ Public ☒ PPP ☐ Private ☐ Others/Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Infrastructure
6	Type of Project (Sub Sector)	Alternative energy
7	Implementing/Facilitating Agencies	Private sector facilitated by the Ministry of Physical Infrastructure Development, Madhesh Province.
8	Project Management (Implementation Mechanism)	Private sector will manage the project with the support from the Federal and Provincial Governments and the local stakeholders.

Project specific information

1	Salient Features of Project	
	Land Profile	Private and Government Land (leased)
	Topography & Orientation	Mostly Flat
	PV Module Technology	Monocrystalline
	Tier	1
	Efficiency	21.1%
	Installed Capacity	5 MWac in each location with a combined capacity of 20 MWac
	DC to AC Ratio	1.20
	Estimated Plant Area	44 Bighas for 4 sites
	Capacity of Each Module	505 Wp
	Total Inverter Capacity	125 kWac x 160 nos. = 20,000 kWac
	Transmission	66/33/11 kV
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	Local people living in each location shall be identified based on the detailed feasibility report of each of the project.
	Land Requirement	About 11 Bighas for each location.
	Acquisition & Resettlement	Government shall identify and provide potential lands where the resettlement issues would be minimal.
	Materials and Ease of Access	Solar panels and inverters are available in India and other countries; boulders and aggregate are available in Madhesh province ; Bricks, cement and reinforcement available in Madhesh Province and within Nepal.
	Environmental and Social Management Plan (ESMP)	Production of energy with low impact on the environment. ESMP has to identify the potentially significant social and environmental issues and risks of the proposed project and suggest appropriate mitigation measures to mitigate or minimize the adverse impacts so that the project is implemented in an environmentally sound manner.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desktop Study ☐ Feasibility Study ☐ Detailed Engineering/DPR
4	Estimated Cost to Complete the Project	NPR 422.17 Million for each of the site.
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months IEE of each site: 6 months PPA: 6 months Approval and Financial Closure: 1 year Construction Period: 6 months Concession Period: 25 years

6	Project Financing Options	Private sector will invest the majority share. Local Governments may contribute for land acquisition and may invest by taking minority shares of the project.
7	Project Technology/Components	Solar modules; Monocrystalline (pc-Si) Inverters (String/Central) Power supply Mounting Structures Aggregate Cement Sand Water
8	Contribution to SDG and Green Growth	Solar energy is low cost production with no environmental effect and becomes the most sustainable energy to reduce the carbon emission with low operation and maintenance. Similarly, the project would contribute, among others, to attaining the following Sustainable Development Goals in Nepal. Goal No. 7: Affordable and clean energy Goal No. 9: Industry, innovation and infrastructure Goal No. 13: Climate action
9	Project Capacity (at 100%)	5.987 MW per project
10	IRR	14.61%
11	Benefit Cost Ratio	1.79
12	Private Sector/Consumer Committee/ Beneficiary Roles	Plan, design, operate, maintain and invest in the project.
13	Government's Role	• Support in finding out feasible location and land acquisition. • Facilitate for the legal permission • Support in providing basic infrastructure like roads.

Other project information

1	Target Beneficiaries	Local people residing in each district.
2	Market of Project's Service/Product	Local people residing in each district.
3	Key risks and opportunities of Project Development & Operation	• Risk of change in weather like lack of sunshine, heavy rainfall, flooding, etc. • Risk of change in policy related to the project like change in tax rate, compliances • Sabotage , theft of parts. • Pollution free and causes no emission of greenhouse gasses.
4	Strengths and Opportunities	• Reduce dependence on fossil fuel. • Durable. • Renewable clean power.
5	Risks and Issues	• Cloudy days do not produce as much energy. • Lower solar production in the winter months. • High initial cost for the installation.

1

BACKGROUND

1.1 Introduction

Nepal's solar energy system offers a lot of promise. With around 300 days of sun each year, Nepal receives 3.6 to 6.2 kWh of solar radiation per square meter per day, making it ideal for solar energy². For energy security, the White Paper of 2018 envisions renewable energy in the national energy mix, with 5-10% renewable energy sources in the power generating mix. It intends to achieve distributed generation in each of the 753 local units - "Providing Energy Access to All Settlement". In terms of the idea of "One Province, One Mega Projects" 'According to the white paper, solar power generation in Madhesh Province should be at least 200 MW. Renewable energy is depicted as a mainstream energy source in the 15th periodic plan. The energy mixing strategy and generating enough power to fulfill the demand for development and electricity services have been prioritized by both public and private investment. Under the idea of "Every Home, Energy Home," the 15th plan states that energy

efficiency programs and initiatives to link rooftop solar energy plants to the grid based on net metering and net payment would be pushed. The plan also calls for renewable energy to expand from 7% to 12% of total energy consumption, and per capita electricity usage to reach 700 kilowatts per hour. It proposes the creation of a solar energy system and its integration into the national grid in order to meet its goal, as well as the collecting and verification of field data on solar energy sources. It also wants to create and run Special Economic Zones (SEZs), Industrial Zones, and Industrial Villages.

According to the Department of Electricity Development, 17 solar power projects with a total generating capacity of 110.47 MW have acquired building permits so far³. In Madhesh Province, there are three projects with a total capacity of 17 MW. Similarly, survey licenses have been awarded to 35 projects with a total capacity of 510 MW, with Madhesh Province accounting for the largest

- 2 Nepal Renewable Energy Programme. 2021. Pre-Feasibility Study Report of Grid Connected Solar PV project In Rajgadh Rural Municipality, Madhesh Province. Retrieved from https://rajgadhmun.gov.np/sites/belhichapenamun.gov.np/files/PFS_Rajgadh%20RM_V1.pdf
- 3 Nepal Renewable Energy Programme. 2021. Pre-Feasibility Study Report of Grid Connected Solar PV project In Rajgadh Rural Municipality, Madhesh Province. Retrieved from https://rajgadhmun.gov.np/sites/belhichapenamun.gov.np/files/PFS_Rajgadh%20RM_V1.pdf
- 4 NREP. (2021) Energy Profile: Madhesh Province , Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

share with 11 projects with a total capacity of 345.2 MW⁴. Similarly, two solar projects with a combined capacity of 5 MW have applied for construction permits. Both projects are located in Madhesh Province jurisdiction. In addition, three projects with a total capacity of 120 MW have applied for survey permits, while a project with a total capacity of 100 MW is located in Madhesh Province. Butwal solar power, with a capacity of 8 MW, was recently linked to the national grid. The first phase of Nepal's first 25 MW solar array, which will feed power directly into the national grid, was also launched by the government utility. Solar panels are used in the project, however there are no storage batteries, therefore the power generated is delivered directly into the grid when sunlight is available. According to a survey conducted by the National Planning Commission, Madhesh Province has the largest potential capacity for solar PV installations in the country, with a total capacity of 127 MW. When hydro electric capacity is limited in the winter, solar electricity helps to reduce power disruptions. Furthermore, it is expected to increase the reliability of the power supply system and minimize system loss.

The Local Government Operation Act, 2074, which took effect on October 15, 2017, established a solid legal framework for the Local Government's legislative, executive, and quasi-judicial practices. Several arrangements related to local government authorities, duties and responsibilities, assembly meeting and working system, assembly management procedures, plan formulation and implementation, judicial works, financial jurisdictions, administrative structure, and district assembly, among others, are outlined in the Act. It specifies the role, obligations, and rights of municipalities/Rural Municipalities without altering the universality of Schedule-8 of the constitution. The legislation expressly specifies that the local government can develop, implement, monitor, assess, and control policies, rules, standards, and plans connected to hydropower projects of up to one megawatt at the local level. In addition, the municipality has control over the management, operation, and regulation of local energy distribution systems and services.

This pre-feasibility report has been prepared based on a preliminary site assessment carried out to examine the viability of the establishing 5 MW (5.987MWp) grid-connected solar photovoltaic (PV) station at 4 locations across Madhesh Province. The project aims to make contributions towards the energy mix policies envisioned

by the GoN by supplying clean energy to the national grid. Further, the proposed solar plant will be able to address the energy deficit faced by the national grid during the off-seasons and complement the national grid to attain a stable supply during the wet season.

1.2 Alternative Energy in Nepal

With a development potential of 83,000 megawatts (MW) and commercially exploitable hydropower generating potential of about 42,000 MW, Nepal had a total installed generation capacity of 1,182 MW against a peak electricity demand of 1,320 MW in the fiscal year 2018–2019. Nepal's energy consumption revolves around a mix of coal biomass, hydropower, and oil products.

With a renewed focus on building energy infrastructure using the energy mix concept, the Government of Nepal aims to ensure supply reliability and national energy security in the long run. As an outcome of this policy on-grid solar projects are on the rise, and the momentum has attracted IPPs to invest in utility-grade solar PV plants.

1.3 Rationale of the Project

The benefits of this solar plant project to the GoN and various other stakeholders include but are not limited to:

- Energy security.
- Diversification of energy portfolio
- Import substitution.
- Reduction in country's energy sector risk premium.
- Local industry development, local employment, and skill development.
- Promotion of alternative energy in a bid to contribute to green growth.

In Madhesh Province, the per connection electricity consumption fell for all sub-sectors in 2020. Compared to 2019, the largest drops were in irrigation, non-commercial, non-domestic, and commercial with consumption reduced by 34.3%, 29.8%, 24.4%, and 22.5%, respectively. The consumption in industries fell the least with a 6.4% reduction and domestic by 8.7%. Madhesh Province does not have any generating system, so it imports all the electricity from other provinces. The total revenue generated from the sold electricity was NPR 16,069 million which is 21% of the overall revenue earned in Nepal in FY 2076/77. The total system loss is above the national average. Against this backdrop, solar power stations with a combined capacity of 20Mw can help Province 2 cut down on electricity

imports from other provinces while helping the province government adapt sustainable solutions to fulfill the energy needs of the households and industries alike.

1.4 Objectives

By establishing a single platform at the next Investment Summit, the Provincial 2 Planning Commission (PPC) hopes to attract investment in a variety of initiatives, including alternative energy projects. As a result, PPC has put together a prospective Solar Projects in Madhesh Province. Finally, it aspires to present the proposal at the Investment Summit (2022) in order to attract investors. As a result, the following are some of the report's main goals:

- To supply renewable energy to the national grid and contribute to energy mix as envisioned by the GoN.
- Determine the feasibility of 4 grid-connected 5MW scale solar projects in Provincial 2.
- Identify potential areas for solar precincts across Provincial 2 based on solar irradiation data.
- Test the concept that the desired location of solar plants near to existing substations facilitates sharing of transmission infrastructure and thus may expedite financial viability.
- Compare different solar technologies.
- Identify the role of the Provincial Government, private sector, and investors to support such solar projects such that lessons learned can be applied to large-scale projects in the future.

1.5 Scope of Work

The goal of the pre-feasibility study is to represent a case for a photovoltaic station in Provincial 2 against the federal government's decision to prioritize energy mix policy to induce energy stability while focusing on green and sustainable solutions. This study outlines the technical and financial feasibility of solar power stations across 4 locations in Madhesh Province with an aim to aid a general understanding of investment opportunities in this particular sector and location. The following are some of the study's primary scopes:

- To gather primary and secondary data and any other necessary information for the project's development.
- Analyze the acquired data for many elements such as technical, economical, social, and environmental concerns.
- Develop the most appropriate investment model, such as private, Public Private Partnership, or blended finance.
- Provide recommendations and a way forward regarding project modality, and investment appraisal.

1.6 Approach & Methodology

A professional team from Invest and Infra Pvt. Ltd. produced this pre-feasibility study. After a thorough examination of market demand and business development prospects, the project's components were determined. For the purposes of determining project features/components, input collected during consultations with Province Level Ministries and associated stakeholders was also taken into account. Secondary and primary sources were used to obtain the necessary data, information, and facts to meet the study's goals.

Primary data was acquired by telephone and e-mail conversations, as well as a field-based research, which included a field visit. Producers, marketers, entrepreneurs, and government officials from Madhesh Province (Provincial Ministries, Rural/Municipalities, etc.) participated in stakeholder consultations and group discussions.

Secondary data was gathered from numerous publications issued by Nepalese government agencies, other similar nature projects in Nepal, and academic research papers published by various organizations and experts. An appropriate investment plan was recommended based on the conclusions of a technological, social, and environmental investigation. In addition, a thorough financial study was carried out to discover some of the key financial metrics that assure the project's financial feasibility.

2

PROJECT DETAILS

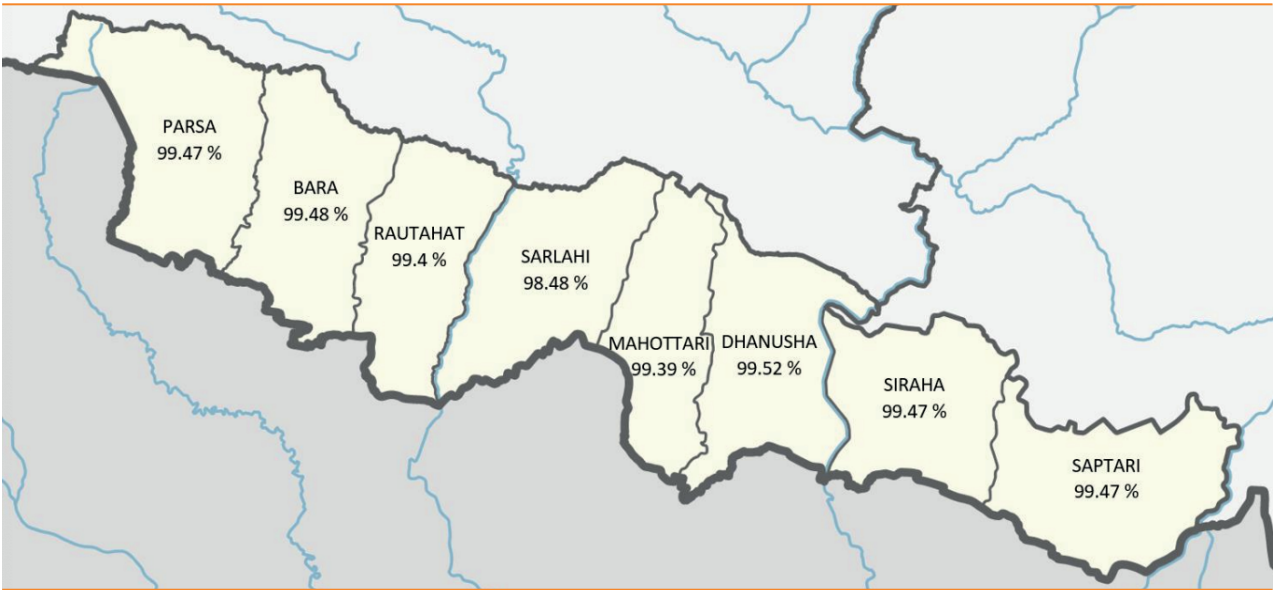
2.1 Project Background and Description

Bara

With 3.3 percent of Nepal's total GDP and the highest per capital income in Madhesh province, Bara District

is Nepal's third wealthiest district after Kathmandu and Morang. The district has a population of 687,708 people and occupies an area of 1,190 km² (460 sq mi)⁶. Bara district includes Simraungadh. It is a historically significant location in Nepal, known for tourism and

Fig 1: Electrification of Madhesh Province⁵



5 NREP. (2021) Energy Profile: Madhesh Province, Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

6 NREP. (2021) Energy Profile: Madhesh Province, Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

agricultural goods. Two Sub-Metropolitan cities, five Urban Municipalities, and nine Rural Municipalities comprise the district. Kalaiya is a Sub-Metropolitan city and the administrative center of Bara District. Nepal had 141,179 people living in 28,645 households at the time of the census in 2021⁷.

Birgunj

Parsa district, with Birgunj as its district capital, has a population of 601,017 people and spans an area of 1,353 km² (522 sq mi)⁸. One metropolitan city, three Urban Municipalities, and eleven Rural Municipalities make up the district. Birgunj is a metropolitan city in Nepal's Madhesh Province's Parsa District. It extends across 132.07 square kilometers. It is located 135 kilometers south of Kathmandu, and is bordered on the north by Raxaul, in the Indian state of Bihar. Birgunj is the biggest city in Madhesh Province and one of Nepal's major cities. With a population of 36,697 people, it is one of the most populous cities in the nation⁹. Birgunj is the country's sixth most populous city. It is also known as Nepal's "Commercial Capital." The town is vital to Nepal's economy since much of the country's commerce with India passes via Birgunj and the Indian town of Raxaul.

Dhanusha

Dhanusha district is one of Nepal's seventy-seven districts and is located in Madhesh Province. It is located in the Outer Terai. The district, which has its headquarters at Janakpurdham, has an area of 1,180 km² (460 sq mi) and had a population of 754,777 people in 2021¹⁰. One Sub-Metropolitan city, eleven Urban Municipalities, and six Rural Municipalities make up the district. Janakpur is the administrative center of the Dhanusa district,

which is located in Nepal's southern region. The city that occupies an area of 91.97 square kilometers, is a hub for religious and cultural tourism. Janakpur is Nepal's largest Sub-Metropolitan city and one of the country's fastest growing cities. In 2021, the city had a population of 195,438 people¹¹. Janakpur is Nepal's most populous sub-metropolis at the moment. Nepal Railways connects India's Janakpur and Jaynagar.

Rautahat

Rautahat district is one of Nepal's seventy-seven districts and is located in Madhesh Province. The district headquarter is Gaur, including municipalities like Garuda, Chandrapur, Paroha, has an area of 1,126 km² and had a population of 545,132 in 2011 and 686,722 in 2021¹². There are eighteen municipalities in the district, sixteen of which are Urban Municipalities and two of which are rural communities.

2.2 Project Features

The project is located in Madhesh Province and the project will fulfill the energy demand of the province that is deprived of hydropower projects. The four solar sites will be helpful for the supply of electricity during day time and will make productive use of barren land. The solar irradiation of the project site is good for solar power generation. The construction of the power plant will be easier due to the terrain of the project area and availability of substations. The financial parameters of the project is good and makes these projects lucrative. The decreasing of solar panels that comprises around 50% of the overall cost will make sure that the overall project cost decreases that will eventually increase the financial benefits from the project.

7 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

8 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

9 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

10 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

11 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

12 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

2.3 Overview of the Area

Location 1: Near the Industrial Corridor, Bara

GLOBAL SOLAR ATLAS

BY WORLD BANK GROUP

Bara, Nepal

27.107328°, 85.069339°

unnamed road, Nepal

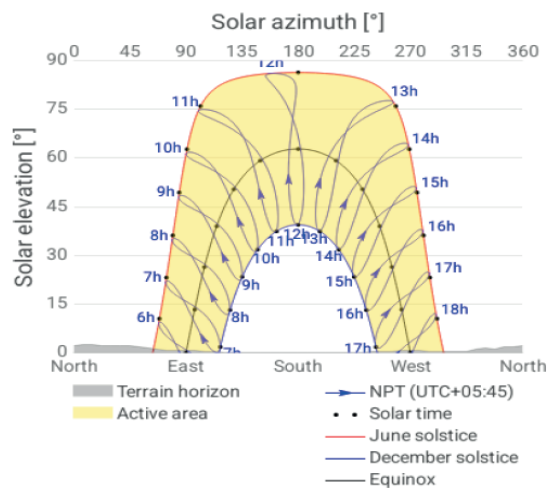
Time zone: UTC+05:45, Asia/Kathmandu [NPT]

🕒 Report generated: 30 Jan 2022

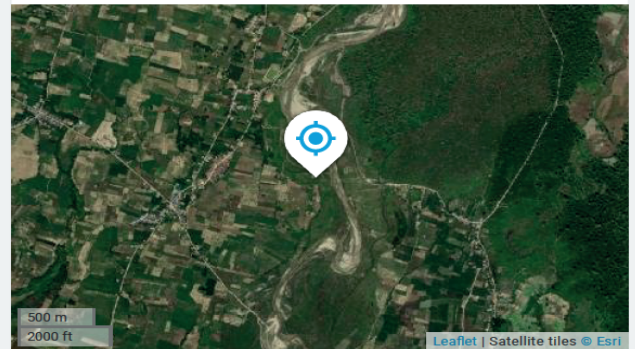
SITE INFO

Map data		Per year
Direct normal irradiation	DNI	1234.2 kWh/m ²
Global horizontal irradiation	GHI	1738.2 kWh/m ²
Diffuse horizontal irradiation	DIF	885.1 kWh/m ²
Global tilted irradiation at optimum angle	GTI opta	1872.8 kWh/m ²
Optimum tilt of PV modules	OPTA	25 / 180 °
Air temperature	TEMP	25.1 °C
Terrain elevation	ELE	116 m

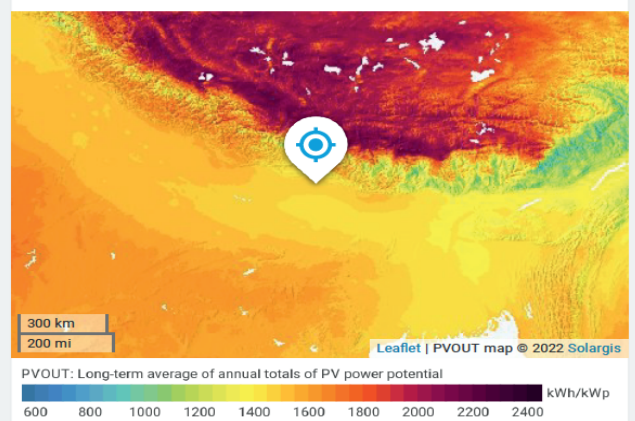
Horizon and sunpath

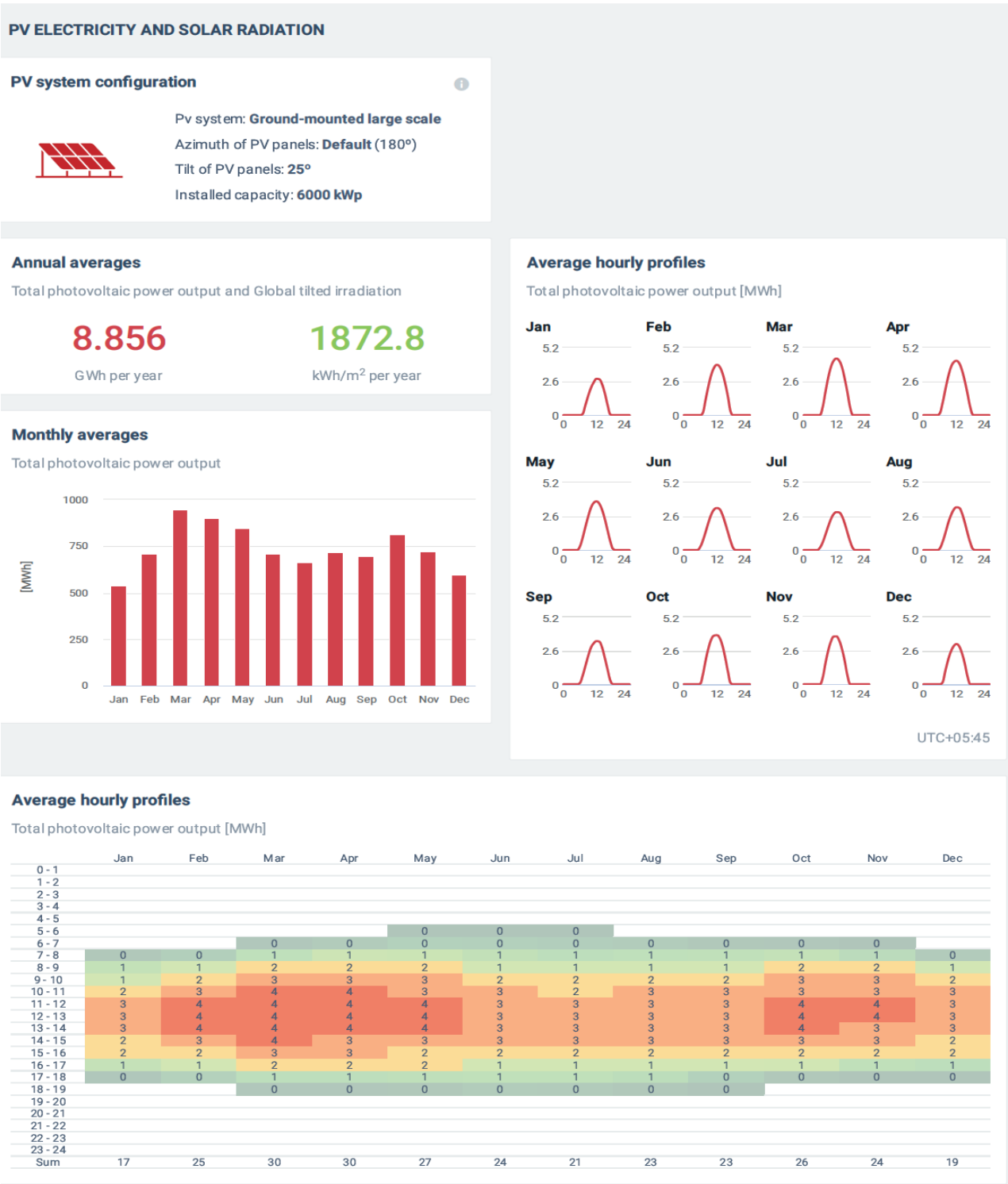


Map



PVOUT map





PV ELECTRICITY AND SOLAR RADIATION

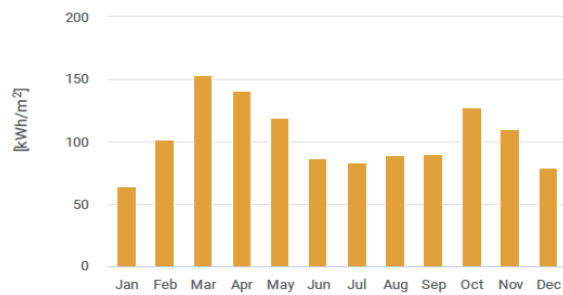
Annual averages

Direct normal irradiation

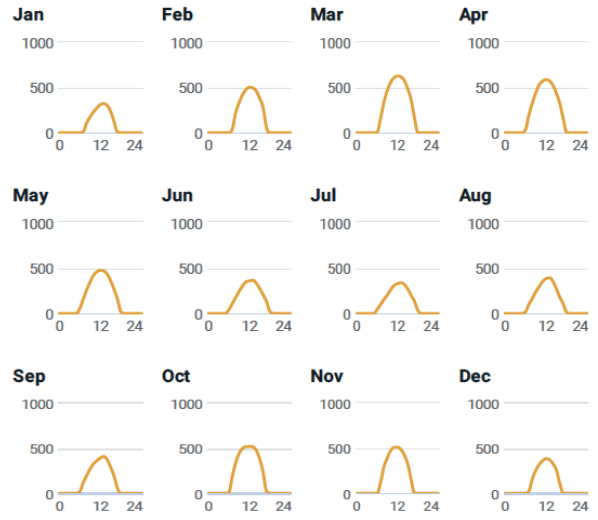
1243.7kWh/m² per year

Monthly averages

Direct normal irradiation



Average hourly profiles

Direct normal irradiation [Wh/m²]

UTC+05:45

Average hourly profiles

Direct normal irradiation [Wh/m²]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6												
6 - 7			7	34	54	39	42	19	17	7		
7 - 8	12	38	155	197	155	105	96	100	114	179	115	24
8 - 9	105	218	335	327	257	175	153	166	193	334	291	160
9 - 10	172	329	465	439	344	241	203	238	267	438	391	253
10 - 11	228	416	554	526	418	302	260	295	324	496	471	318
11 - 12	271	472	606	568	458	345	308	351	361	517	507	360
12 - 13	308	501	623	583	474	357	326	383	389	520	509	383
13 - 14	320	493	613	570	467	365	337	392	408	514	485	371
14 - 15	299	459	575	521	431	332	318	350	371	474	423	326
15 - 16	232	379	483	433	359	275	269	270	288	380	325	254
16 - 17	123	273	363	320	264	205	200	179	190	229	152	107
17 - 18	8	56	163	153	155	130	132	104	54	24	1	1
18 - 19			3	4	18	23	33	11				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	2077	3635	4945	4675	3853	2894	2675	2859	2977	4113	3671	2558

Location 2: Near the Industrial Corridor, Birjung, Parsa

GLOBAL SOLAR ATLAS

BY WORLD BANK GROUP

Birgunj, Parsa, Nepal

27.108407°, 84.912097°

unnamed road, Lalparsa, Nepal

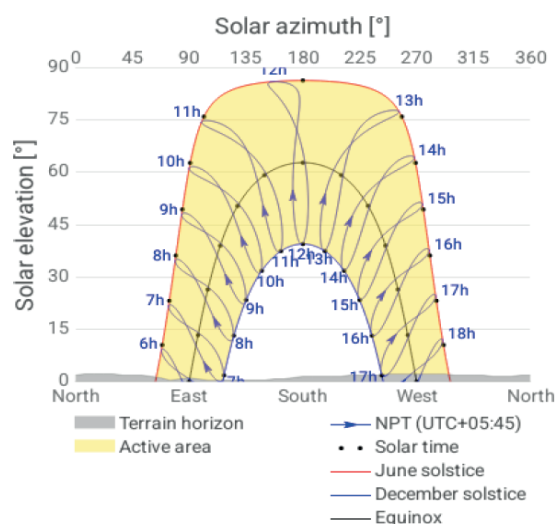
Time zone: UTC+05:45, Asia/Kathmandu [NPT]

Report generated: 30 Jan 2022

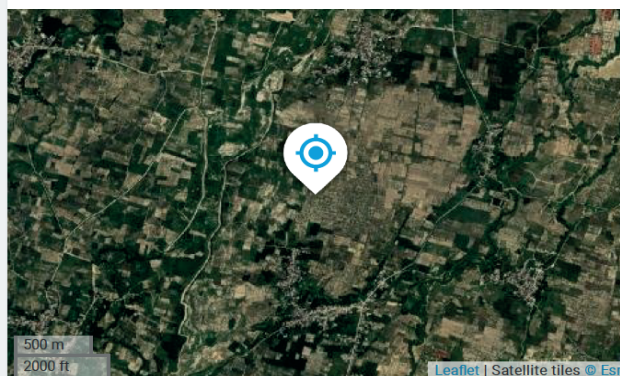
SITE INFO

Map data		Per year
Direct normal irradiation	DNI	1232.2 kWh/m ²
Global horizontal irradiation	GHI	1737.8 kWh/m ²
Diffuse horizontal irradiation	DIF	886.5 kWh/m ²
Global tilted irradiation at optimum angle	GTI opta	1873.8 kWh/m ²
Optimum tilt of PV modules	OPTA	25 / 180 °
Air temperature	TEMP	25.0 °C
Terrain elevation	ELE	100 m

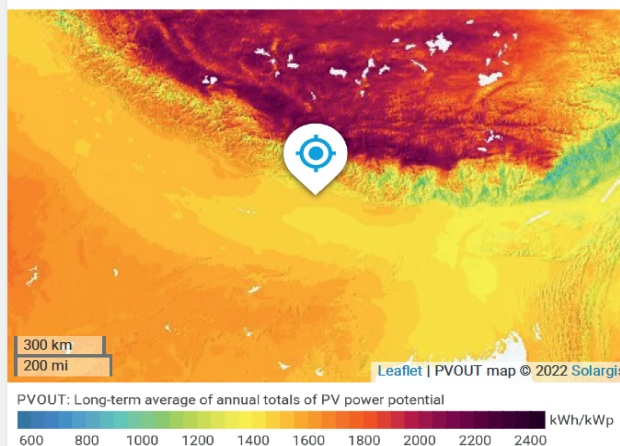
Horizon and sunpath



Map



PVOUT map



PV ELECTRICITY AND SOLAR RADIATION

PV system configuration

Pv system: **Ground-mounted large scale**Azimuth of PV panels: **Default (180°)**Tilt of PV panels: **25°**Installed capacity: **6000 kWp**

Annual averages

Total photovoltaic power output and Global tilted irradiation

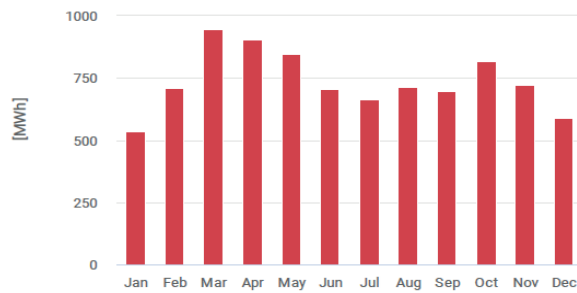
8.860

GWh per year

1870.1kWh/m² per year

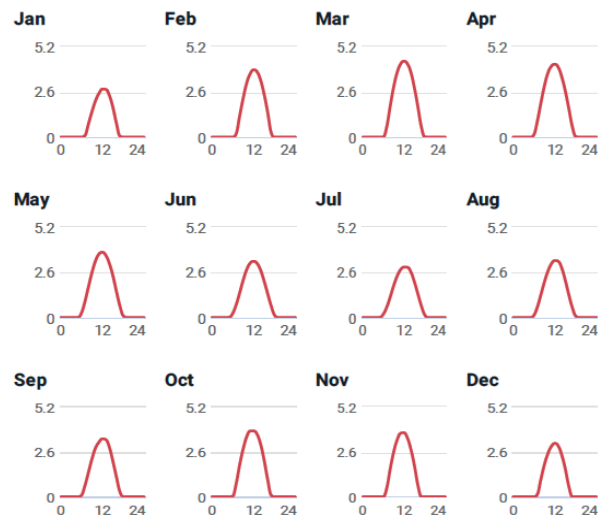
Monthly averages

Total photovoltaic power output



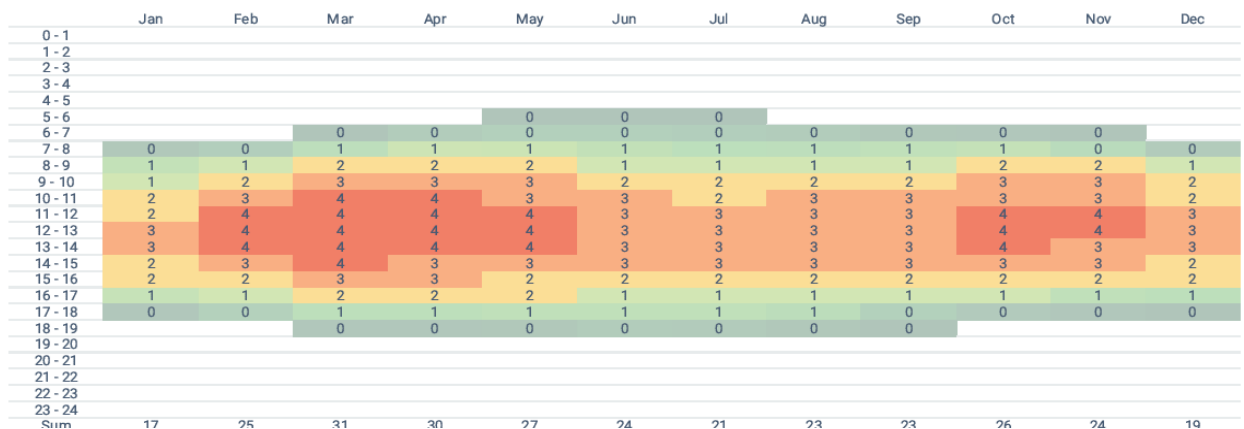
Average hourly profiles

Total photovoltaic power output [MWh]



Average hourly profiles

Total photovoltaic power output [MWh]



PV ELECTRICITY AND SOLAR RADIATION

Annual averages

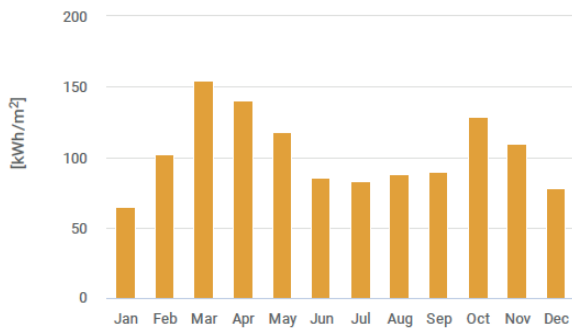
Direct normal irradiation

1241.6

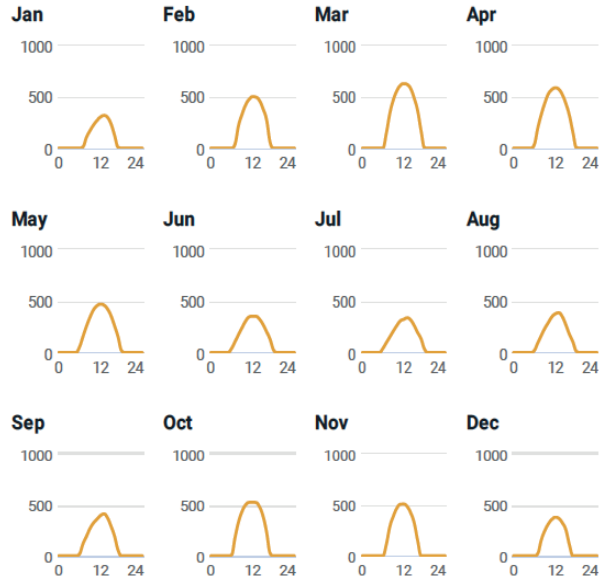
kWh/m² per year

Monthly averages

Direct normal irradiation



Average hourly profiles

Direct normal irradiation [Wh/m²]

UTC+05:45

Average hourly profiles

Direct normal irradiation [Wh/m²]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6												
6 - 7				35	53	39	40	19	18	8		
7 - 8	13	39	147	196	155	105	96	94	118	179	114	24
8 - 9	105	220	337	328	256	175	151	166	191	333	287	157
9 - 10	169	328	469	438	343	241	208	235	267	435	388	248
10 - 11	224	418	555	526	415	304	261	291	323	500	467	313
11 - 12	268	473	609	569	454	346	307	346	360	525	506	357
12 - 13	302	500	627	586	470	353	323	376	396	526	508	378
13 - 14	317	495	618	572	460	351	337	386	412	523	484	367
14 - 15	299	460	578	519	423	323	316	348	373	479	422	324
15 - 16	235	381	487	433	357	271	263	269	291	388	326	255
16 - 17	126	275	366	319	260	203	195	178	194	233	153	110
17 - 18	9	57	169	155	153	127	132	103	57	26	1	1
18 - 19			3	5	18	24	32	11				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	2067	3647	4965	4681	3816	2861	2659	2821	2999	4155	3655	2533

Location 3: Along the Bank of Kamala River, Dhalkebar, Dhanusha

GLOBAL SOLAR ATLAS

BY WORLD BANK GROUP

Dhalkebar

26.948485°, 085.960464°

unnamed road, Dhalkebar, Nepal

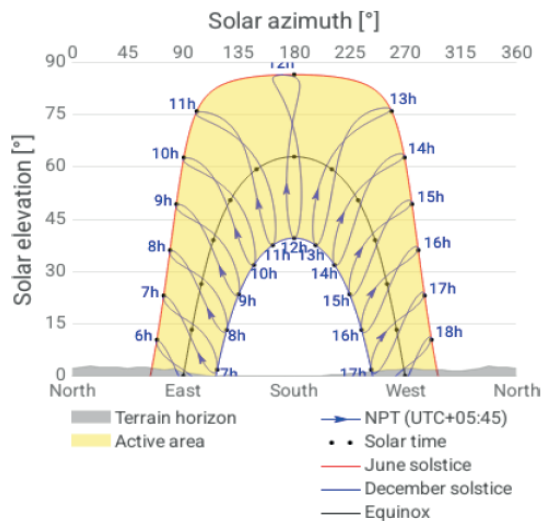
Time zone: UTC+05:45, Asia/Kathmandu [NPT]

Report generated: 30 Jan 2022

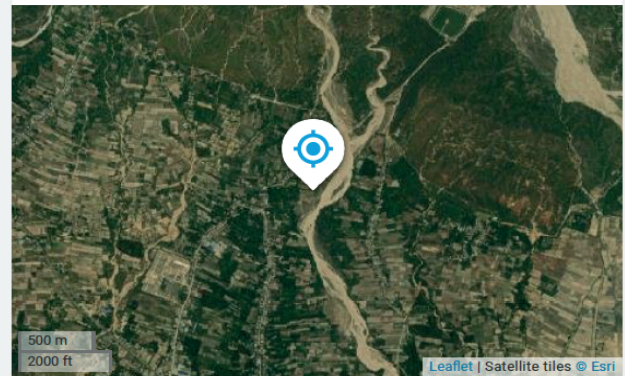
SITE INFO

Map data		Per year	
Direct normal irradiation	DNI	1267.4	kWh/m ²
Global horizontal irradiation	GHI	1748.2	kWh/m ²
Diffuse horizontal irradiation	DIF	874.6	kWh/m ²
Global tilted irradiation at optimum angle	GTI _{opta}	1887.0	kWh/m ²
Optimum tilt of PV modules	OPTA	25 / 180	°
Air temperature	TEMP	25.1	°C
Terrain elevation	ELE	198	m

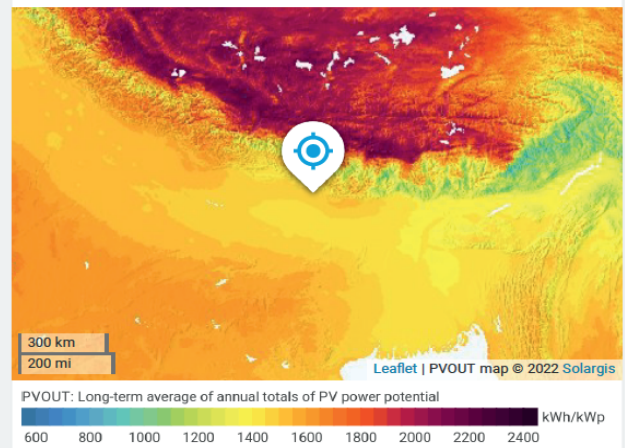
Horizon and sunpath

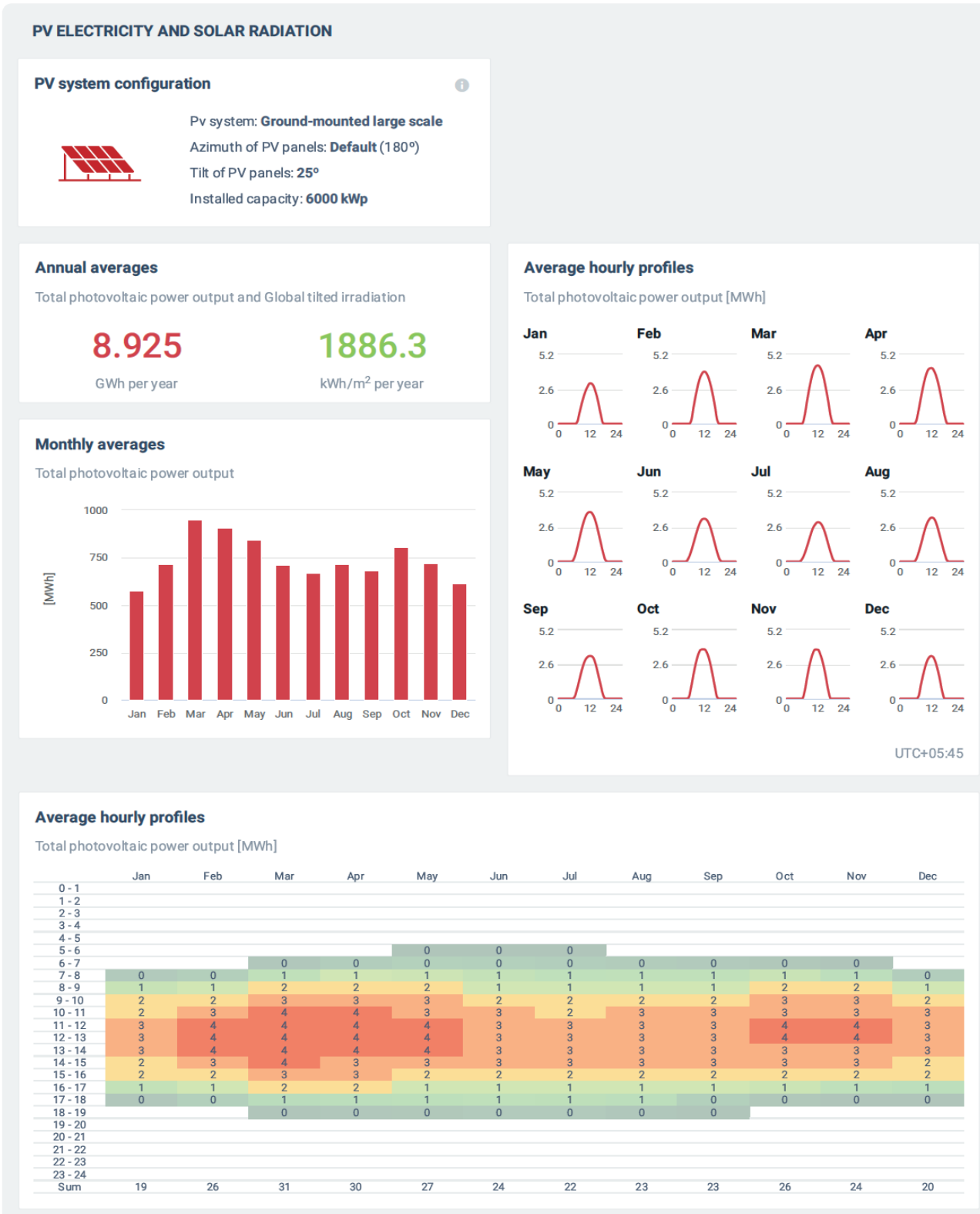


Map



PVOUT map





PV ELECTRICITY AND SOLAR RADIATION

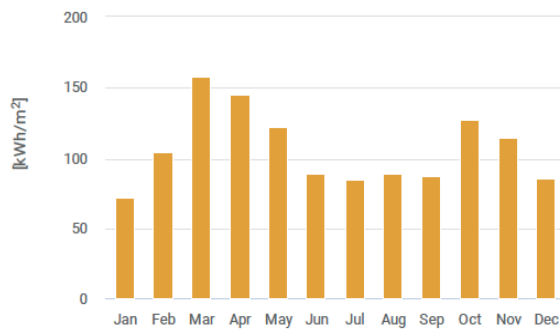
Annual averages

Direct normal irradiation

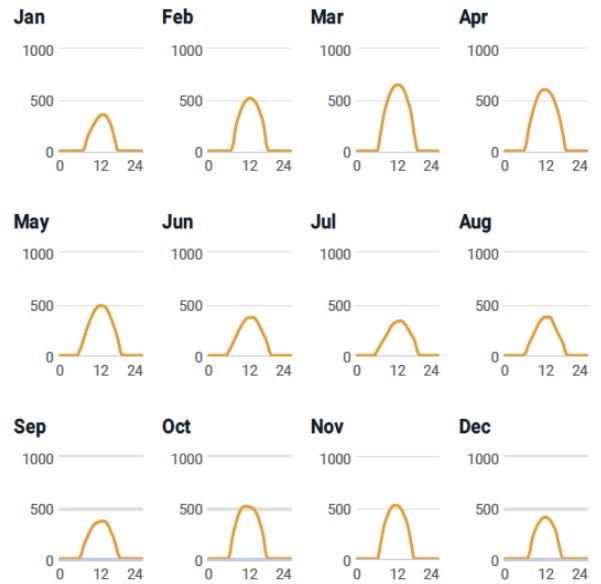
1278.0kWh/m² per year

Monthly averages

Direct normal irradiation



Average hourly profiles

Direct normal irradiation [Wh/m²]

UTC+05:45

Average hourly profiles

Direct normal irradiation [Wh/m²]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6							1					
6 - 7			6	38	61	45	46	22	21	21	1	
7 - 8	15	43	171	220	161	111	103	110	128	210	147	32
8 - 9	124	241	363	358	264	182	159	176	208	352	318	191
9 - 10	201	354	484	472	354	253	214	249	283	450	418	290
10 - 11	263	442	574	556	427	311	275	316	333	507	494	357
11 - 12	317	493	628	592	471	356	315	357	356	515	523	397
12 - 13	349	514	645	597	484	367	330	373	368	507	521	407
13 - 14	352	500	633	575	477	369	335	373	367	493	490	387
14 - 15	317	458	584	525	437	338	312	326	334	445	423	336
15 - 16	247	376	486	439	357	279	263	252	260	351	326	257
16 - 17	121	271	366	320	264	208	203	184	174	222	153	105
17 - 18	6	50	152	158	153	131	146	116	51	20	1	1
18 - 19			3	4	15	22	30	14				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	2314	3744	5094	4855	3923	2974	2731	2869	2884	4095	3815	2759

Location 4: Along the Bank of Bagmati River, Rautahat

GLOBAL SOLAR ATLAS

BY WORLD BANK GROUP

Rautahat, Nepal

26.988977°, 085.28289°

unnamed road, Pipara Pokhariya, Nepal

Time zone: UTC+05:45, Asia/Kathmandu [NPT]

🕒 Report generated: 30 Jan 2022

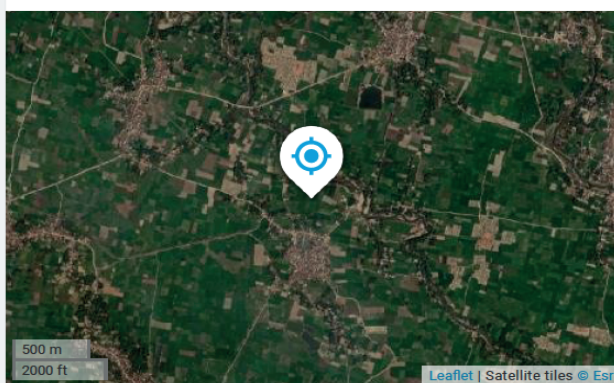
SITE INFO

Map data

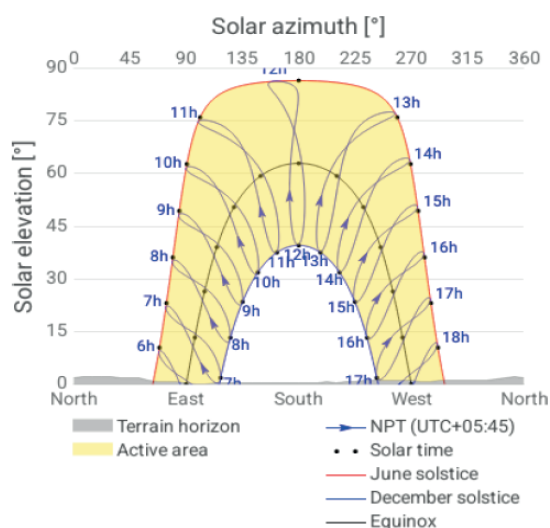
Per year

Direct normal irradiation	DNI	1225.5	kWh/m ²
Global horizontal irradiation	GHI	1734.6	kWh/m ²
Diffuse horizontal irradiation	DIF	885.5	kWh/m ²
Global tilted irradiation at optimum angle	GTI opta	1866.5	kWh/m ²
Optimum tilt of PV modules	OPTA	25 / 180	°
Air temperature	TEMP	25.1	°C
Terrain elevation	ELE	93	m

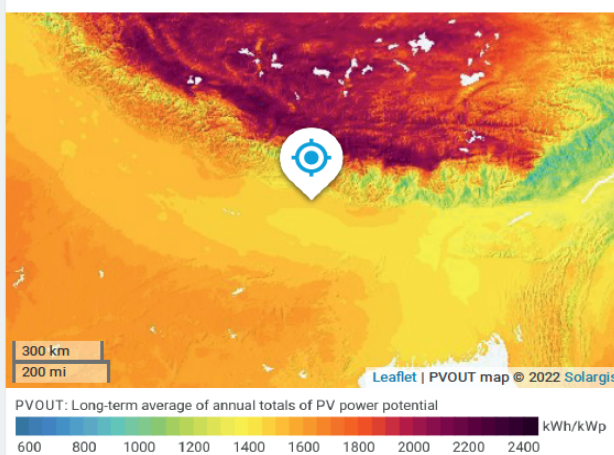
Map



Horizon and sunpath



PVOUT map



PV ELECTRICITY AND SOLAR RADIATION

PV system configuration

Pv system: **Ground-mounted large scale**Azimuth of PV panels: **Default (180°)**Tilt of PV panels: **25°**Installed capacity: **6000 kWp**

Annual averages

Total photovoltaic power output and Global tilted irradiation

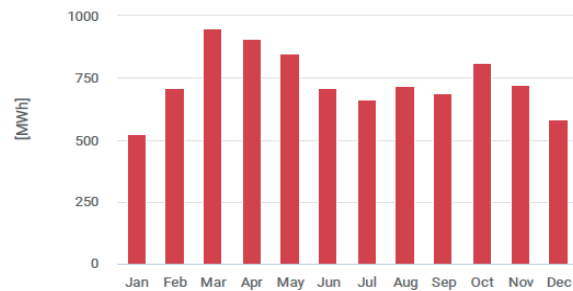
8.819

GWh per year

1864.6kWh/m² per year

Monthly averages

Total photovoltaic power output



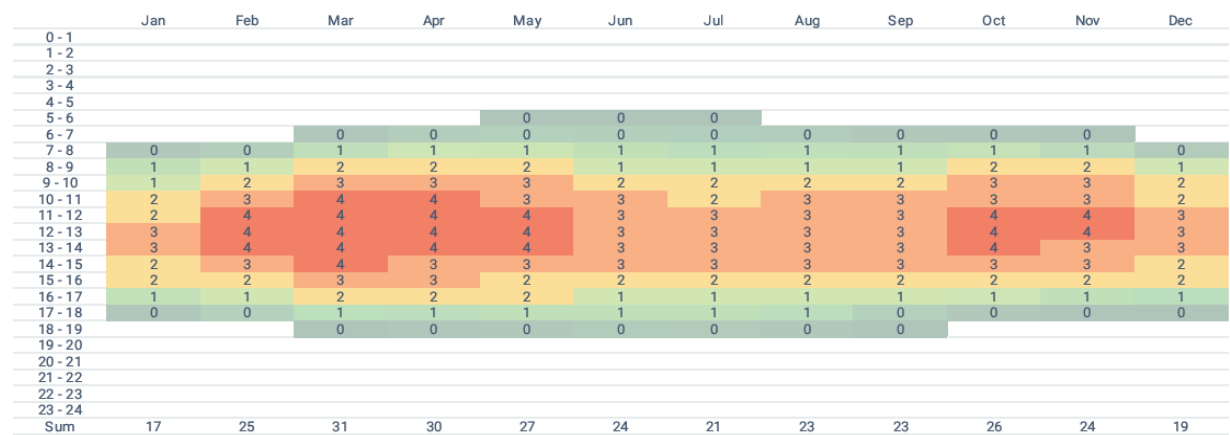
Average hourly profiles

Total photovoltaic power output [MWh]



Average hourly profiles

Total photovoltaic power output [MWh]



PV ELECTRICITY AND SOLAR RADIATION

Annual averages

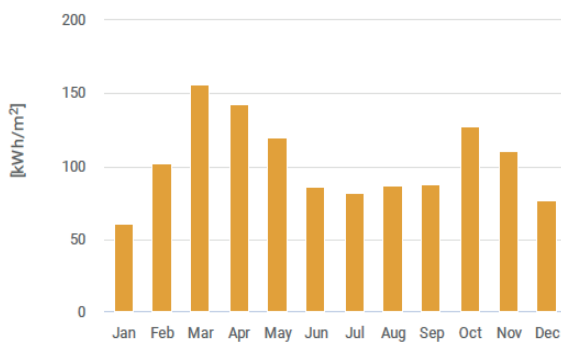
Direct normal irradiation

1235.7

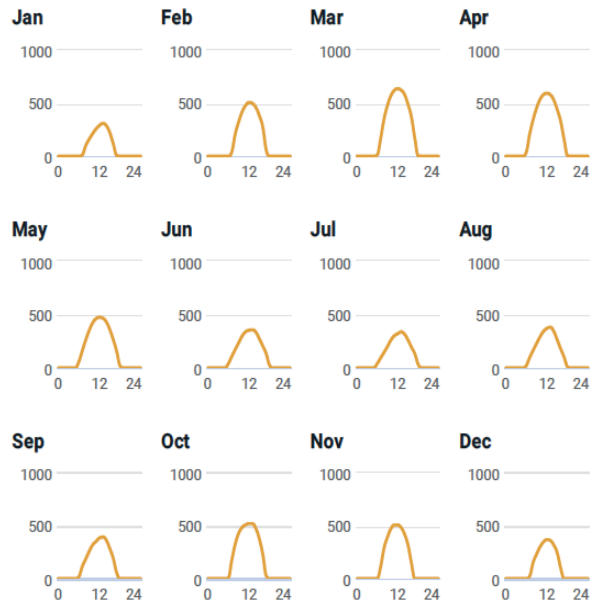
kWh/m² per year

Monthly averages

Direct normal irradiation



Average hourly profiles

Direct normal irradiation [Wh/m²]

UTC+05:45

Average hourly profiles

Direct normal irradiation [Wh/m²]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5												
5 - 6												
6 - 7			12	35	57	41	41	20	17	7		
7 - 8	11	40	166	205	159	108	94	97	113	176	113	22
8 - 9	97	208	350	340	261	174	147	164	185	328	290	152
9 - 10	158	322	477	450	350	236	201	229	257	431	393	231
10 - 11	210	417	567	531	421	299	261	291	318	485	472	299
11 - 12	255	475	617	576	462	339	302	342	352	510	507	347
12 - 13	288	503	634	590	474	354	321	371	384	521	508	369
13 - 14	307	494	619	576	466	358	338	382	395	521	483	361
14 - 15	285	456	578	527	431	335	316	343	363	473	421	318
15 - 16	221	379	486	437	359	272	263	263	284	375	320	244
16 - 17	116	270	369	328	264	205	196	180	192	227	150	101
17 - 18	7	55	170	157	154	131	133	101	54	25	1	1
18 - 19			3	5	17	22	34	11				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	1955	3619	5047	4758	3878	2873	2647	2793	2916	4079	3660	2445

Madhesh Province (also known as Madhesh or Mithila) is located in Nepal's southeastern area. It is the smallest province in terms of land area, but the second biggest in terms of people. It is bordered on the east by Province 1, on the north by Bagmati Province, and on the south by India. It covers 9,661 square kilometers, or around 6.5 percent of the country's total area. As of 2019, the province has a total population of 6,158,649 people, making it Nepal's most densely populated province¹³. From Saptari district in the east to Parsa district in the west, the province is divided into eight districts.

Despite the fact that Madhesh Province has no severe terrains, the region's transportation infrastructure is lacking owing to a lack of investment and negligence. In Nepal, however, Madhesh Province is the only province possessing a passenger train line. The Mahendra Highway, which runs longitudinally across the province is the province's main connecting connection with Janakpurdham(27.7 kms), Rajbiraj(15.4 kms), Birgunj(23.4 kms) & Gaur(44.6 kms) south of Mahendra Highway. Although the Tribhuvan Highway does not cover as much ground as the Mahendra Highway, it is the most essential route since it links the province to Kathmandu and India. Birgunj, the starting point of the Tribhuvan Highway, is the province's and country's most significant international gateway and trade route, and is hence known as "The Gateway of Nepal." Birgunj custom point is the largest in terms of revenue generation.

In Madhesh Province, a few railway projects are in the works. Nepal Railways is responsible for all of these projects. The Nepalese government has suggested Janakpur as the main station for a 1024-kilometer east-west Metro Railway Project that would eventually be extended to India and China, allowing Nepalese railways to link with Indian and Chinese railways for economic and tourism purposes. Madhesh Province is served by three domestic airports, the busiest in the country. Rajbiraj Airport, Janakpur Airport, and Simara Airport are all located in Rajbiraj. Meanwhile, at Nijgadh, an international airport, Nijgadh International Airport, is being built.

2.4 Developing a Business Case

Product Mix

The product mix for this project consists of the following components:

2.4.1 Solar PV Options

2.4.1.1 Poly Crystalline Technology

Polycrystalline technology allows for low-cost, high-efficiency, and long-lasting solar panels. The solar panels made with this method are made up of multiple silicon crystals in a single PV cell. Polycrystalline solar panels are made up of wafers made up of many silicon pieces fused together. In the case of polycrystalline solar panels, the molten silicon vat used to make the cells may cool directly on the panel. The surface of these solar panels resembles a mosaic. These solar panels are square in form and have a gleaming blue tint due to the fact that they are made up of numerous silicon crystals. Polycrystalline solar panels enable less mobility of electrons within the cells since each cell has many silicon crystals. The sun's energy is captured by these solar panels and converted into power.

Multiple photovoltaic cells make for polycrystalline solar panels. Silicon crystals are included in each cell, allowing it to act as a semiconductor device. When photons from the sun strike the PN junction, they provide energy to the electrons, allowing them to flow as an electric current. In this case, p-type materials are electron-deficient, while n-type materials are electron-rich. The PV cells are attached to two electrodes. Small wires make up the electrode on the top surface, while a foil-like conductor makes up the electrode on the bottom.

The following are some of the benefits of solar panels made using polycrystalline technology:

1. Polycrystalline solar panels are more environmentally friendly than monocrystalline solar panels since they do not need separate shape and positioning of each crystal, and the majority of the silicon is used in the manufacturing process. As a result, relatively little trash is generated.

13 Central Bureau of Statistics. (2021) Central Bureau of Statistics of Nepal: National Population and Housing Census 2021 (Preliminary Report).

2. The maximum temperature for polycrystalline solar panels is 85 degrees celsius, while the lowest temperature is -40 degrees celsius.
3. The heat tolerance of polycrystalline solar panels is lower than that of monocrystalline panels. As a result, these solar panels are less efficient at higher temperatures than others.
4. The temperature coefficient of polycrystalline solar panels is larger than that of monocrystalline panels.
5. The power density of these panels is quite high.
6. They come with their own structural frame, which makes installation cheaper and easier.

2.4.1.2 Mono Crystalline Technology

Solar cells made of silicon manufactured as a single crystal with a continuous internal structure are known as mono-crystalline technology. This silicon is made into a big cylindrical ingot and then finely cut into wafer cells, which are often dark blue or black in color. These manufacturing procedures use more resources than polycrystalline cells, therefore they are normally more expensive, but they are somewhat more efficient.

First, pure silicon is created in arc furnaces by numerous chemical and thermal processes of silicon oxide. The silicon melt is then used to dip a mono-crystalline structured silicon piece. The cooling silicon melt piles up all around the core when it is taken from the melt. After obtaining a piece of silicon, it is separated into slices. This occurs in two stages. The pile is then chopped into rectangular chunks. Following that, these blocks are cut into slices and processed into a panel. The downside of these cells is the large quantity of material loss during manufacturing. They have a thickness of roughly 0.5 mm and are manufactured in a variety of colors. Their hue is dark blue, and they weigh less than 10 grams on average. Furthermore, the octagonal form of mono-crystalline solar cells gives them a distinct appearance.

When sunlight falls on a mono-crystalline solar panel, the cells absorb the energy and form an electric field via a sophisticated process. This electric field, which consists of voltage and current, creates electricity that may be utilized to power direct current devices directly (DC). An inverter may also convert this electricity to alternating current (AC).

The mono-crystalline solar cells in the panel have the following characteristics:

1. They have a pyramid design, which provides a bigger surface area for collecting more energy from the sun's beams.
2. The top surface is phosphorus diffused, which serves to generate an electrically negative orientation in comparison to the bottom, which has a positive electrical orientation, which helps to create the electric field.
3. The cells are coated with silicon nitride to decrease reflection and hence maximize absorption.
4. Metal conductors printed onto the cells gather the generated power.
5. The major benefit of mono-crystalline solar cells over its two counterparts is the better efficiency of conversion of solar energy into electric energy as a result of the aforesaid properties.
6. These panels have a 30 years life expectancy.
7. These panels are more resistant to heat.

2.4.2 Grid Connected Inverter Options

A solar-PV power plant's inverter is one of its most important components. It transforms the solar-PV modules' DC power into alternating current (AC) electricity. The size and number of inverters needed are determined by the amount of PV capacity installed and the system design choices.

The inverter is directly linked to the low voltage power distribution grid for small-scale solar PV installations. The inverter is linked to the step-up transformers in large utility-scale solar-PV power plants to enhance the AC power voltage before feeding to the medium or high voltage power grid.

For a solar-PV power plant, there are three common inverter ideas to consider. The central inverter, multi-string inverter, and micro-inverter are the three types.

2.4.2.1 String Inverter

String inverters are the most popular form of inverter used in residential and commercial solar power systems. It's a big box that's usually placed a long way from the solar panels. There may be more than one string inverter present, depending on the size of the installation.

String inverters have been around for a long time and are ideal for installations where there are no shading difficulties and the panels are all on the same plane,

facing the same direction. If a string inverter system is used and even one panel is shaded for a period of the day, the output of every panel on the string is decreased to the level of the struggling panels. Despite the fact that string inverters cannot cope with shade concerns, the technology is reliable and well-proven, and they are less costly than microinverter systems. In both home and business settings, string inverters are widely utilized. String inverters are also becoming a popular alternative to central inverters in small utility installations under 1 MW as technology advances, enabling them to have higher power density in smaller sizes.

String inverters may also be used in conjunction with power optimizers, which is becoming more common. Module-level power electronics, or power optimizers, are put at the module level, so each solar panel has one. Some panel manufacturers combine their products with power optimizers and market them as a smart module as a single solution. This may help the installation process go more smoothly. String inverters alone cannot minimize the impacts of shading, but power optimizers can. They condition the DC power before passing it to the inverter, resulting in a greater overall efficiency than a string inverter alone. The solar panel array is connected in series, rather than parallel, using a string inverter. The solar panel array is still commonly rated at 12V, 24V, or 48V per panel (although higher voltage panels are also coming out). It's as easy as that: the panels are arranged in a "string" to generate the same amount of total power but at higher voltages (usually 200-800V), resulting in reduced current, allowing for considerably less wiring and inverter design. Because the inverter equipment's electronics suffer from the same IR losses as the cable, higher voltage DC input circuitry may be produced more cheaply and with fewer internal losses, boosting efficiency in both the electronics and the cabling between the solar array and the inverter.

2.4.2.2 Central Inverter

A central inverter is normally located near the main electrical supply panel, in a protected setting away from adverse environmental conditions. The DC electricity from all of the solar panels is collected in one combiner box, then sent to the central inverter to be transformed into AC power. As a consequence, voltages in the central inverter may reach 600 volts DC in extreme cases.

String inverters and micro inverters have smaller capacity than central inverters, which are often utilized for

large-scale industrial applications. The electricity of the facility is converged into a single location using central inverters. In comparison to string inverters, central inverter units are physically bigger, have longer cables, and can convert more electricity per unit. A 5 MW PV system demands the use of a central inverter with a 5 MW minimum rating.

All module strings are combined centrally in the event of a central inverter. This is especially advantageous when all PV modules are subjected to comparable inclination and orientation circumstances. As a result, central inverters are often utilized in the form of a control cabinet or a station in container construction for bigger roof systems or free-space systems. The produced solar electricity is fed directly into the medium-voltage grid with a voltage of 20,000 volts via central inverters with a capacity of 100 to 1,200 kW.

A central inverter's basic construction consists of a single DC-AC conversion step. A DC-DC boost stage is used in certain inverters to enhance the MPP voltage range. A low frequency transformer may be used at the output to enhance the AC voltage and offer isolation in certain instances. However, this reduces efficiency and increases the inverter's size, weight, and cost. In commercial installations, transformerless inverters with a front-end boost stage are becoming more popular.

In Europe, central inverters have always been rated at 1000V, however in the United States, they are available in two DC voltage categories: 600V and 1000V. Commercial rooftop projects, as well as certain utility-scale installations, often employ the 600V DC category. Larger (>500kW) 1000V DC rated inverters have been employed in "behind-the-fence" (utility-owned) projects for many years. In response to code revisions, smaller 1000V DC central inverters are now being used in commercial rooftop installations.

In the United States, commercial inverters have either 480V or 208V 3-phase outputs. Utility inverters often have a lower AC output (defined by the lowest DC voltage) and are coupled to an MV transformer. If the arrays are ungrounded, it is usual to parallel the outputs of numerous inverters on a single transformer winding. To take advantage of BOS cost advantages, the wind industry standard of 690V AC has recently become a preferred output voltage.

central inverters may be monolithic (using a single power train and MPP tracker) or modular (using numerous power trains and MPP trackers) (with multiple power trains). Modular inverters are more complicated, but they offer the benefit of being able to run at lower power levels if one or more modules fail. They might control the system using either a multi-MPPT or a Master-Slave method. Under partial shade situations, the multi-MPPT strategy effectively employs a separate converter and MPPT for each floating sub-array, which enhances the total energy harvest. The Master-Slave technique increases inverter efficiency under low isolation circumstances since the Master module is constantly on and directs additional modules (slaves) to switch on when more power is available from the array.

In the past, solar inverters were required to operate at unity power factor and to disconnect from the grid in the event of low voltage or frequency (anti-islanding). Low-Voltage/Low-Frequency Ride Through (LVRT/LFRT), reactive power support, and dynamic power factor management are all characteristics that are increasingly needed to support the grid. This needs the capacity to control rather than merely observe the inverter settings.

2.4.3 Ground Mounting Structure Options

Module Mounting Structures are essential for constructing a long-lasting, effective solar power plant. The foundation of these buildings should be inspected first before the installation of module mounting structures for a ground mount solar plant. The foundation may be erected in a variety of ways, including pile foundations and ramming. The key to a robust mounting structure is a solid base. Different module mounting structures may be employed to carry out Ground-Mounted solar systems, depending on the design of the plant and the financial limitations involved.

2.4.3.1 Fixed Tilt System/Tracking System

The modules are elevated on buildings with fixed tilt structures. With a sturdy foundation, they are held securely to the ground. Because the tilt of the modules cannot be modified after the structures and modules are placed, the fixed tilt structures are intended for year round optimal tilt.

The quantity of power produced by a fixed-tilt solar PV system is determined by the PV panels' direction

in relation to the sun. When the sun's beams are perpendicular to the panels of a solar PV system, the panels capture solar energy more effectively.

PV systems with a fixed tilt employ two angles to establish their orientation in relation to the sun: azimuth and tilt.

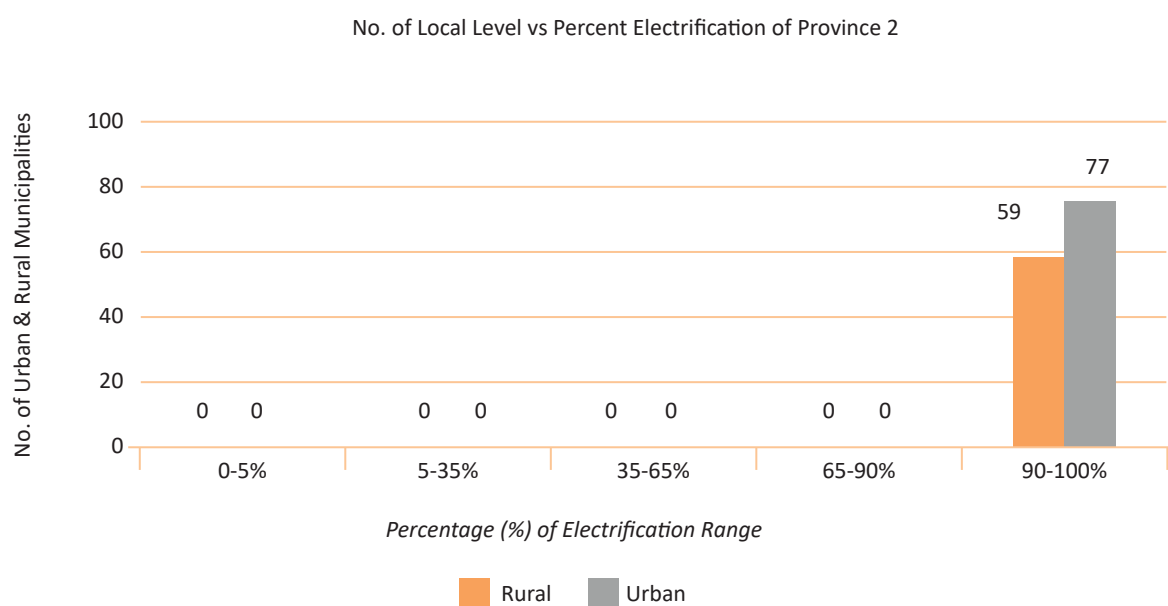
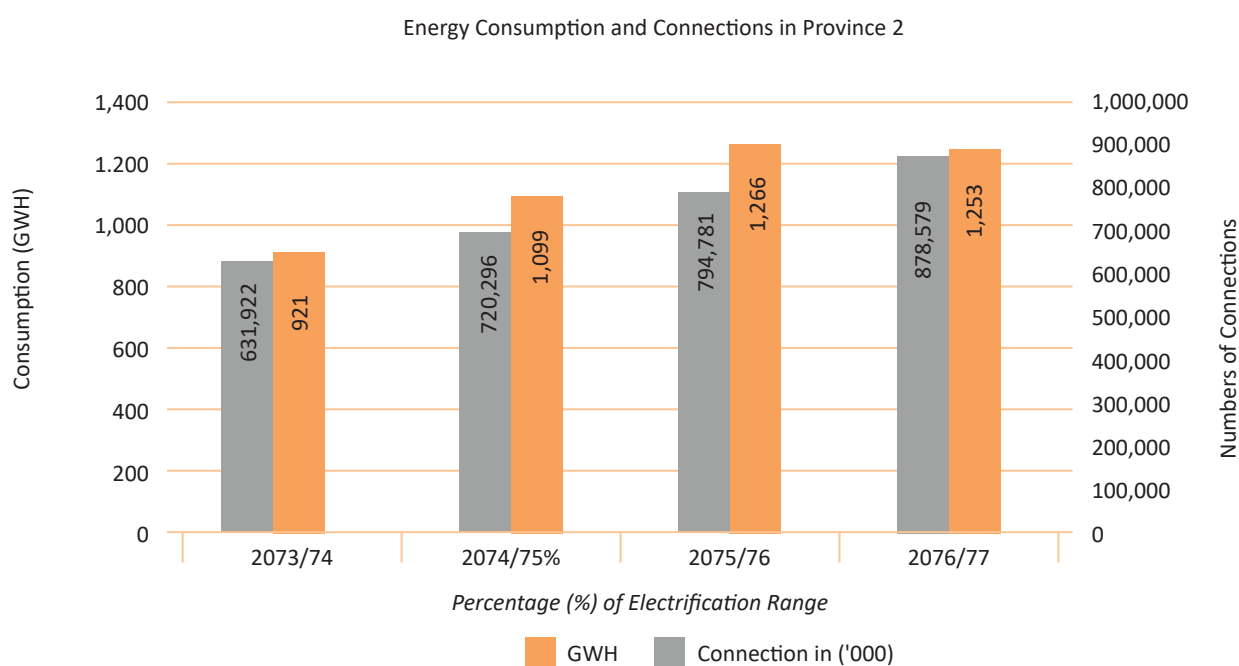
1. A slanted panel's azimuth indicates the compass direction it is facing: north, south, east, or west. The majority of panels in the Northern Hemisphere face south.
2. The tilt is the angle between the horizontal ground and the object. A tilt of zero degrees indicates that the panel is level on the ground, while a tilt of 90 degrees indicates that the panel is perpendicular to the ground, like on a building's side.

The tilt of modules may be changed in a more precise way using a tracking system. This eliminates the need for the laborious operation of manually tilting the modules to the proper angles. There are two kinds of trackers that are often used:

1. Single Axis Trackers: These allow a module to move along a single axis that may be evenly maintained over a single row or a block of modules. This may be thought of as giving the module a single rotational axis. Single axis trackers enable the module to move along either a vertical or horizontal axis. In slanted module installations, single axis trackers may also be used.
2. Dual Axis Trackers: These trackers enable modules to spin along two axes, allowing for more exact monitoring of the sun's movement across the sky and optimal solar exposure at various times of the day and year.

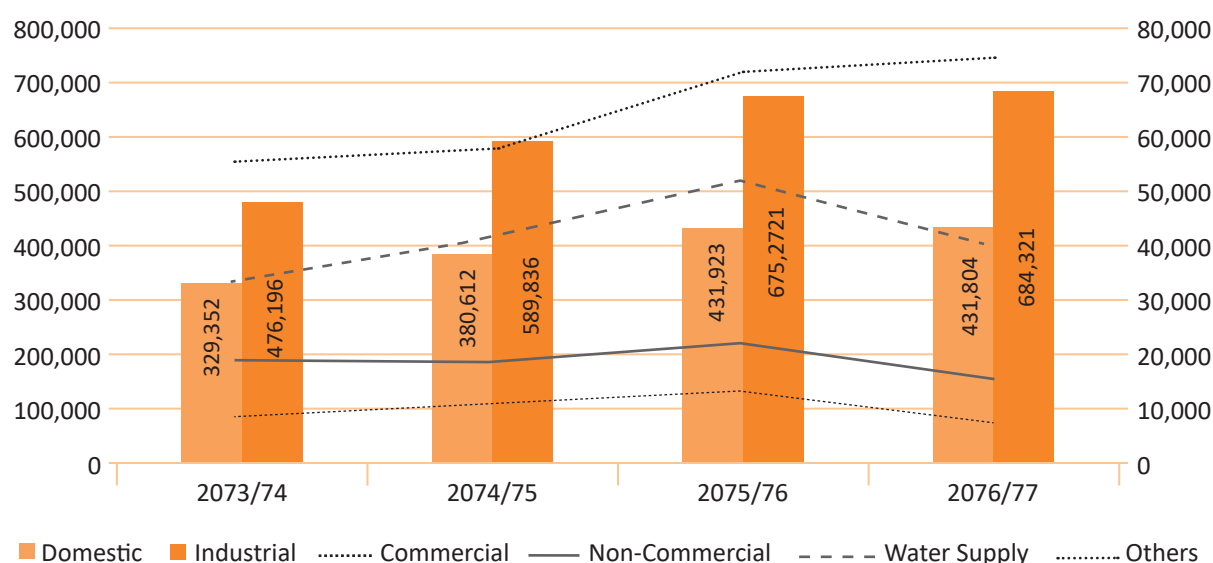
2.5 Market Assessment

Madhesh Province is the first and only province in the country to achieve a 99 percent electrification rate, with 90 percent electrification in all of its rural and urban towns. Madhesh Province contains about 17% of the total substations in Nepal, with an average size of 15 MVA, the largest in the nation. There are 15 (33/11 Kv) substations under construction, each with a capacity of 12.5 MVA. With an annual current power usage of 1,253 GWh, Madhesh Province has the third-longest coverage of 33 kV and 11 kV lines in Nepal.

Fig 2: Grid electrification of Madhesh Province¹⁴Fig 3: Annual change in consumption and connections in Madhesh Province¹⁵

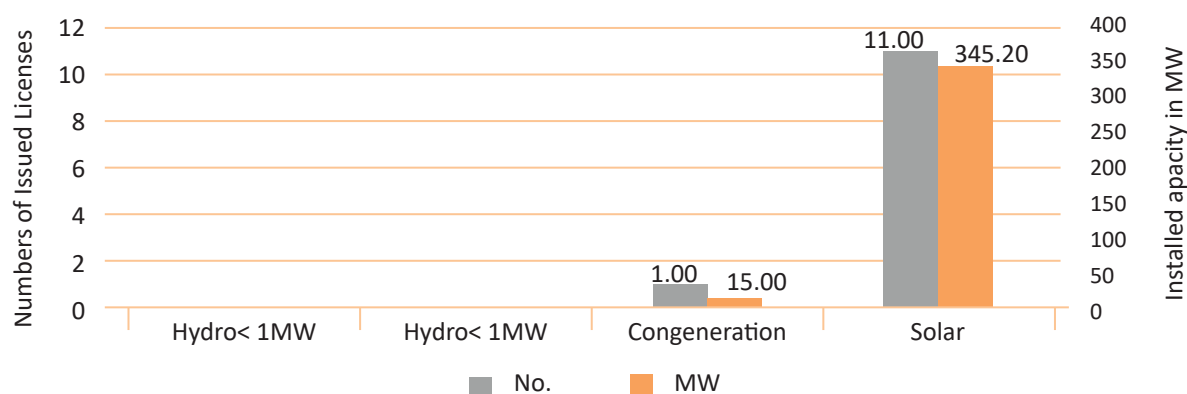
14 UNFPA. (2020). Demographic Profile of Madhesh Province. Retrieved from <https://nepal.unfpa.org/en/publications/demographic-profile-Provincial-2>

15 NREP. (2021) Energy Profile: Madhesh Province, Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

Fig 4: Change in energy consumption of Madhesh Province¹⁶

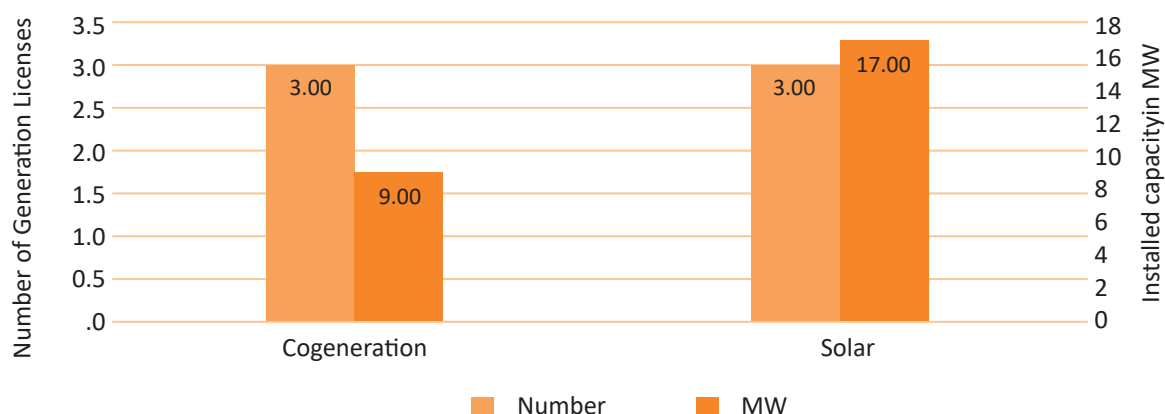
Electricity usage in Madhesh Province is at 1,253 GWh, down 1% from the previous year. The province accounted for a 31% increase in energy consumption compared to FY 2074/75. This might be Covid-19's influence on Madhesh Province's energy-intensive commercial and industrial sectors. Even during the lockdown, however, the number of new connections climbed by 10%, owing mostly to the installation of new residential meters. Madhesh Province's energy usage decreased by 0.9 percent in FY 2076/77, totaling 1,253 GWh. Industries

used 54.6 percent of the power, while households and businesses used 34.45 percent and 3.17 percent, respectively. Industries, home, and commercial sectors used 53.36 percent, 34.13 percent, and 4.07 percent of total consumption in FY 2075/76, respectively. Industries' consumption climbed by 44 percent during the previous four years, followed by home and commercial consumption. While non-commercial and water supply use has decreased by 16 and 14 percent, respectively.

Fig 5: Issued survey licenses in Madhesh Province(2021)¹⁷

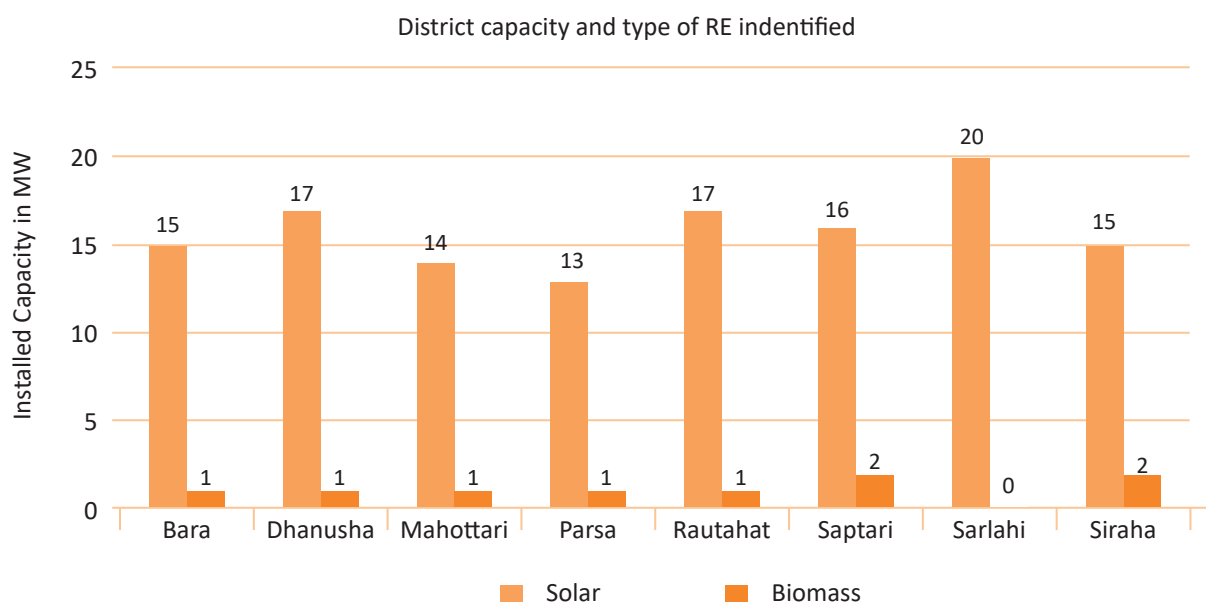
16 NREP. (2021) Energy Profile: Madhesh Province, Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

17 NREP. (2021) Energy Profile: Madhesh Province, Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

Fig 6: Issued generation licenses in Madhesh Province¹⁸

A total of 12 projects have been granted survey licenses, including 11 solar projects totaling 345.2 MW and 1 cogeneration project totaling 15 MW. According to April 2020 licensing data, a total of 9 solar projects with a combined capacity of 190.5 MW have been granted survey licenses in Madhesh Province. The average solar

project size was 21 MW last year, but it has climbed to 31.4 MW this year. Survey permits have been granted to three projects in the Dhanusha district, three in the Parsa district, two in the Mahottari district, and two in the Bara district. A survey license has also been granted to a Siraha project.

Fig 7: Renewable energy project identified by NPC in Madhesh Province¹⁹

18 NREP. (2021) Energy Profile: Madhesh Province , Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

19 NREP. (2021) Energy Profile: Madhesh Province , Lumbini and Karnali. Retrieved from <https://www.nrepnepal.com/wp-content/uploads/2021/04/Energy-Profiles-Provincial-2-Lumbini-Province-and-Karnali-Province.pdf>

Generation permits have been given to three solar projects with a combined capacity of 17 MW and three co-generation projects with a combined capacity of 9 MW. According to April 2020 licensing data, two solar projects with a total capacity of 14 MW have been granted generating licenses. Solar power licenses have decreased in size from 7 MW to 5.6 MW on average.

A total of 127 rural and urban towns have the capacity to create 127 MW from 127 locations, according to a research done by NPC in 2018. Meanwhile, nine local levels have the ability to produce power from biomass with a total installed capacity of 9 MW from nine separate locations. The district of Sarlahi has the most potential solar sites, whereas Saptari and Siraha have the most potential biomass sites.

2.6 SWOT Analysis

SWOT analysis allows for the discovery of elements that characterize a company or organization in the context of a certain goal, as well as the classification

of those characteristics into four areas. As seen in the table, two of them are positive, while the other two are negative:

2.7 Examination and Evaluation of Alternatives

In Madhesh Province, the only possibility to generate large-scale electricity is through solar power plants. Other sources of electricity generation are not possible in the province. However, there is a possibility of Agri Voltaics wherein some of the agriculture produce could be produced under the solar panels that could generate additional revenue.

2.8 Relevant Case Studies

Case Study 1

Project Type: Solar Farm Pvt Ltd

Location: Shuklagandaki Municipality-5, Tanahun, Nepal

Solar energy generates a total of 5 MW of electricity in

SWOT Analysis for Solar Projects in Madhesh Province

Strength	Weakness	Opportunities	Threats
- Vast untapped solar potential resource. - Increasing trends in overall revenue and profit. - Size of operation. - Areas with higher solar potential near the existing national grid. - Public support for solar (in contrast to coal and large hydro). - Increasing experience in solar PV through off-grid projects. - Due to the flat terrain, infrastructure construction is simple. - Shorter lead times for the construction of solar power plants. - Easy access to basic infrastructure such as roads, communication, water supply, and power.	- High costs- sunk cost, research and development costs, cost of energy production. - A scarcity of qualified personnel and energy professionals. - Inadequate budget allocation by the responsible authorities. - A large land area is needed for the solar projects. - Lack of policies to support the development of renewables.	- Possibility of export generation surpluses to neighboring countries. - In addition to strong earnings, foreign countries have favorable exchange rates, so there is a potential of earning foreign currency. - Seasonal complementarity between solar and hydro resources. - Decreasing global prices of solar energy. - International investment interest in Nepal.	- Difficulties to improve business environment due to high levels of perceived corruption. - Unwillingness to propose new projects due to delays in the implementation of currently approved projects. - Reluctance to invest due to possible security and reputation concerns. - Legal proceeding. - Reduced investment interest due to the very low level of solar energy in the government's capacity expansion plans.



Tanahun's Shuklagandaki Municipality-5. Solar Farm Private Limited's project, had received approval to generate power from solar energy for the first time in Nepal. According to a four-year-old agreement with the corporation, Bhanubhakta Multiple Campus in Bel Chautara has provided 100 Ropanis land.

Initially, each MW was allotted roughly Rs. 80 million in capital. The proposal, however, said that they would need to expand the funds later. "The Rs. 400 to 450 million capital may now be increased to Rs. 520 to 550 million," director Gurung said²⁰. According to the deal with the NEA, the power generated by solar energy would be purchased by the NEA for Rs. 7.30 per unit for a period of 25 years, according to Hari Kumar Shrestha, the Solar Farm company's manager and shareholder.

The project has installed 13,494 solar panels. Power is generated for around six hours every day. According to Shrestha, 30,000 units of power is being generated in a single day and one million units in a year.

The farm's power is being sent into the Bel Chautara Substation, which is 500 meters away from the project site.

Case Study 2

Project Name: Chanauta 1.5 MW Solar PV Project
Location: Shivaraj Municipality, Kapilvastu, Nepal

Api Power Company Limited's 1.5 MW Solar PV Plant is located at an elevation of 128 meters above sea level. The project location is along the East-West Highway in Chanauta town Shivaraj Municipality, Kapilvastu district, Lumbini zone of Southern Nepal. The 1.5 MW PV Plant will be built on around 8 acres of land.

The project involves a techno-commercial assessment of various commercially existing solar PV technologies for the proposed site location, based on the benefits that each technology may provide during a 25-year project lifespan. Polycrystalline technology was chosen for the 1.5 MW Solar Project based on this evaluation. For the whole 1.5 MW project, Trina TSM-315PEG14 or Suntech STP315-24/Vem polycrystalline PV modules are used, along with ABB PVS800-57-1000kW Central Inverters or comparable inverters. The project was designed with a 1.35 DC:AC oversizing in conjunction with ABB 1000kW and 500kW Central Inverters with appropriate operating ranges.

²⁰ Naharki, A.R. 2021. Construction Of Solar Plant Nears Completion, 5 MW Electricity Being Produced. The Rising Nepal. Retrieved from <https://risingnepaldaily.com/business/construction-of-solar-plant-nears-completion-5-mw-electricity-being-produced#:~:text=12%3A%20total%20of%205,solar%20energy%2C%20is%20nearing%20completion.>

S.No.	Project Details	Descriptions
1	Project Authority	Api Power company Limited
2.	Project Capaacity (MW) (AC side)	1.5MW
3.	Longitue	82°51'55.72" E to 82°51.47.15"E
4	Latitude	27°38'14.4" N o 27°37'56"N
5	Selected Location	Chanauta
6	NearestMajor Town	Chanauta
7	Accessibility	By East-West National Highway
8	Nearest Airport	Siddharthanagar,Nepal
9.	Solar Module Type	Trina TSM-315PEG14/Suntech STP315-24Verm(Si-poly)
10.	Capacity of each Module	315
11	Strings in Parallel	322
12.	No. of Modules	6440
13.	PV system Mounting Structure Type	MS Galvanized
14.	Power conditioning Unit (invertors) capacity	1000kwx1Nos, 500kwx 1nos
15	Power Conditioning Unit Specifications	Input Voltage Range 450-825V (500kw), 600-850V(1000kw)
16	No. of Invertors	2
17.	Invertors Make	ABB
18.	Cables and Earthing Systems	1 set
19	Plant Load Factor (p50%)	23.72%
20.	Expected CUF AC Capacity @P75%	23%
21	Total Project Cost (NPR in Crs)	18.94
22.	Equity From Promoters (NPR in Crs)	5.68%
23	Term Loan From Financial Institution (NPR in Crs)	13.26%
24.	Working capital and interest on Term Loan	8.5%
25	Equity IRR%	15.05%
26.	Project IRR%	11.74%
27.	Land	8 Acres of vacand land
28.	Land development	The entire station will be laid at a palin land
29	Power Evacuation	Through 33kv transmission lines to NEa owned Grid substation ²¹

The project has been designed as a single modular plot with a DC capacity of 2.03 MWp, two inverters of 1000 kW and 500 kW, and a maximum AC output of 1.5 MW. Inverters, MV transformers, and switchgear must be strategically positioned inside the modular plot to reduce DC ohmic losses. Electrical connections between PV modules are made with cables that are sized to reduce

DC ohmic losses. The DC electrical output from the PV modules is delivered to junction boxes, which are subsequently linked to inverters, through DC cables of appropriate grade. The DC electrical input is converted to AC output, which is then stepped up using a single 1.5 MVa 415 V/33 kV Transformer.

21 Api Power Company Ltd. 2022. Chanauta 1.5 MW Solar PV Project. Retrieved from <http://apipower.com.np/home/pagesDisp/chanauta-1-5-mw-solar-pv-project>

Case Study 3

Project Name: Dhalkebar 10 MW Solar Project

Location: Dhalkhebar Municipality, Dhanusha, Nepal

The Mithila Saurya 10MW solar PV (photovoltaic) plant is the first privately owned solar PV (photovoltaic) plant with a capacity of 10 MW AC. Despite the crises and hurdles posed by the COVID-19 pandemic, the project was finished in just six months in Dhalkebar, Dhanusha District, Madhesh Province. The plant was built with the goal of meeting Nepal's growing energy demands, reducing energy reliance, and boosting economic growth in the energy sector.

Eco Power Development Company created the solar system under a 25-year power purchase agreement (PPA) of (Nepalee Rupee) NPR 7.30/unit, or roughly \$0.063/unit.

The PV mono crystalline modules are used in the project, which is stretched out over 6.3 hectares of land. Three

FIMER PVS980-58 central inverters, one with 1045 KW and the other two with 4500 KW each, were requested²². These convert the DC current from the solar modules to 690 V AC, with a conversion efficiency of >98.8%. To step up voltage to 33kV, ONAN Outdoor Three Phase type transformers with rated capacities of 1.5 MVA and 5MVA are also used. The 10 MW generated is sent to a 400/220/132/33KV grid-station at Dhalkebar, which is 1km away from the project site, through a 33KV high tension vacuum circuit breaker.

The Honorable Prime Minister of Nepal, Shri K.P. Sharma Oli, also inaugurated the Dhalkebar Grid on February 2, 2021, and it is presently generating around 70,000 units of power per day since its inauguration.

"This installation is one of Nepal's landmark solar projects," Sandeep Agrawal, Managing Director of Kushal Projects, the plant's EPC, remarked. We are delivering electricity to adjacent places such as Janakpuri, one of the most popular tourist destinations in all seasons, using



²² Renewable Watch. 2021. Fimer Powers 'Milestone' 10 MW Solar Project in Nepal. Retrieved from: <https://renewablewatch.in/2021/03/17/fimer-powers-milestone-10mw-solar-project-in-nepal/>

the energy generated by our solar project. Previously, severe power outages in the area had a considerable impact on tourism. The local Nepalese population has reaped considerable benefits as power outages have

been decreased by more than 40%. Our organization will continue to work for the improvement of society and to promote a cleaner, greener, and more sustainable future."

3

FINANCIAL ANALYSIS

The total output of four sites with 24 MWp (DC power) i.e. around 20 MW (AC power) is 35.46 GWh/year. This energy value could be used for the financial analysis for the total project.

3.1 Pre-Feasibility Approaches & Assumptions

Project Cost

Total cost of the Project amounted to NPR 410 Million excluding interest during construction. The total cost

including interest amounted to NPR 422.17 million for each.

70% of the total cost of the project will be financed from bank debt and the remaining 30% will be financed from equity capital.

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Cost Components	NRP'000	% of Total Cost
Preliminary and pre-operative expenses	5,148.00	1.22%
Evacuation cost (Cables and transformers including transmission line)	53,497.65	12.67%
Inverters	26,208.00	6.21%
Mounting structures	37,378.41	8.85%
Civil and general works	40,202.28	9.52%
Modules	1,96,975.58	46.66%
Other costs	50,590.07	11.98%
Total project cost excluding IDC	4,10,000.00	97.12%
IDC and financing cost	12,166.33	2.88%
Total project cost including IDC	4,22,166.33	100.00%

70% of the total cost of the project will be financed from bank debt and the remaining 30% will be financed from equity capital.

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Capital Structure

The project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of working capital would be financed by internal resources itself. Based on the structure, the total investment pattern has been tabulated below:

Component	Percentage	Amount in Dollars '000
Equity	30.00%	1,055.42
Debt	70.00%	2,462.64
Total		3,518.05

Project Construction and Operation Period

The project is assumed to be built in the period of 6 months. And the total operation period after the construction period would be 26 years. The project would be handed over to the government after the completion of the operation period.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project will be at the rate 0% for the first initial 10 year from date of operation, 10% for 11 to 15 year and 20% on the remaining period on profit earned during the year. Further the loss carryforward has been taken for 12 years in due consonance with the provisions of Income Tax Act 2058. Further, the staff bonus is assumed at 2% of net profit (Gross profit-tax) during any year of the operation as required.

Also, the rate depreciation and basis of depreciation is assumed at the rate of 4% for the 25 years as a straight line basis.

Direct Income and Direct Expense

The income has been classified majorly in one categories:

Energy Sales

Particulars	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Saleable Energy (in Kwh)	10,534	10,493	10,452	10,406	10,349	10,283	10,207	10,129	10,050	9,975
Rate/Kwh	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Revenue	76,898	76,599	76,300	75,964	75,548	75,066	74,511	73,942	73,365	72,818

Revenue will be generated from sales of solar energy. Total saleable energy of the project would be 10,534 Kwh. The tariff rate is fixed to NPR. 7.30 per unit (i.e., NPR. 7.30 per kWh). This is a fixed rate for 25 years and there is no escalation on this rate. The rate has been fixed as per the directive of the Ministry of Energy namely "Grid Connected Alternative energy working procedure-2074" approved on 2074/10/15.

Operational Expenditure of the Project

The proposed project will take a period of one year for construction and will be in operation for 25 years. Operation cost of the project includes regular operation and management cost, insurance cost of the properties, depreciation on fixed assets, reserve for replacement/maintenance of assets, bonus and welfare cost of staff and other miscellaneous costs relating to operation of project. Estimation of such cost are made as follows:

Operational expenditure

Estimation of Annual Operation & Management Cost	Base	Remarks
Operation & Maintenance Cost	1.00%	of total construction cost
Insurance Cost	0.25%	of total base cost of the project
Bonus & Welfare Fund	2.00%	of Net Profit (Gross Profit-Tax)
Major Maintainace Cost	6,25,000	Reserve/yr for MM Cost drawn from 5th to 20th year
Total Maintainace Reserve	1,00,00,000	25% of HM and EM Cost
Royalty on Capacity	100.00	NRs/kW for (1-15 yrs)
Royalty on Revenue	2.00%	1-15 yrs
Royalty on Capacity	1000.00	NRs/kW (16-25 yrs)
Royalty on Revenue	10.00%	16-25 yrs

Other assumptions

Assumptions and Parameters	Base	Remarks
Installed Capacity of the Project	5.987	MWp
Net Salable Energy	10,534	KWh
Total Salable Energy	10,534	KWh
Project Base Cost	4,10,000	NPR '000
IDC and Financing Fees	19,530	NPR '000
Total Project Cost including IDC	4,29,530	NPR '000
Total Equity 30%	1,26,650	NPR '000
Total Debt 70%	2,95,516	NPR '000
Annual Depreciation	4%	straight line per annum
Depreciation Years	25	years
Reference Year	2021	-
Start of Construction Activity	2022	-
Commercial Operation Year	2022	-
Construction Period	6	Months
Weighted Average Energy Sales Price	7.3	NPR/KWh
Land Lease Cost per Year per Ropani	20	NPR '000
Total Private Land	147	ropani

Working capital

It has been assumed that the overall working capital requirement would be financed by the equity holders. The working capital has been assumed on the following basis.

Receivable & Advance	15	Days
Payable and Liabilities	15	Days

Total number of working days has been assumed to be 360 days and 12 working months.

3.2 Financial Analysis

3.2.1 Financial Results

The cost of the project was calculated using data from an IBN desk research report. All of the expenses are considered to be in line with the existing cost structure. The project development cost is also supposed to have been calculated using district rates and current market rates.

The project's overall cost is NPR 422.17 Million, with an interest component of NPR 12.17 million during construction for each. The overall project, excluding working capital, was financed by loan for 70% and equity for the remaining 30%. The project's Internal Rate of Return (IRR) is assessed to be 14.61%, while the project's equity IRR is calculated to be 18.53%. The project's IRR and equity IRR prove the project's viability.

After the date of operation, the project has a simple payback term of 6.11 years. The pay-back term appears to be enough, given the nature of the firm and the broader industry. At 1.33 times of the project, the average debt service coverage ratio is determined. Furthermore, the project's cost-benefit ratio is multiplied by 1.79.

Major financial indicators

Particulars	Rate
Firm IRR	14.61%
Equity IRR	18.53%
NPV- Equity	USD 9,60,803
Debt Equity Service Ratio (average)	1.33 Times
Project BCR	1.79
Simple Payback Period	6.11 years

3.2.2 Sensitivity Analysis

Sensitivity Analysis has been carried out on three different variables Namely : Interest Rate, O & M Cost and Project cost which impact the financial viability of the project. In such analysis, impact on project's IRR on different scenarios are observed as follows.

Project Cost Increase/Decrease by 5%

Percentage of Change Project Cost	Impact on Project IRR	% of Change
0.00%	14.61%	-
5.00%	13.68%	-6.34%
-5.00%	15.62%	6.94%

O & M Increase/Decrease by 5%

O&M Cost	Impact on Project IRR	% of Change
0.00%	14.61%	-
5.00%	14.46%	-1.00%
-5.00%	14.75%	0.99%

Interest Rate Increase/Decrease by 5%

Project cost	Impact on Project IRR	% of Change
0.00%	14.61%	
5.00%	14.62%	0.04%
-5.00%	14.60%	-0.04%

Based on the analysis, It seems that project cost is highly sensitive as compared with O&M expenses and interest rate. The special focus to provide to project cost ensures the cost remains as projected.

Conclusions

Considering the profitability of the project, favorable future cash flows, Favorable equity & project IRR, positive DSCR ratio, B/C ratio greater than 1, lower payback period, favorable LCOE ratio (i.e. very lower than sales rate) and positive NPV , It can be concluded that the project is financially feasible wherein the input parameters are as per the practice in solar projects and prevailing laws of Nepal. The produced energy from the solar project will be sold to NEA at a fixed tariff rate of NPR. 7.30 per Kwh also justify the stability of sales rate over the life of the project. Besides, the produced energy will be reduced by a certain percentage as per the degradation rate of solar panels which can be assumed at 2% for the first year and afterwards the annual degradation will be 0.4%.

4

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

Various governmental agencies are in motion to offer regulatory and operational framework to mechanize the support for the solar power industry in Nepal in order for utility-scale solar PV projects to grow, fulfill electricity demand, and eventually contribute to economic development in the nation.

The Department of Electricity Development (DoED) is in charge of aiding the Ministry in the execution of overall government policies in the power and electricity sectors. The Department of Energy's main responsibilities include ensuring regulatory framework transparency, accommodating, promoting, and facilitating private sector participation in the power sector by providing a "One Window" service, and then facilitating power project licensing requirements such as Survey License and Generation License. The Department of Energy's role also includes developing, promoting, and facilitating inspectorate technical assistance to commercial power companies.

The Nepal Electricity Authority (NEA) is an independent public corporation and the Government of Nepal's biggest wholly owned organization. It is overseen by a Board chaired by the Minister of Energy, Water Resources, and Irrigation (MoEWRI), and plays a significant role in the

country's economy. It is in charge of power production, transmission, and distribution throughout the nation. In Nepal, the energy supply sector is mostly based on a single buyer-single seller arrangement. Electricity from Independent Power Producers is purchased by NEA as a "Single Buyer" (IPPs). It is also a 'Single Seller,' meaning it is the country's single biggest electrical provider and distributor.

The Ministry of Energy, Water Resources, and Irrigation (MoEWRI) oversees Nepal's energy sector and works to develop energy resources to help the country's social and economic development. Its responsibilities include policy development, planning, energy conservation, regulation, and energy research and studies. MoEWRI also oversees the building, operation, maintenance, and marketing of multifunctional electrical projects, as well as encouraging private sector participation in the sector. Furthermore, the Ministry of Energy and Water Resources is engaged in bilateral and international energy and power agreements, tax issues, and the coordination of organizations in the sector.

The Ministry of Forest and Environment (MoFE) was established to promote sustainable development by protecting, conserving, and promoting the country's natural environment and cultural heritage. It seeks to

promote a clean and healthy environment by conserving life-sustaining resources such as air, water, and soil, as well as poverty reduction via environmental research. Similarly, the Ministry of the Environment organizes adaptation and mitigation initiatives to reduce the detrimental effects of climate change.

The Electricity Regulatory Commission (NERC) is responsible for regulating electricity production and transmission, as well as setting rates and adopting a national grid code to oversee the country's power industry. It also manages power purchase agreements.

The Right Honorable Prime Minister chairs the Office of the Investment Board (OIBN), which is a high-level government organization. IBN is a primary fast-track government body tasked with facilitating Nepal's economic growth by fostering an investment-friendly environment and mobilizing and managing local and international investments. IBN promotes and develops utility-scale solar PV power projects with a capacity of more than 200 megawatts. If a solar project's capacity exceeds 200 MW, Investment Board Nepal (IBN) is tasked

with acting as a "One Window" service, which includes providing survey licenses, generating licenses, and project monitoring.

In addition to the aforementioned organizations, the Alternative Energy Promotion Centre (AEPCC) was established to promote the use of alternative/renewable energy technology to suit Nepal's energy demands. AEPCC's operations include renewable energy policy formation, planning, and enabling the implementation of policies and plans at the operational levels of international development and donor organizations, private promoters of renewable energy, and policy decision levels in relevant ministries. In the energy industry, provincial and local governments also play a role. They strive to improve and develop renewable energy projects in accordance with the Nepalese Constitution of 2015 and the Local Government Operational Act of 2017. The local government is in charge of resolving any land disputes or conflicts that may occur between the energy developer and the community. Similarly, the Provincial Government manages the power developer's grid connection arrangement.

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Solar-PV power plants offer an advantage over conventional power plants, as well as other renewable energy sources, in that they do not make particles, emit no greenhouse gases, produce no noise, and emit no odor. They don't produce any ash or other waste. Solar-PV projects, such as this one, may or may not include a battery, depending on how they are constructed. As a result, battery disposal will not be a problem. However, the deployment of solar-power plants raises environmental problems. Land use issues, such as the use of large tracts of land that compete with other uses such as food and grazing; soil and water impacts during construction; ecological impacts on vegetation and wildlife; use of pollutants and heavy metals during solar panel construction; and disposal issues after

decommissioning are among them. It is believed that the benefits of solar-power installations would ultimately outweigh the disadvantages.

The table below summarizes the results of a preliminary desktop based environmental and social impact assessment. It highlights some of the potential repercussions that might occur throughout the project's pre-construction, construction, and operation stages, as well as mitigation techniques for each impact. Later in the project cycle, a full evaluation will be done, if required by relevant regulations, through an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA).

Activity	Possible Environment Impact	Possible Mitigation Measure
Pre-construction Phase	1. Distress to the micro-habitat and natural fauna due to tree felling.	1. Cutting of trees shall be avoided to the extent possible and natural vegetation present on the site shall be kept in mind while preparing the architectural and landscape designs of the project. Compensatory plantations should be carried out.
Construction Phase- Construction Activities for the Development of the Project	1. Air pollution due to earth work excavation and other construction activities.	1. Frequent spraying of water at construction sites to suppress dust emission. Soil, muck and other construction materials should be covered during transport by vehicles.

Activity	Possible Environment Impact	Possible Mitigation Measure
	2. Soil contamination	2. Preventive measures should be taken to minimize spillage of oil/ diesel from the construction equipment. Appropriate measures should be taken in case of accidental contamination.
	3. Water pollution/ contamination- Impact on lake	3. It should be ensured that the water bodies- surface and groundwater, are not polluted due to the project. Appropriate measures should be taken in case of accidental contamination. Particular attention should be given to avoid pollution in the lake due to the project.
	4. Disposal of excess earth	4. The excess earth should be transported to a designated place and shall be used for filling and covers.
	5. Disturbance to other services	5. Any shifting of cable/utility lines should be attended to with a minimum period of disturbance.
	6. Safety of road users in the project area	6. Provision of temporary crossings/bridges as well as warning signs wherever necessary to facilitate normal movement.
	7. Noise pollution due to the use of machinery and movement of traffic.	7. Use of less noise generating equipment and avoiding activities during night.
	8. Impacts due to hazardous waste	8. Hazardous waste will be managed as per applicable laws of Nepal.
	9. Impacts due to construction waste	9. Construction debris will be managed/disposed properly.
Operation Phase	1. Impact on water resources supply to nearby residents due to possible extraction of ground-water	1. This will be a residual impact if water is sourced from well/ boring in the project area. However, possible mitigation measures can be recharging of the groundwater by installation of a well-designed rain-water harvesting system, which is already envisioned by the project as one of its components. Similarly, water saving features could be installed where feasible. In addition, wastewater treatment plants or biological treatment systems (reed-bed) could be installed, if feasible, to treat gray water with utilization of the treated water for watering plants, etc.
	2. Contribution to GHG emissions from use of machines and equipment (heating, air conditioning, etc) in the building, etc.	2. Efforts will be taken to offset carbon emissions by incorporating a green/sustainable building design, including installation of solar power and energy-efficient equipment, as well as ensuring that natural light is received for maximum duration.
	3. Increased solid waste generation, if not managed well can be a nuisance to surrounding communities and may create health hazard	3. Segregate wastes and ensure they are collected frequently by waste collection companies/facilities. Build a compost facility, if feasible, and use the compost in the green spaces/plants inside the project compound.
	4. Water contamination- Impacts on lake/river	4. Ensure that the water bodies\flowing adjacent are not contaminated. Appropriate measures should be taken in case of accidental contamination. Install a waste water treatment plant if feasible.

The initiative will provide locals and other Nepalese with both short and long-term job opportunities. Through its spin-off economic impacts, it will help other current businesses as well as bring up new investment prospects.

6

PRELIMINARY RISK ANALYSIS

The following are some of the most significant risks linked with the PPP project:

1. Technical Risks

PV Module Power Degradation

PV module power degradation of multi c-Si PV modules is typically between 0.4 and 0.5 percent each year, with a first-year deterioration of about 2%. However, owing to a variety of factors such as Potential Induced Degradation (PID), snail trail, moisture in the PV cell, and other factors, it is possible to have a greater PV module power degradation rate than this range. These issues might arise as a result of flaws in PV module production, poor solar PV power plant design, or improper PV module installation.

Power Cable Insulation Degradation

When the insulation on a power line is adequate, the deterioration is usually slow and steady during the cable's lifetime. However, the rate of power cable insulation deterioration may be greater, resulting in more current leakage in the solar-PV power plant. This kind of deterioration might be caused by a manufacturing error, a poor cable and insulation design, or inappropriate power cable installation by an unskilled installer.

Damaged or Underperforming Inverter

Because of an inverter flaw, bad design, wrong installation, or a situation of the inverter functioning in an unsuitable environment, an inverter may not perform at optimal efficiency in certain circumstances. Furthermore, activating the inverter in an unsuitable environment might result in it exploding or catching fire.

Instability of Transmission Line

Because of an inverter flaw, bad design, wrong installation, or a situation of the inverter functioning in an unsuitable environment, an inverter may not perform at optimal efficiency in certain circumstances. Furthermore, activating the inverter in an unsuitable environment might result in it exploding or catching fire.

2. Operational Risks

Operator Error: Normally, the solar-PV power plant's functioning is constantly monitored by the operator, who reacts quickly to any failure or irregularity. Operator error, on the other hand, might lengthen the reaction time and result in a larger failure or anomaly, damage to the solar-PV power plant component, or a decrease in the amount of energy produced.

Lack of Competent Manpower

Solar-PV power plants are a new kind of power production that has only just been accessible in Southeast Asia, and their development pace has accelerated. As a result, the expertise and experience required to operate a solar-PV power plant are scarce and in great demand on the job market. The solar sector is having trouble finding a qualified and experienced operator to match the demand for newly constructed solar power facilities.

Lack of Operating Budget

During various times, some solar-PV power plants may not have enough operating capital, which may prevent the replacement of some components that need to be repaired or replaced, as well as the employment of competent operators who need to be replaced. As a consequence, system performance may suffer.

Natural Disaster: It is difficult, if not impossible, to forecast natural catastrophes that may strike the solar-PV power plant's location. Natural calamities such as thunderstorms, typhoons, earthquakes, floods, and wildfires might knock the solar-PV power plant out of commission.

3. Market Risks

Payment Default or Delay

The project is reliant on a single electricity off-taker. The project's viability would be severely harmed if the off-taker defaulted. Even payment delays would have an impact on the availability of working capital, which is required for the power plant's successful functioning.

Change in Tariff Rates

The off-agreed-upon taker's electricity price is very important to the project's viability.

4. Other Risks

Construction Risk

There aren't many contractors with the necessary expertise and qualifications to build solar-power installations. Hiring an unskilled or unqualified contractor might result in issues with safety, workmanship quality, system performance, and so on throughout the building process

Cost Overrun

Projects may easily incur more expenses during construction than anticipated during the feasibility study stage or even in contrast to the equipment supply contract.

7

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnerships (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investment²³.

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

The PPP model is appropriate in the current context of solar projects in Madhesh Province. According to the preliminary research done in these towns, the Local Government would give land for the construction of Solar Projects in Madhesh Province.

23 World Bank, 2072, Public Private Partnership Policy

8

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. The solar projects in Madhesh Province will provide and support in fulfilling Madhesh Province's energy demand.
2. According to the study, Bara, Birgunj, Dhalkebar and Rautahat is the best place for developing the Solar Projects in Madhesh Province because of its climate, proximity to the border, accessibility, and other factors.
3. The project's business model was determined to be a Public Private Partnership.
4. With a total cost of NPR 422.17 million for

each (including interest component throughout construction period). The project's internal rate of return (IRR) is assessed to be 14.61%, while the project's equity IRR is calculated to be 18.53%. The project's IRR and equity IRR prove the project's viability.

5. Payback period has been determined as 6.11 years.

8.2 Recommendations

The project appears to be technically and financially viable for a developer to invest, based on the findings. In the following step, however, environmental and social aspects, as well as a thorough examination of all other components, must be addressed.

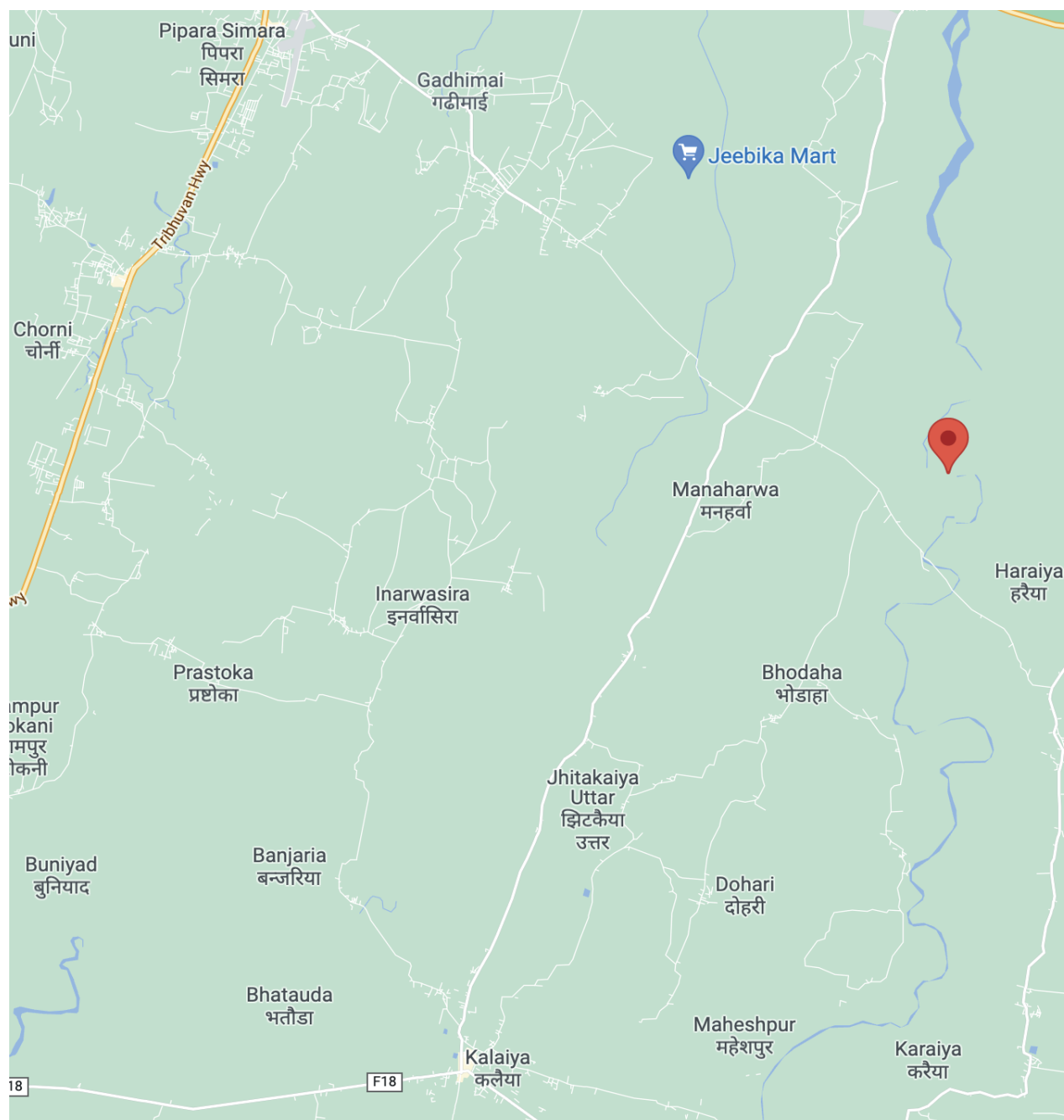
Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.



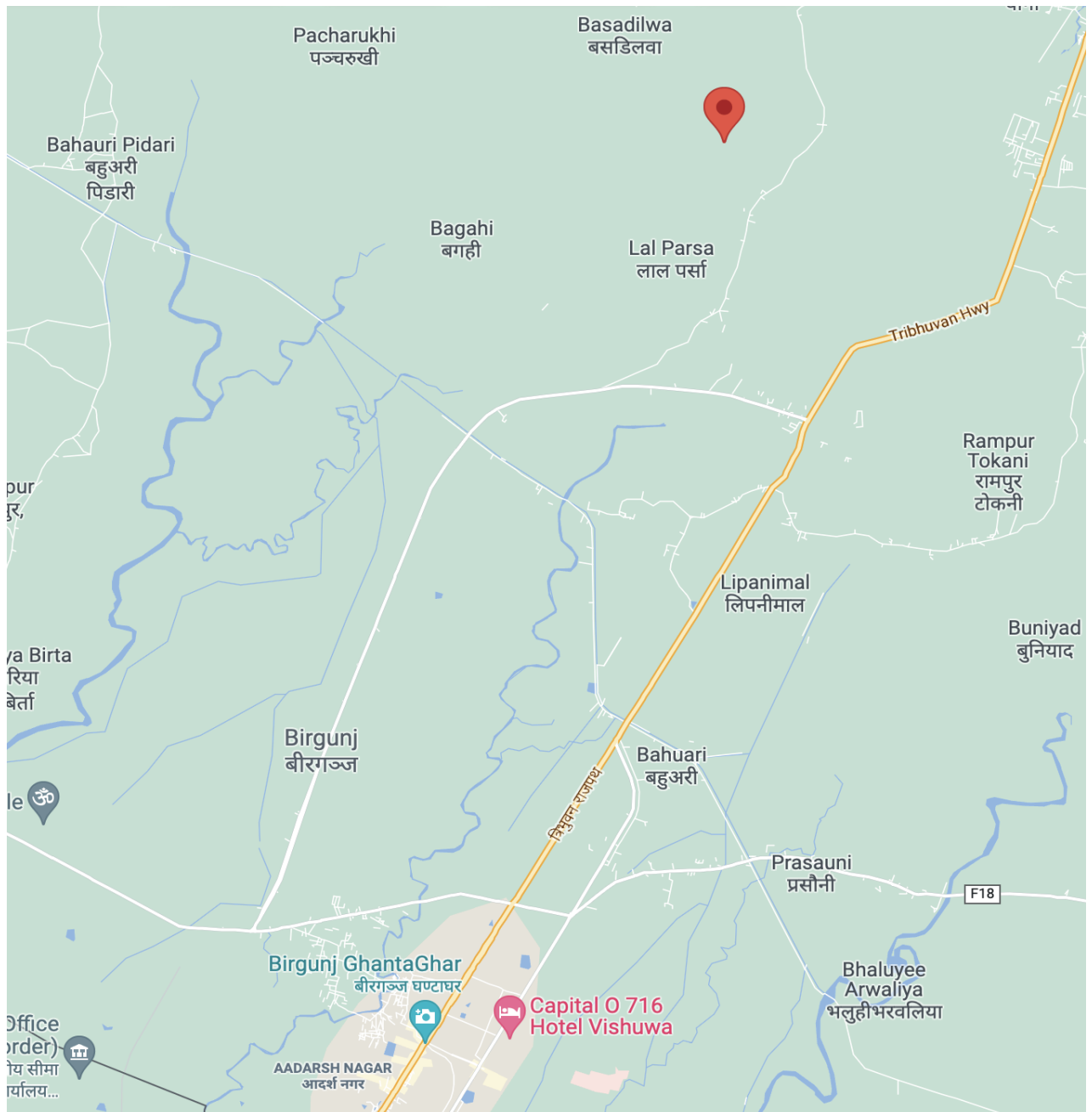
ANNEX

9.1 Map of Location 1: Near the Industrial Corridor, Bara



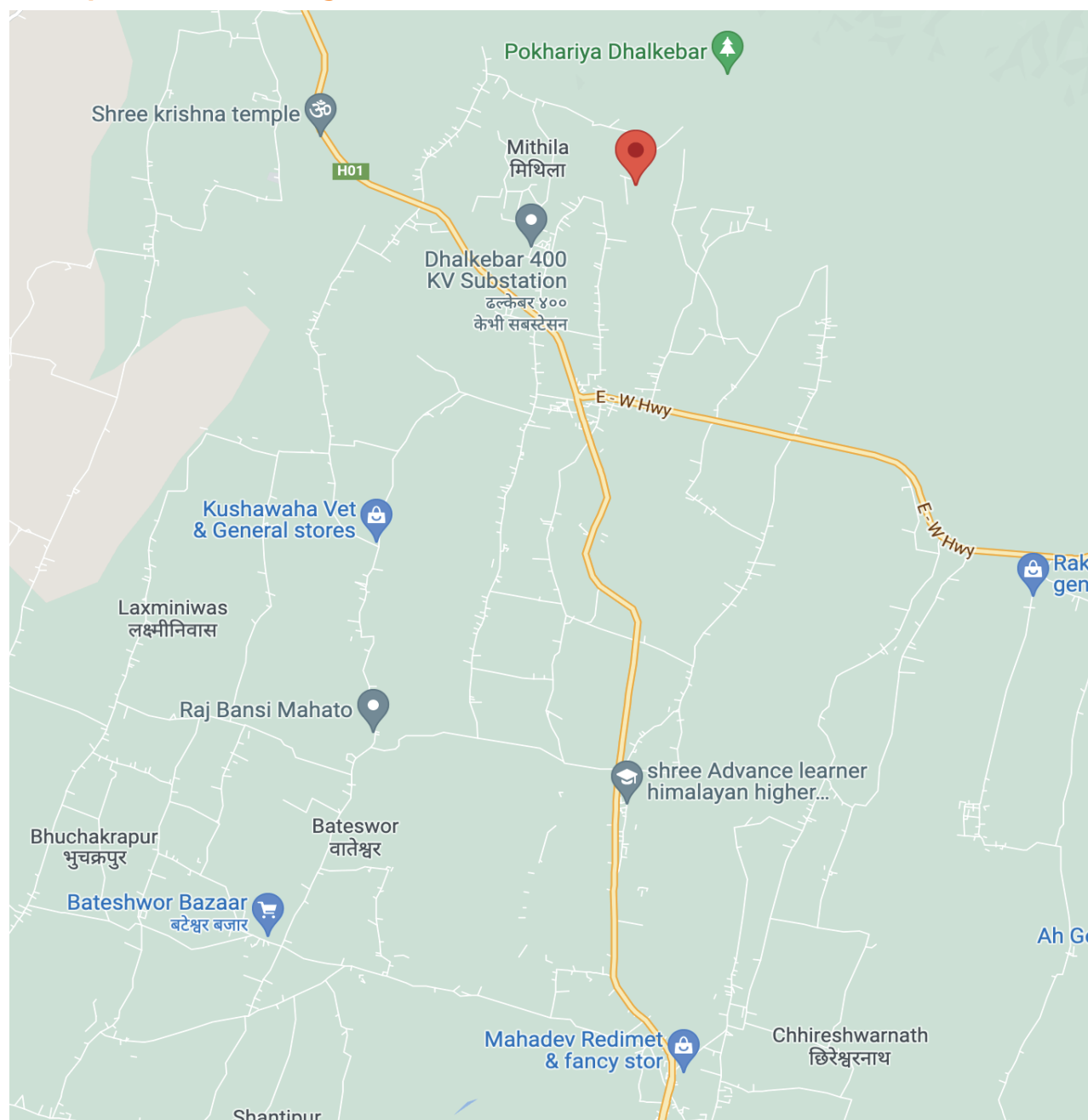
Source: Google Maps

9.2 Map of Location 2: Near the Industrial Corridor, Birjung, Parsa



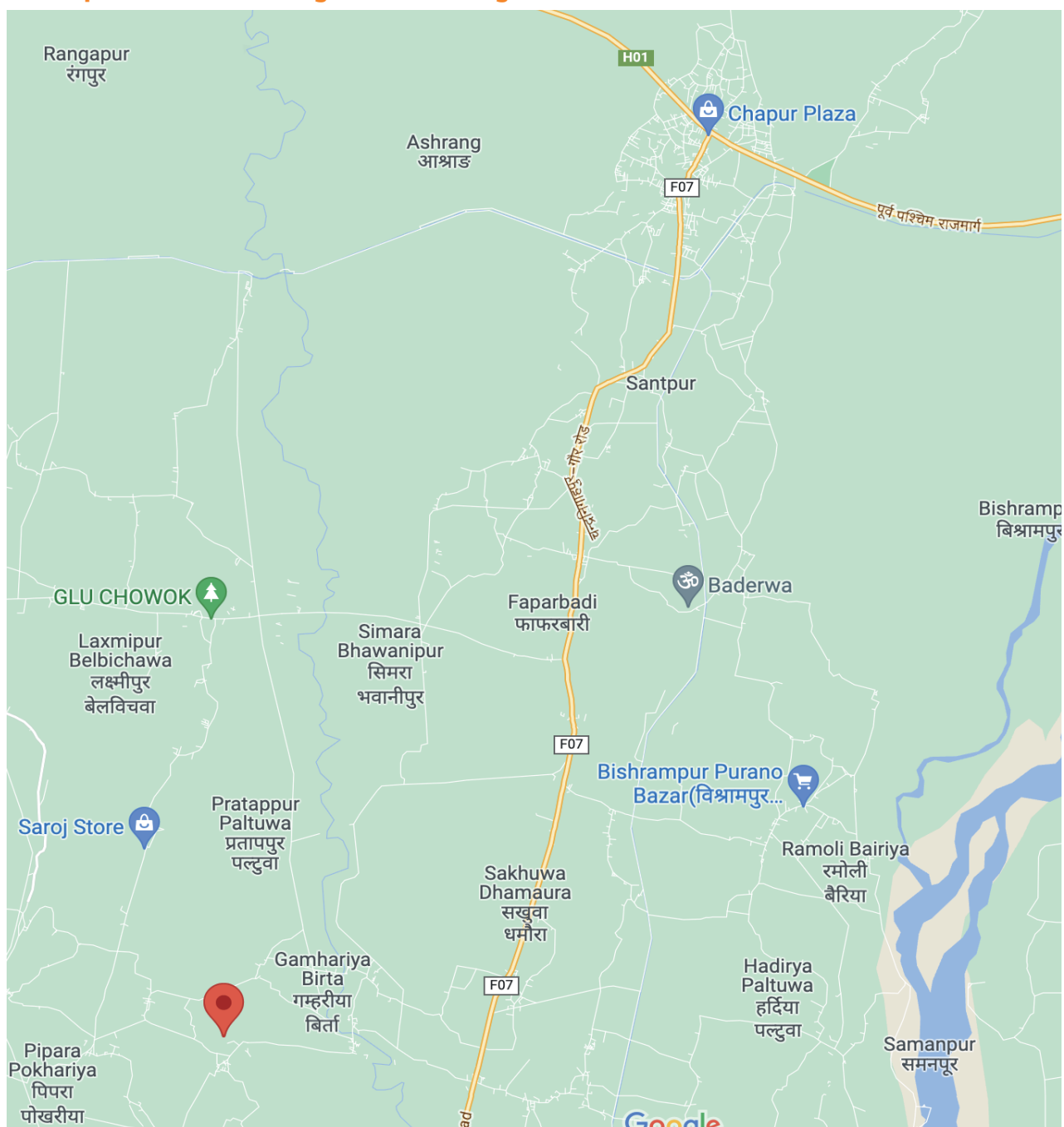
Source: Google Maps

9.3 Map of Location 3: Along the bank of Kamala River, Dhalkebar, Dhanusha



Source: Google Maps

9.4 Map of Location 4: Along the bank of Bagmati River, Rautahat



Source: Google Maps

9.5 Financial Report

Projected Financial Position Statement for Initial 10 years of Operations

Particulars	Amount in NPR '000									
	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Share Capital	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650	1,26,650
Reserve and Surplus	25,338	52,104	80,482	1,10,640	1,42,114	1,75,700	2,11,601	2,50,106	2,91,542	3,36,307
Loan Fund	-	-	-	-	-	-	-	-	-	-
Term Loan	2,77,195	2,56,996	2,34,726	2,10,174	1,83,105	1,53,262	1,20,360	84,085	44,092	-
Short Term Loan	-	-	-	-	-	-	-	-	-	-
Total	4,29,183	4,35,750	4,41,858	4,47,465	4,51,870	4,55,612	4,58,611	4,60,841	4,62,284	4,62,957
Assets										
Fixed Assets (Net)	4,05,280	3,88,393	3,71,506	3,54,620	3,37,733	3,20,846	3,03,960	2,87,073	2,70,186	2,53,300
Investment	-	-	-	-	-	-	-	-	-	-
Current Assets										
Sundry Debtors	3,160.20	3,148	3,136	3,122	3,105	3,085	3,062	3,039	3,015	2,993
Advances	500	500	500	500	500	500	500	500	500	500
Cash Equivalents	20,454	43,925	66,937	89,449	1,10,764	1,31,418	1,51,332	1,70,478	1,88,838	2,06,426
Current Liabilities	211	216	221	226	232	237	243	249	256	262
Net Current Assets	23,904	47,357	70,352	92,845	1,14,137	1,34,766	1,54,651	1,73,768	1,92,098	2,09,657
Total	4,29,183	4,35,750	4,41,858	4,47,465	4,51,870	4,55,612	4,58,611	4,60,841	4,62,284	4,62,957

Projected Profit and Loss Statement for Initial 10 years of Operations

Particulars	Amount in NPR '000									
	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Sales Revenue	76,898	76,599	76,300	75,964	75,548	75,066	74,511	73,942	73,365	72,818
Less: Operation Cost	(5,125)	(5,248)	(5,375)	(5,505)	(6,265)	(6,403)	(6,546)	(6,692)	(6,844)	(7,000)
Less: Bonus & Welfare	(444)	(472)	(504)	(539)	(566)	(608)	(654)	(707)	(765)	(832)
PBDIT	71,330	70,879	70,421	69,919	68,718	68,055	67,311	66,543	65,756	64,985
Less: Depreciation	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)	(16,887)
PBIT	54,443	53,992	53,534	53,032	51,831	51,168	50,425	49,656	48,869	48,099
Less: Interest Cost	(29,105)	(27,227)	(25,156)	(22,874)	(20,357)	(17,583)	(14,524)	(11,151)	(7,433)	(3,334)
PBT	25,338	26,766	28,378	30,159	31,474	33,586	35,901	38,505	41,436	44,765
Less: Tax	-	-	-	-	-	-	-	-	-	-
PAT	25,338	26,766	28,378	30,159	31,474	33,586	35,901	38,505	41,436	44,765

Projected Cash Flow Statement for Initial 10 years of Operation

Particulars	Amount in NPR '000									
	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
Operating Cash Flow	-									
Profit Before Tax	25,338	26,766	28,378	30,159	31,474	33,586	35,901	38,505	41,436	44,765
Interest	29,105	27,227	25,156	22,874	20,357	17,583	14,524	11,151	7,433	3,334
Depreciation	16,887	16,887	16,887	16,887	16,887	16,887	16,887	16,887	16,887	16,887
Cash flow before Working Capital Change	71,330	70,879	70,421	69,919	68,718	68,055	67,311	66,543	65,756	64,985
Changes in WC	(3,450)	17	18	19	23	25	29	29	30	29
Cash Flow Before Tax	67,880	70,896	70,438	69,938	68,740	68,081	67,340	66,572	65,786	65,014
Tax Paid										
Cash Flow From Operating Activity (A)	67,880	70,896	70,438	69,938	68,740	68,081	67,340	66,572	65,786	65,014
Investing Cash Flow	-									
Purchase of Fixed Assets	-									
Cash Flow from Investing Activity(B)										
Financing Cash Flows	-									
Repayment of Loan	(18,321)	(20,199)	(22,270)	(24,552)	(27,069)	(29,843)	(32,902)	(36,275)	(39,993)	(44,092)
Share Capital			-		-					
Payment of Interest	(29,105)	(27,227)	(25,156)	(22,874)	(20,357)	(17,583)	(14,524)	(11,151)	(7,433)	(3,334)
Cash Flow From Financing Activity (C)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)	(47,426)
Total Cash Flow (A+B+C)	20,454	23,470	23,012	22,512	21,314	20,655	19,914	19,146	18,360	17,588
Opening Cash Balance	-	20,454	43,925	66,937	89,449	1,10,764	1,31,418	1,51,332	1,70,478	1,88,838
Closing Cash Balance	20,454	43,925	66,937	89,449	1,10,764	1,31,418	1,51,332	1,70,478	1,88,838	2,06,426

Project will Distribute the equity dividend considering the free cash flow and profitability available within a project.

PRE-FEASIBILITY STUDY OF
AMUSEMENT PARK IN MADHESH PROVINCE

EXECUTIVE SUMMARY

Entertainment is a component of several tourism settings and can be a strong incentive to visit particular places.¹ The pre dominant and most popular mode of travel is still heavily entertainment featured.² One of the vital components of a tourism destination's offering is entertainment activities.³ It's also one of the most important variables in defining a destination's appeal to tourists. Recently, entertainment tourism has grown in popularity, and there are only a few recreational centers and amusement parks in Nepal to keep tourists entertained. Amusement Park in Madhesh Province is a project that has several attractions and amenities that may provide guests with a unique and one-stop travel experience.

By establishing a single platform at the next Investment Summit, the Provincial Planning Commission (PPC),

Madhesh Province hopes to attract investment in a variety of initiatives, including tourism projects. Amusement Park in Madhesh Province is one of the primary sites designated for investment. The research on the Amusement Park in Madhesh Province is primarily intended to document the project's technical and financial feasibility. Both primary and secondary data gathering approaches were used in the study. Primary data was acquired from field-based research, which included a field visit and stakeholder consultations and group discussions. Secondary data was gathered from a variety of sources, including published papers, journal articles, and other verified and trustworthy online sources.

This project appears to be best suited for a Public Private Partnership (PPP) approach, in which GoN will

- 1 Sage Journals, 2015, Entertaining international Tourists: An Empirical Study of an Iconic Site in China, <https://journals.sagepub.com/doi/abs/10.1177/1096348015598202?journalCode=jhtd>
- 2 Taylor & Francis online, 2018, Entertainment Tourism, <https://www.tandfonline.com/doi/abs/10.1080/02614367.2018.1454976?needAccess=true&journalCode=rlst20>
- 3 Entertainment planet, 2007, The tourism and entertainment industry, <http://entplanet.blogspot.com/2007/09/tourism-entertainment-industries.html>

assist in obtaining the necessary land for the project. The developer will then build all of the infrastructure required for the project's smooth execution and will run it for 30 years before handing it over to GoN in good working order.

The research examined the project's technical and financial elements and determined that it is technically and financially feasible, with a total anticipated cost of roughly USD 3,614,745 (including interest component throughout the construction period) and an equity IRR of 18.09 percent.

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SALIENT FEATURES OF THE PROJECT

Table 1: Salient features of the project

General information of the project		
1	Name of Project	Amusement Park in Madhesh Province
2	Project Location	Province: Madhesh Location: Provincial Capital area around Dhanusha District.
3	Project Implementation Modality	☐ Public ☒ PPP ☐ Private ☐ Others /Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Physical Infrastructure
6	Type of Project (Sub Sector)	Infrastructure
7	Implementing/Facilitating Agencies	Private sector facilitated by the provincial Ministry of Physical Infrastructure Development.
8	Project Management (Implementation Mechanism)	BOOT concession period of 30 years Private sector will manage the project with support from the Federal, Provincial and Local Governments and local stakeholders.

Project specific information		
1	Salient Features of Project	The park will feature state-of-the-art entertainment services, including recreational centres, water park zone, mini golf course, children train, and other unique attractions.
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	Local population where the centers are built, including competing businesses; unlikely to be affected a lot due to intentional choices of the locations.
	Land Requirement	5 Bighas
	Acquisition & Resettlement	No issue of resettlement.
	Materials and Ease of Access	The materials for constructing the refreshment centers are easily available. Other accessories required in the park can be imported from India.
	Environmental and Social Management Plan (ESMP)	Careful consideration to be taken while establishing and operating an amusement park. No destruction of natural resources to be ensured. Initial environmental examination will need to be carried out to determine ESMP.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desktop Study ☐ Feasibility Study ☐ Detailed Engineering/DP
4	Estimated Cost to Complete the Project	USD 3,614,745
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months Approval and Financial Closure: 6 months Construction Period: 2 years Concession Period: 30 years
6	Project Financing Options	Majority investment of the private sector; Government to contribute for required infrastructure development.
7	Project Technology/Components	● Picnic spots ● Parking facilities ● Ferris wheel ● Rock climbing ● Restaurants ● Columbus ● Smart lighting
8	Contribution to SDG and Green Growth	This project will help attain the following sustainable development goals. Goal No. 8: Decent work and economic growth Goal No. 11: Sustainable cities and communities
9	Project Capacity (at 100%)	1000 person a time
10	Project IRR	15.37%
11	Benefit Cost Ratio	1.23 times
12	Private Sector/Consumer Committee/Beneficiary Roles	Planning, designing, building and financing the project.

13	Government's Roles	- Facilitating various legal approvals/permits for the smooth operation of the project. - Coordination for land acquisition and land leasing with Local Government . - The Province Government will support in branding and promoting the amusement park.
----	--------------------	---

Other Project Information

1	Target Beneficiaries	People in Madhesh Province.
2	Market of Project's Service/Product	Domestic tourists, Childrens.
3	Key risks and opportunities of Project Development & Operation	
	Strengths and Opportunities	- This project will fill a significant market gap in high quality refreshment centers. - The project will also stimulate economic activity in the vicinity of the project site.
	Risks and Issues	Solid waste management can be a potential issue with the project. However, this can be addressed with sustainable solid waste management projects in the province.

1

BACKGROUND

1.1. Introduction

Nepal has huge natural and scenic splendor, as well as all important attractions found in just a few nations throughout the globe. Natural, aesthetic, and recreational features, as well as historical, cultural, and religious qualities, are among them. These characteristics bode well for Nepal's tourism sector, and tourism projects should be seen as supporting infrastructure for attracting local and international visitors.

Entertainment has become a buzzword in the twenty-first century. People are looking for an authentic, pleasurable, and involved experience. For everyone, especially youngsters, visiting an amusement park is a fascinating experience. The wait and anticipation of the gratification may be thrilling for parents. Amusement parks have a wide range of attractions, such as rides and games, as well as other forms of entertainment. It's also a place where people from all walks of life may find work. Amusement parks are a welcome addition to tourist destinations. A trip to an amusement park may

be a once-in-a-lifetime adventure. Amusement parks are not only a fun location to visit, but they are also a lucrative business and a significant part of a country's tourist industry. Amusement parks are one of the sectors that provide a shared platform for friends and family to relax and unwind. This would be Madhesh Province's first amusement park, and it may be one of the best locations to visit for both kids and adults.

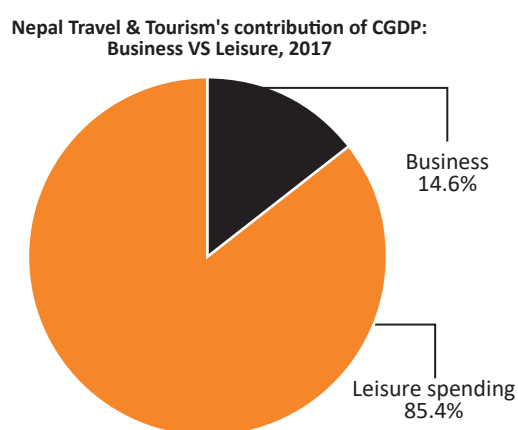
Entertainment is a component of several tourism settings and can be a strong incentive to visit particular places.⁴ The appeal of entertainment tourism has recently increased. The tourism industry relies heavily on the entertainment industry. Leisure tourists' recreational activities are an important part of the tourism experience. The predominant and most popular mode of travel is still heavily entertainment featured. Taylor and Francis's research 'Entertainment Tourism' is crucial since it enables tourism marketers to gain new insights and a better knowledge of travelers' experiences and satisfaction. One of the vital components of a tourism

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- 4 Sage Journals, 2015, Entertaining international Tourists: An Empirical Study of an Iconic Site in China, <https://journals.sagepub.com/doi/abs/10.1177/1096348015598202?journalCode=jhtd>
 - 5 Entertainment planet, 2007, The tourism and entertainment industry, <http://entplanet.blogspot.com/2007/09/tourism-entertainment-industries.html>

destination's offering is entertainment activities.⁵ It's also one of the most important variables in defining a destination's attractiveness and appeal, as well as contributing to tourist pleasure. Entertainment will become a more essential source of attracting tourists in the short term, as well as maintaining them for a longer length of time.

In 2017, leisure travel expenditure (including inbound and domestic) accounted for 85.4% of direct Travel & Tourism GDP (NPR 144.1 billion), compared to 14.6% for business travel spending (NPR 24.6bn).⁶ Leisure travel spending is predicted to increase by 4.2% pa to NPR 226.5 billion in 2028.

Fig 1: Leisure vs business tourism spending



Source: World Travel & Tourism Council⁷

In the year 2019, approximately 1.2 million visitors visited Nepal. In the years 2016, 2017, 2018 and 2019, the number of visitor arrivals increased consistently, with significant growth rates of over 40%, 25%, 25% and 2.05%⁸, respectively. Many Indian visitors who come to Nepal by land are not included in the number of entering tourists. In addition, domestic tourism is quickly expanding. Domestic tourists, in particular, from major towns like Kathmandu, Biratnagar, Bhairahawa, and

Pokhara, among others, are always looking for new and exciting travel and vacation experiences.

Nepal is well suited to be promoted as a top leisure tourist destination due to its pleasant climate and warm hospitality. It offers a tranquil and secure environment, as well as stunning and magnificent natural beauty and a unique combination of cultures. Given its accessibility and location as a transportation hub, Madhesh has the potential to grow into a regional center for leisure tourism for both local and foreign visitors visiting Nepal's eastern and south-eastern borders.

1.2 Amusement Parks Industry

In Asia, the theme park sector is also booming. A total of around 35 big parks are anticipated to draw approximately 71 million people, earning nearly \$1.5 billion in income. A total of 49 medium-sized parks earn \$350 million in income each year⁹. India and China, Nepal's next-door neighbors, are proving to be potential locations for amusement and theme parks. In India, there are 150 small and big amusement parks, and 80 amusement parks in China. Today India stands with a total number of 150 Amusement parks with a varied investment range of 5cr to 150cr to 300cr and above, where the total capital investment (excluding investment on land) has been estimated at INR 40 billion. The Amusement park industry contributes around 40% of the total turnover of Indian Leisure Industry with its growth and development.¹⁰

Asia accounts for almost one-third of worldwide theme park attendance, according to the Global Attractions Attendance Report of 2011 (103.3 million). Shanghai Disneyland is anticipated to attract 10 million people in its first year of operation, which will take place at the end of 2015. In addition, another 5-10 parks are being built or planned to be added to Asia's already extensive list. As a result of this growth, Asian theme park attendance will catch up to that of their Western counterparts.

6 World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from, <https://nepalindata.com/media/resources/items/12/bNepal2018.pdf>

7 World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from, <https://nepalindata.com/media/resources/items/12/bNepal2018.pdf>

8 Ministry of Culture, Tourism and Civil Aviation. 2020. Nepal Tourism Statistics. Retrieved from tourism.gov.np/files/NOTICE%20MANAGER_FILES/Nepal_%20tourism_statics_2019.pdf

9 https://www.researchgate.net/publication/341201858_Business_Plan_of_Kathmandu_Disneyland

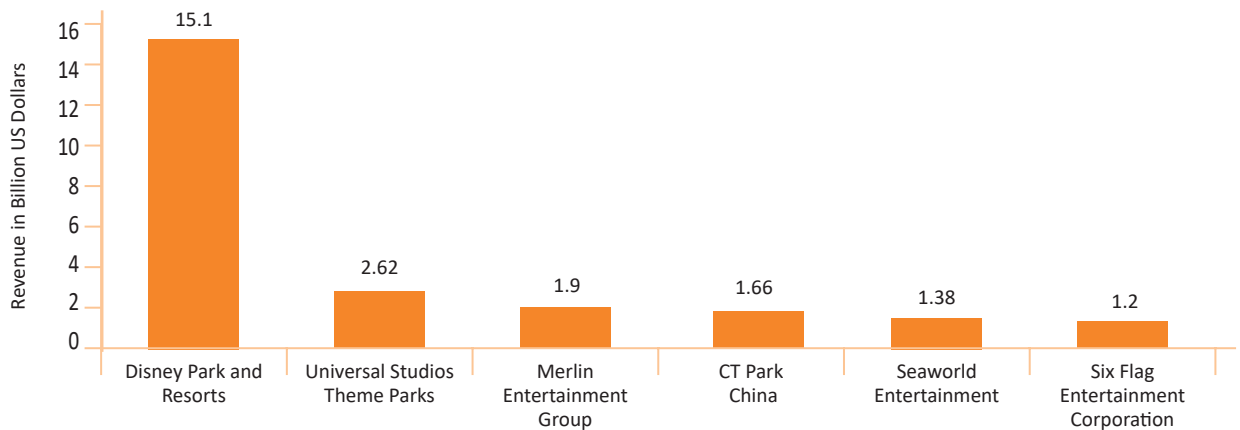
10 Bhattacharya, D and Rajani, C. 2021. A Comparative study of five different theme parks of India to evaluate their quality parameters for value addition in the tourism sector. Retrieved from <https://www.bibliomed.org/mnsfulltext/218/218-1617212904.pdf?1641108234>

There are 6 Water & Amusement Parks in Nepal as sorted by traveler favorites, which are: Big Splash (Pokhara), Whoopee Land Amusement (Kathmandu), Kathmandu Fun Park (Kathmandu), Kathmandu Fun Valley (Suryabinayak, Bhaktapur), Ocean Park & Resort Pvt. Ltd. (Itahari) & Water Kingdom Park & Resort Ltd (Jhapa). We are a population of 29.14 million¹¹ as of 2020 and do not have enough entertaining sources. Ocean Park, located at Itahari, is not as big as the Project that is proposed here. This project focuses on including many rides and adventurous activities as mentioned in Project components below (2.4.), which is a great entertainment factor for the people residing in the closest area, all over the country and tourists, contributing to the national and local economy.

Waterpark

Waterpark Name	Country	Visitors in Millions (2019)
Chimelong Water Park	China	3.01
Typhoon Lagoon	USA	2.25
Blizzard Beach	USA	1.98
Themas Dos Larajas	Brazil	1.85
Therme Erding	Germany	1.85
Universal's Volcano Bay	USA	1.81
Bahamas Aqaventure Water Park	Bahamas	1.81
Aqatica	USA	1.53
Hot Park Rio Quentre	Brazil	1.47
Whu Fantawild Parer Park	China	1.35

Fig 2: Revenue of top amusement park companies¹²



Every year, millions of people visit these parks for refreshment and recreation which generates generous revenue to the government. Some of the most visited parks and number of visitors in those parks are as follows:

The number of visitors in the tables below conclude that people are attracted to such parks and development of such parks can be beneficial to the visitors as well as to the country.

¹¹ The World Bank

¹² https://www.researchgate.net/publication/341201858_Business_Plan_of_Kathmandu_Disneyland

¹³ World Travel and Tourism Council. (2018). Travel and Tourism Economic Impact 2018 Nepal. Retrieved from <https://nepalindata.com/media/resources/items/12/bNepal2018.pdf>

Theme/amusement park

S.No.	Amusementpark Name	Location	Visitors in Millions (2019)
1	Maggic Kingdom Theme Park	Lake Buena Vista, Florida	20.96
2	Disneyland Park	Anaheim, California	18.66
3	Tokyo Ddisneyland	Tokyo, Japan	17.91
4	Tokyo Dsneysea	Tokyo, Japan	14.65
5	Universal Sstudios Japan	Osaka, Japan	14.50
6	Ddisney's Animal Kingdom	Lake Buena Vista, Florida	13.88
7	Dpcot at Walt Disney Wordl Resort	Lake Buena Vista, Florida	12.44
8	Chimelong Ocean Kingdom	Hengqin, China	11.74
9	Disney's Hollywood Studios	Lake Buena Vista, Florida	11.48
10	Shanghai Dissneyland	Shanghai, China	11.21

1.3 Domestic Tourism in Nepal

In 2018, tourism related activities contributed 7.9% to Nepal's GDP and accumulated a share of 25% in Nepal's total exports. According to the World Travel and Tourism Council's study on Travel and Tourism Economic Impact 2018 Nepal, domestic travel accounted for 57% of total expenditure produced through direct travel and tourism GDP in 2017, while foreign tourism accounted for 43%.¹³ This goes to show that the domestic tourist base is a reliable consumer segment of tourism related products and services and provides significant stability to the entire sector. Domestic travel spending was predicted to increase by 4.3% to NPR 100.4 billion in 2018, and it is predicted to grow by 3.4% each year to reach as high as NPR 140.7 billion by 2028.

1.4 Rationale of the Project

Apart from the economic benefits, there will be numerous other indirect benefits emanating from the proposed project, which are enumerated as follows:

- Multiplier effect to other sectors of economy through forward and backward linkages.
- Increased tourist inflow.
- Technological advancement.
- Foreign currency earning.
- Work culture improvement.
- Stemming outflow of workforce.
- Domestic technical skill enhancement.
- Enhanced industry-public relationship with implementation of CSR activities.

An increase in the number of parks is clearly beneficial to the community. Aside from the considerable growth in employment, there has been progress in the area's infrastructure. The quality of job, as well as numerous services-related training, are all contributing to a better standard of living. Having said that, these parks also provide a large consumer base for other businesses such as retail, restaurants, transportation, and others.

Theme parks and amusement parks contribute significantly to the area's tourist boom. This has been observed in other countries, where theme parks are given considerable legislative backing, with governments providing specialized infrastructure for connection, equity, and tax breaks. The majority of people are taxed in the single digits. As a result, the sector is better able to develop its potential to improve user experiences and provide even greater results.

1.5 Objectives

By establishing a single platform at the next Investment Summit, the Provincial Planning Commission (PPC), Madhesh Province, hopes to attract investment in a variety of initiatives, including tourism projects. As a result, PPC has put together a prospective Amusement Park in Madhesh Province, which includes touristic facilities and attractions. Finally, it aspires to present the proposal at the Investment Summit (2022) in order to attract investors. The following are some of the report's main goals:

1. To determine the demand for, as well as the feasibility of, an Amusement Park in Madhesh.
2. To investigate the project's technical and financial feasibility at the chosen site.

1.6 Scope of Work

The purpose of the pre-feasibility study is to present the current situation of Amusement Parks in Madhesh at the proposed site, as well as to record the project's technical and financial feasibility. Finally, the study will aid in gaining a general understanding of investment opportunities in this particular sector and location. The following are some of the study's primary scopes:

1. To gather secondary data and other necessary information for the project's development.
2. To analyze the acquired data for many elements such as technical, economical, social, and environmental concerns.
3. To develop the most appropriate investment model, such as private, public-private partnership, or blended finance.
4. Finally, to provide recommendations based on the findings.

1.7 Approach & Methodology

A professional team from Invest and Infra Pvt. Ltd. produced this pre-feasibility study. After a thorough

examination of market demand and business development prospects, the project's components were determined. For the purposes of determining project features/components, input collected during consultations with province-level ministries and associated stakeholders was also taken into account. Secondary and primary sources were used to obtain the necessary data, information, and facts to meet the study's goals.

Primary data was acquired by telephone and e-mail conversations, as well as a field-based research, which included a field visit. Producers, marketers, entrepreneurs, and government officials from Madhesh Province (Provincial Ministries, Rural/Municipalities, etc.) participated in stakeholder consultations and group discussions.

Secondary data was gathered from numerous publications issued by Nepalese government agencies, other similar nature projects in Nepal, and academic research papers published by various organizations and experts. An appropriate investment plan was recommended based on the conclusions of a technological, social, and environmental investigation. In addition, a thorough financial study was carried out to discover some of the key financial metrics that assure the project's financial feasibility.

2

PROJECT DETAILS

2.1 Project Background and Description

Janakpurdham, also known as Janakpur, is a Sub-Metropolitan city in Nepal's Madhesh Province's Dhanusa District. The city is a popular destination for religious and cultural travelers. Janakpur is the capital of Madhesh Pradesh and the headquarter of the Dhanusha district. The city was established in the early 1800s. According to legend, an older city in the area known as Janakpurdham existed, which was allegedly the capital of the Videha dynasty that dominated the Mithila region in ancient times.

Janakpur is 225 kilometers (140 miles) southeast of Kathmandu. The city has a population of 177,945 people in 2074/75, making it Nepal's biggest Sub-Metropolitan city and sixth largest city.¹⁴ Janakpur is Nepal's most populous Sub-metropolis at the moment. Nepal Railways connects Janakpur to India's Jaynagar.

Janakpur is located in the Terai region, which has a humid subtropical climate with hot, dry, and windy months in March and April. May through September is the rainy season, followed by a warm dry autumn from October

to November. From December through February, it is a chilly winter.

Dudhmati, Jalad, Rato, Balan, and Kamala are the important rivers that surround Janakpur.

Janakpur is Nepal's largest Sub-Metropolitan city and one of the country's fastest growing cities. The city features an abundance of parks, private schools, universities, and internet service providers, as well as good health care facilities. Tribhuvan University is associated with medical, engineering, and management colleges. Tourism, agriculture, and local industry account for the majority of the economy.

Migrants from the surrounding area flock to Janakpur for medical treatment, education, and work opportunities. The Janakpur Cigarette Factory Limited and the Janakpur Railway were the major employers until they collapsed in 2013 owing to political corruption and high debt. Service was restored at the end of 2018. The Zonal Hospital, Zonal Police, and the Banking Sector all assist the inhabitants in leading reasonably comfortable lives.

14 Health Management Information System 2074/75, MoHP, GoN

Nepal Rastra Bank, State Bank of India, Nepal, Everest Bank LTD, Machhapuchhre Bank, NIC Bank, Nepal Bank LTD, and Agriculture Development Bank all have their respective branches in the city.

Janakpur features educational institutions where various prominent individuals of Nepal attended school, including Ram Baran Yadav, the first president of the Federal Republic of Nepal. Janakpur is home to several private and public schools and institutions. Ramsworup Ramsagar Bahumukhi Campus (RR Multiple Campus), which is affiliated to Tribhuvan University, is the oldest government school for higher education. Rajarshi Janak Campus and Model Multiple College are two well-known private institutions.

Janakpur is also home to Janaki Medical College, a Tribhuvan University affiliated medical school.

2.2 Project Features

The park will feature state-of-the-art entertainment services including:

- Recreational centers
- Water park zone
- Mini golf course
- Children train
- Ferris wheel
- Rock climbing
- Columbus
- Restaurants
- Smart lighting
- Picnic Spots
- Parking facilities

2.3 Overview of the Area

Dhanusha district is one of Nepal's seventy-seven districts and is located in Madhesh Province. It is located in the Outer Terai. The district, which has its headquarters at Janakpur, has an area of 1,180 km² (460 sq mi) and had a population of 754,777 people in 2011¹⁵. Maithili is the most widely spoken language in Dhanusha.

Dhanusha's tourist attractions include temples and ponds, the most of which are located in Janakpur. These include the Janaki Temple in Dhanusha, where a piece of Shiva's bow that Lord Rama shattered is supposed to have

fallen, according to Hindu legend. A tourist attraction in the vicinity is the Mithila Women's Art Center.

Dhanusha district has an airport and Nepal's only railway system, which connects Janakpur to Jayanagar, an Indian town. It has numerous good hotels, including the starred Hotel Rama, Hotel Sita Palace, Hotel Welcome, Sitasaran hotel, and Happy hotel. The Janakpur Zonal Hospital, as well as other private hospitals, are located here.

Madhesh Province is located in Nepal's southeastern area. It is the smallest province in terms of land area, but the second largest in terms of population. It is bordered on the east by Province No. 1, on the north by Bagmati Province, and on the south by India. It covers 9,661 square kilometers, or around 6.5 percent of the country's total area. As of 2019, the province has a total population of 6,158,649 people, making it Nepal's most densely populated province.¹⁶ From Saptari District in the east to Parsa District in the west, the province is divided into eight districts.

Maithili, Bhojpuri, Bajjika, and Nepali are the most widely spoken languages in the province. Janakpur, the capital city and a Sub-Metropolitan city of Janakpur, is a religious and cultural tourism hub. It is also considered to have been the ancient capital of the Videha dynasty, which dominated the Mithila area. Rajbiraj, Nepal's first urban planned municipality, is also the oldest municipality in the Terai area. Birgunj is the province's only metropolitan city and an economically important industrial center.

Despite the fact that Madhesh has no difficult terrains, the region's transportation infrastructure is lacking owing to a lack of investment and negligence. In Nepal, however, Madhesh is the only province possessing a passenger train line. The Mahendra Highway, which runs longitudinally across the Province is the Province's main connecting connection with Janakpur (27.7 kms), Rajbiraj (15.4 kms), Birgunj (23.4 kms) & Gaur (44.6 kms) south of Mahendra Highway. Although the Tribhuvan Highway does not cover as much ground as the Mahendra Highway, it is the most essential route since it links the province to Kathmandu and India. Birgunj, the

15 Central Bureau of Statistics. (2011) Central Bureau of Statistics of Nepal: National Population and Housing Census 2011.

16 UNFPA *(2020) <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh-province>

Table 2: Total population (District wise)¹⁷

District	Headquarters	Population(2019)
Sarlahi	Malangawa	881,413
Dhanusa	Janakpur	832,772
Bara	Kalैया	814,084
Rautahat	Gaur	826,635
Saptari	Rajbiraj	703,219
Siraha	Siraha	696,657
Mahottari	Jaleshwar	700,871
Parsa	Birgunj	702,998

Table 3: Targeted population (Age group wise)¹⁸

District	Headquarters	Population (2019)
5-9	589,629	100%
10-14	588,538	100%
15-19	656,778	100%
20-24	660,795	100%
25-29	565,034	100%
30-34	451,296	100%
35-39	388,097	65%
40-44	338,473	45%
45-49	295,606	25%
50-54	255,429	15%
55-59	212,620	5%
60-64	171,503	3%

starting point of the Tribhuvan Highway, is the province's and country's most significant international gateway and trade route, and is hence known as "The Gateway of Nepal." Birgunj custom point is the largest in terms of revenue generation.

In Madhesh Province, a few railway projects are in the works. Nepal Railways is responsible for all of these projects. The Nepalese government has suggested Janakpur as the main station for a 1024 kilometer east-west Metro Railway project that would eventually be

extended to India and China, allowing Nepalese railways to link with Indian and Chinese railways for economic and tourism purposes. Madhesh Province is served by three domestic airports, the busiest in the country. Rajbiraj Airport, Janakpur Airport, and Simara Airport are all located in Rajbiraj. Meanwhile, at Nijgadh, an international airport, Nijgadh International Airport, is being built.

Population falling under the age group of 5-34 constitutes 3,512,070 in number & 58.36 in percentage out of total population & this group has been fully targeted.¹⁹ Likewise, other age groups are targeted partially as shown in the table above. The capital city, a Sub-Metropolitan city of Janakpur, also known as Janakpurdham, is a center for religious and cultural tourism, which adds a lot more to the exploration of amusement parks.

2.4 Developing a Business Case

Product Mix

The product mix for this project consists of the following components:

Component 1, Recreational Centers

Leisure time activities are often undertaken for enjoyment, amusement, or pleasure and are considered to be fun. Recreational activities include arcades, bowling alleys, fitness center, indoor archery and shooting range, ghost house, basketball, skates, paintball war zone and others.

Component 2, Water Park Zone

Madhesh experiences temperatures that rise up to 40°C in the summer and is hot and humid. Therefore, water parks have a great deal of potential in the Province. Water park zone includes family raft, speed slide, crusader slide, swimming pool, waterfall, rain dance, multi lane slide.

Component 3, Mini Golf Course

Mini golf courses with an area between 15000 and 22000 sq feet are recommended. However, a site as small as 9000 sq feet can also be accommodated. Clubhouse and parking area are additional to the playing surface.

¹⁷ <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh-province>

¹⁸ <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh-province>

¹⁹ <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh-province>

Component 4, Children Train

Children train is one of the popular rides among kids. Kids would love to ride on the train with happy music. Track size can be as per the space which can be round, oval, B shape, 8 shape.

Component 5, Ferris Wheel

Ferris wheels are the major attraction for amusement parks irrespective of their size. Ferris wheels help the park stand out in the surroundings. It also increases the visibility for the amusement park. It would be more attractive, if it is lighted in the dark. We can build a 30 meter tall ferris wheel with 72 seating capacity. It requires a total area of 18mx16m.

Component 6, Rock Climbing

Artificial rock climbing attempts to mimic the experience of outdoor rock. It is primarily made up of brick, limited to the steepness of the wall and variety of hand hold.

Component 7, Columbus

Visitors are fascinated by the fantasy of riding an antique ship and continuously experience the sensation like soaring up a wave and then suddenly dropping from its crest – a sensation of real time sailing. It is one of the thrilling and exhilarating experiences for many visitors, even for those who have ridden columbia a hundred times.

Component 8, Restaurants

Restaurants are also one of the main attraction centers for amusement parks. We can build theme park restaurants having different varieties of foods and beverages including local foods. People who visit the place can enjoy a variety of cuisines. In addition, we can set up stalls that offer the most liked snacks like pani puri, chuski, cotton candy and many others.

Component 9, Smart Lighting

When people visit an amusement park, the experience should transport them to another world seamlessly, part of which is achieved by the lighting on rides which is planned to ensure the proper illumination scope, color and effects. Especially during the night time, lighting and audio must be synced for the best effect.

Component 10, Zip Line

A short zipline specially for children who are not allowed to take a longer zipline.

Component 11, Regeneration, Conservation and Development

Existing facilities and services of Amusement Park in Madhesh will require upgrading and renovation, adding new activities.

2.5 Market Assessment

Madhesh Province has a population of 6,158,649 (the second largest in the country) in 2020, with a population density of around 750 persons per square kilometer, making it Nepal's densest province and accounting for 20.35 percent of the country's overall population.²⁰ With the majority of the population in the age group of 15 to 59, the key target consumers for the proposed Kathmandu Disney Amusement Park are young people seeking adventure and adrenaline rush.

Despite the fact that the nation is impoverished, residents in Nepal's cities and visitors are far from impoverished, and would be prepared to spend a fortune for quality time with their friends and family, making them our primary target market.

Madhesh is also a significant entry point for the country's tourism economy. Because there are no other worldwide franchised amusement parks in Nepal that provide high-quality services while maintaining reliable security, this proposed amusement park would be a popular tourist destination for pleasure and relaxation.

The province's amusement park will cater to the following categories of people and market groups as customers:

- Adults between the ages of 19 and 50.
- Kids of all ages dreaming of a fantasy world-class amusement park are flocking to the park, ranging in age from 11 to 18.
- Families looking for a unique vacation.
- Tourists from the middle and upper classes who live in the city.
- People who have an "earn, spend, and enjoy" mentality.

20 UNFPA *(2020) <https://nepal.unfpa.org/en/publications/demographic-profile-Madhesh-province>

According to a brief assessment of Kathmandu Fun Park in Pardashanimarg, Nepal, the fun park receives at least 200 visitors every day. On certain events like New Year's Day, Dashain, Tihar, and Saturdays, it may be rather crowded. On New Year's Day 2016, it recorded 8,000 visitors to the amusement park, 5000 riders on the columbus, and 4000+ riders on the Ferris wheel, which is the highest number to date.²¹

As a result, annual attendance at amusement and theme parks is growing. They are popular tourist destinations across the world, attracting people of different ages, ethnicities, and financial levels.

There are only a few amusement parks and tourist

attractions that can provide a one-stop leisure experience for travelers. Almost majority of these are in Kathmandu or the surrounding areas. They are unable to meet the needs of the rapidly rising populations in eastern and southern cities. Furthermore, the absence of such amenities in Madhesh Province has resulted in the province missing out on the opportunity to attract Indian visitors from nearby cities and towns.

2.6 SWOT Analysis

SWOT analysis allows for the discovery of elements that characterize a company or organization in the context of a certain goal, as well as the classification of those characteristics into four areas. As seen in the table, two of them are positive, while the other two are negative:

SWOT Analysis for Amusement Park in Madhesh Province

Strength	Weakness	Opportunities	Threats
- Strong diversification: As the first amusement park in Madhesh, it has a strong chance of attracting local attention. - Increasing trends in overall revenue and profit. - Size of operation. - The major target group is millennials. - Due to a flat terrain, infrastructure construction is simple. - Easy access to basic infrastructure such as roads, communication, water supply, and power.	- High costs- sunk cost, research and development costs, cost of entertainment production. - Inadequate infrastructure, such as airports, for providing high-quality services. - A scarcity of qualified personnel and hospitality professionals. - Inadequate budget allocation by the responsible authorities. - Amusement park success is unpredictable. - As large land area is needed for the Amusement Park, the selected location might be in slight out-skirts of the city	- Venture to boost the financial and commercial improvement to the surrounding locals. - In addition to strong earnings, foreign countries have favorable exchange rates, so there is a potential of earning foreign currency. - Changes in technology and consumer consumption. - Increased media networks and online presence. - Promote Madhesh province as a desirable tourist destination.	- Solid waste management can be a potential issue. - Occupancy issue for hotels, food court and sport court. - Hindrances from neighborhood individuals. - Legal proceeding. - Change in consumption behavior. Switching from physical to digital and online forms of entertainment - Maintaining product discrimination.

21 https://www.researchgate.net/publication/341201858_Business_Plan_of_Kathmandu_Disneyland

2.7 Examination and Evaluation of Alternatives

Amusement Park in Madhesh Province has been transformed into a tourist destination with additional amenities and activities. There are relatively few sites that can offer guests both enticing facilities and a naturally tranquil and beautiful atmosphere.

2.8 Relevant Case Studies

Case Study 1

Project Type: Kathmandu Fun Park

Location: Kathmandu, Nepal

Until 2012, Kathmandu Ramailo Mela (Kathmandu Fun Park) was the only amusement park in the city. This is one of the greatest spots to hang out for kids and others, located on Exhibition Road, Bhrikuti Mandap in Kathmandu. The Bhrikuti Mandap Mela, or simply Fun Park, is a local favorite that caters to all ages. One thing is certain: everyone who enters the premises enjoys themselves to the utmost extent possible, and no one leaves unsatisfied.

The tickets are reasonably priced, with students and children receiving a 50% discount. For individuals over the age of 14, a school identification card must be shown in order to get the discounts. Free admission is given to children under the age of five and elderly people over the age of seventy. After passing through the gate, visitors will see a large portrait of Mickey Mouse on the left hand side, as well as a children's club called Kathmandu Children Club, where they may acquire study materials and tale books. A bit farther on are the game stalls, which provide various activities such as shoot the balloon, seek the animals, ball games, dart games, and so on, with the winner receiving a prize. A laugh-house is nearby, with a variety of mirrors of various forms. A ghost-house is located directly across the street, where you can get a taste of what it's like to be inside a haunted house. Moreover, there are a multitude of additional thrilling games and activities to keep you energized and allow you to enjoy world-class fun.

Although students and children may receive a subsidized or free admission, they must pay separately for each game they play. In front of the gaming zones, there are ticket counters.

Even for those who have ridden columbus a hundred times, it has always been a thrilling and exhilarating experience. The ferris-wheel is so massive that just looking at it gives you the shivers. The draGoN coaster adds to the excitement, and the car fights are no less thrilling. You may even paddle your boat by yourself or skate on the platform, not to mention take a horseback ride.

That's not the end of it. There are also a lot of games for the kids. Some of the sports geared for children include a boat, mini-train, child-train (which takes you around the park), boats, free-jump, skates, swings, basketball, horse ring, and others. In addition, a children's park has been built within the amusement park, complete with swings and skates made to resemble army training. After paying a fee of Rs. 70, children are able to play anything they like for thirty minutes within the children's park. A large tub for water boating is also erected near the Fun Park's main entrance. For Rs 50/5 minutes, the youngsters may drive their own boat.

Furthermore, the pleasant cartoon figures wandering through the park have become huge draws for youngsters who want to take pictures with them.

The Paint War Zone is a new addition to the Fun Park, where you may get the feeling of fighting in a real battle. What could be more enjoyable than fighting a combat as if your life depended on it, knowing that even if you are shot, you will not die and can always return later.

In addition, the Fun Park's cafés and restaurants provide a wide range of food and beverages. The stalls that offer pani puris, chuski, and cotton candy have been set up. The park's restrooms are clean and well-managed, however during peak hours, one may have to wait in line for a long time.

Case Study 2

Project Name: Wonderla Holidays Limited (Amusement Parks Chain)

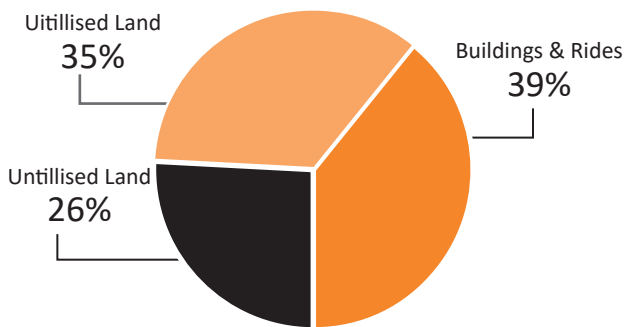
Location: Kochi, Bengaluru, Hyderabad and Chennai, India

Wonderla is one of India's most well-known amusement park chains. It now operates three parks in Kochi, Bengaluru, and Hyderabad, as well as one resort in Bengaluru. Chennai's fourth park is currently under development.

Fig. 4: Sample map of Wonderla Amusement Park



Fig 6: Breakdown of fixed assets as of March 31, 2020



park in Chennai is currently under construction. Once the pandemic situation has stabilized, the company aims to finish the building work in 18 months. For its projected fifth park in Khurda, Odisha, the company is also looking at an asset-light approach.

The park is generally separated into two portions. Land rides are in one sector, while water rides are in another. There are three sorts of rides in each section: conventional rides, high thrill rides, and kiddie rides. In general, there are rides for people of various ages.

All of the parks are located on the city's outskirts. From the city, it takes around 1 to 1.5 hours to go to the

parks. The combination of commuting time and 7 to 8 hours of park hours provides guests with a full day of pleasure.

The company's principal source of revenue is the admittance ticket cost. Adults and children have separate ticket prices. Fast track and regular tickets are the two types of tickets available. A fast track ticket is usually double the price of a regular ticket. With a fast track ticket, you'll spend less time waiting for each ride. Because demand is higher on weekends and holidays, ticket rates fluctuate between weekdays and weekends and holidays. A guest can visit all of the rides as many times as they like during the day with the purchase of an admission ticket.

Each park has a number of eateries strewn throughout. Food and beverage costs are not included in the admission fee and must be paid individually. Each park also includes lockers where guests may keep their items for a fee in addition to their admission ticket.

In 2019, the firm made a profit of INR 74 crores, and in 2020, it made a profit of INR 62 crores.²⁴ Break even sales, based on fixed expenditures of INR 180 crores and a contribution margin of 90%, come to INR 200 crores, or 71% of 2019 sales, suggesting a significant margin of safety.²⁵

23 Vinnakota, R.G. 2021. Case Study - Wonderla Holidays Limited. BudgeTiger. Retrieved from <https://www.budgetiger.in/p/case-study-wonderla-holidays-limited>

24 Vinnakota, R.G. 2021. Case Study - Wonderla Holidays Limited. BudgeTiger. Retrieved from <https://www.budgetiger.in/p/case-study-wonderla-holidays-limited>

25 Vinnakota, R.G. 2021. Case Study - Wonderla Holidays Limited. BudgeTiger. Retrieved from <https://www.budgetiger.in/p/case-study-wonderla-holidays-limited>

3

FINANCIAL ANALYSIS

3.1 Pre-Feasibility Approaches & Assumptions

Project Cost

Total cost of the project amounted to USD 33,98,332 excluding interest during construction. The total cost including interest amounted to USD 36,14,745.

Particulars	Amount in Dollars
Land	-
Building and Civil Works	1,665,292
Furniture and Fixture	251,146
Machinery and Other Equipments	250,000
Other	1,231,895
Interest During Construction	216,412
Total Project Cost	3,614,745

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Capital Structure

The project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of

working capital would be financed by internal resources itself. Based on the structure, the total investment pattern has been tabulated below:

Component	Percentage	Amount in Dollars
Equity	30.00%	1,084,423
Debt	70.00%	2,530,321
Total		3,614,744

Project Construction and Operation Period

The project is assumed to be built in the period of 2 years. And the total operation period after the construction period would be 30 years. The project would be handed over to the government after the completion of the operation period.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project is assumed at 20% on profit earned during the year. Further the loss carryforward has been taken for 12 years in due consonance with the provisions of Income Tax Act 2058. Further, the staff bonus is assumed at 10% on taxable income earned during any year of the operation as required by the Bonus Act.

Also, the rate depreciation and basis of depreciation is in due adherence to the provisions of the Income Tax Act as follows:

Particulars	Depreciation Method	Rate of Depreciation
Land	SLM	3.33%
Building and Civil Work	WDV	5.00%
Machinery and Equipment	WDV	20.00%
Furniture and Fixture	WDV	25.00%

However, 1/3 of the additional depreciation has not been taken into consideration as facilitated by the Income Tax Act.

Direct Income and Direct Expense

The income has been classified majorly in four categories:

1. Amusement Park
2. Food and Beverage
3. Other Amenities

The total units, rates and associated direct cost percentage in 100% capacity has been detailed below:

Particulars	Category	100% Capacity	Rate per Event/ Person Amount in NPR 1000	Unit of Measurement	% of Direct Cost
Recreational Centers	Amusement park	50000 Persons	4.17	Annually	10%
Water Park Zone	Amusement park	50000 Persons	3.33	Annually	10%
Mini Golf Course	Amusement park	30000 Persons	1.25	Annually	10%
Children Train	Amusement park	50000 Persons	2.50	Annually	10%
Ferris Wheel	Amusement park	50000 Persons	2.50	Annually	10%
Rock Climbing	Amusement park	30000 Persons	1.25	Annually	10%
Columbus	Amusement park	50000 Persons	2.50	Annually	10%
Restaurants	Food and Beverage	50000 Persons	6.67	Annually	40%
Smart Lighting	Amusement park	30000 Persons	1.67	Annually	10%
Picnic Spots	Others Amenities	1000 picnic	16.67	Annually	10%
Gift and Souvenir Shop - Lease out 10 outlets	Lease Property	120 Events	166.67	Annually	10%
Swimming Pool- Water games	Amusement park	30000 Persons	2.50	Annually	10%

The Operational Efficiency

The operational efficiency of each component in various years has been estimated as below:

From	To	Overhead and Salary Charging	Food and Beverage	Others Amenities	Amusement Park	Lease Property
0 year	2 years		0%	0%	0%	0%
3 years	9 years	60%	60%	50%	60%	80%
10 years	14 years	70%	65%	65%	75%	90%
15 years	24 years	80%	70%	75%	80%	100%
25 years	32 years	100%	75%	80%	90%	100%

Salary & Overhead Expenses

Total of the office overhead cost of per annum is USD 225,000.00 and employee cost of USD 293,930.00 shall be apportioned throughout the project period on 100% operation capacity.

The details of Overhead is as below:

Details of Office Overhead Cost Amount in Dollars	Amount in Dollar '1000
Annual Function & General Assembly Expenses	4.17
Printing, Stationery & Other	16.67
Telephone, Internet, Postage and Communication	8.33
Traveling & Conveyance	41.67
Fuel	83.33
Audit Fee	12.50
Internal Audit Fees	-
Legal Fee	8.33
Meeting Fee & Expense	8.33
Hospitality Expenses	8.33
Registration & Renewal	16.67
Miscellaneous	16.67
Total	225.00

Details of employee cost on 100% capacity is as below:

Department	Total Number of Employees	Total Cost Amount in Dollars 1000
A. Administration	25	122.36
B. Front Desk	11	39.90
D. Restaurant	16	39.90
E. Business Events	15	42.56
F. Swimming Pool	3	9.84
H. Kitchen	13	39.37
Total	83	293.93

The overhead is charged based on the following modality for employee cost and overhead charging is as below:

From	To	Overhead and Salary Charging
0 year	4 years	0%
5 years	9 years	60%
10 years	14 years	70%
15 years	24 years	80%
25 years	34 years	100%

Other Assumptions

Besides salary cost and overhead cost, the total operating expense is likely to incur at the rate of 2% of total project cost which is likely to increase at the inflation of 2% with the cap of 200%. As discussed in the earlier paragraph, the project would be financed by 70% debt. The interest rate that has been taken into calculation is 12% which would be repaid in four equal installments in the period of 12 years.

Also, the revenue has been estimated to be inflated at the rate of 3% per annum which is capped at 180%. The income tax rate for the project is 20% and the loss carryforward period for the project is 12 years. Further, the project is expected to give the additional income of 10% of the total direct revenue.

It is assumed that the government would provide required land for the project. Total operation period of the project is estimated to be 30 years and 4 years is considered as the period of pre operation.

Working Capital

It has been assumed that the overall working capital requirement would be financed by the equity holders. The working capital has been assumed on the following basis.

Receivable & Advance	30	Days
Payable and Liabilities	15	Days

Total Number of working days has been assumed to be 360 Days and 12 working months.

3.2 Financial Analysis

3.2.1 Financial Results

The project cost for Amusement Park in Province 2 has been taken from a Desk study report prepared by IBN. It is assumed that all the costs presented are in line with current cost structure. It is also assumed that the project development cost was prepared based on the district rates and prevailing market rates.

The total cost of the project is USD 3,614,745 of which USD 216,412.13 is interest component during construction. Working capital has been financed by 70% debt and remaining by equity.

In analysis of the pre-feasibility of the project, projections were made using different techniques. Based on the analysis, Project Net Present Value (NPV) was calculated to USD 790,749.94. Also, the project IRR is calculated to be 15.37% which exceeds the required rate of return of the project. Equity IRR of the project is computed at 18.09%. Project IRR & Equity IRR substantiate the feasibility of the Project.

Project Benefit Cost Ratio (BCR) is 1.23 times whereas equity BCR is 1.73 Times. The project payback period & equity payback period are 5.56 years and 12.11 years respectively. Considering the specific nature of business and overall industry, the pay-back period seems to be satisfactory. The average DSCR is computed at 1.34 times. Although DSCR is low in initial years, it has gradually increased.

Major Financial Indicators

Particulars	Rate
Firm IRR	15.37%
Equity IRR	18.09%
NPV- Equity (Amount'000)	790.75 Dollars
Debt Equity Service Ratio (average)	1.34 times
Project BCR	1.23
Equity BCR	1.73
Simple Payback Period	5.56 years
Discounted Payback Period	12.11 years

3.2.2 Sensitivity Analysis

Sensitivity Analysis has been carried out on three different components: Interest Rate, O & M Cost and Project cost.

Interest Rate Increase/Decrease by 5%

Percentage of Change	Impact on Equity IRR	% of Change
0.00%	18.09%	
5.00%	17.71%	-2.21%
-5.00%	18.48%	2.12%

O & M Increase/Decrease by 5%

O&M Cost	Impact on Equity IRR	% of Change
0.00%	18.09%	
5.00%	17.92%	-0.96%
-5.00%	18.27%	0.96%

Project Cost Increase/Decrease by 5%

Project Cost	Impact on Equity IRR	% of Change
0.00%	18.09%	
5.00%	18.03%	-0.34%
-5.00%	18.16%	0.34%

Based on the analysis, It seems that interest rate is highly sensitive as compared with O & M Expenses and Project cost. The special focus to provide to project cost ensuring the cost remains as the as projected.

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

Before forming a corporation or conducting business in Nepal, foreign investors must first get clearance. Depending on the magnitude of the investment, an application should be filed to the Department of Industry or the Investment Board Nepal.

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The table below summarizes the results of a preliminary desktop-based environmental and social impact assessment. It highlights some of the potential repercussions that might occur throughout the project's pre-construction, construction, and operation stages,

as well as mitigation techniques for each impact. Later in the project cycle, a full evaluation will be done, if required by relevant regulations, through an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA).

Activity	Possible Environment Impact	Possible Mitigation Measure
Pre-construction Phase	1. Distress to the micro-habitat and natural fauna due to tree felling.	1. Cutting of trees shall be avoided to the extent possible and natural vegetation present on the site shall be kept in mind while preparing the architectural and landscape designs of the project. Compensatory plantations should be carried out.
Construction Phase- Construction activities for the development of the project.	1. Air pollution due to earth work excavation and other construction activities.	1. Frequent spraying of water at construction sites to suppress dust emission. Soil, muck and other construction materials should be covered during transport by vehicles.
	2. Soil contamination.	2. Preventive measures should be taken to minimize spillage of oil/ diesel from the construction equipment. Appropriate measures should be taken in case of accidental contamination.
	3. Water pollution/ contamination- Impact on lake.	3. It should be ensured that the water bodies- surface and groundwater, are not polluted due to the project. Appropriate measures should be taken in case of accidental contamination. Particular attention should be given to avoid pollution in the lake due to the project.
	4. Disposal of excess earth.	4. The excess earth should be transported to a designated place and shall be used for filling and covers.

Activity	Possible Environment Impact	Possible Mitigation Measure
	5. Disturbance to other services.	5. Any shifting of cable/utility lines should be attended to with a minimum period of disturbance.
	6. Safety of road users in the project area	6. Provision of temporary crossings/bridges as well as warning signs wherever necessary to facilitate normal movement.
	7. Noise pollution due to the use of machinery and movement of traffic.	7. Use of less noise generating equipment and avoiding activities during night.
	8. Impacts due to hazardous waste.	8. Hazardous waste will be managed as per applicable laws of Nepal.
	9. Impacts due to construction waste	9. Construction debris will be managed/disposed properly.
Operation Phase	1. Impact on water resources supply to nearby residents due to possible extraction of ground-water.	1. This will be a residual impact if water is sourced from well/boring in the project area. However, possible mitigation measures can be recharging of the groundwater by installation of a well-designed rain-water harvesting system, which is already envisioned by the project as one of its components. Similarly, water saving features could be installed where feasible. In addition, wastewater treatment plants or biological treatment systems (reed-bed) could be installed, if feasible, to treat gray water with utilization of the treated water for watering plants, etc.
	2. Contribution to GHG emissions from use of machines and equipment (heating, air conditioning, etc) in the building, etc.	2. Efforts will be taken to offset carbon emissions by incorporating a green/sustainable building design, including installation of solar power and energy-efficient equipment, as well as ensuring that natural light is received for maximum duration.
	3. Increased solid waste generation, if not managed well can be a nuisance to surrounding communities and may create health hazard	3. Segregate wastes and ensure they are collected frequently by waste collection companies/facilities. Build a compost facility, if feasible, and use the compost in the green spaces/plants inside the project compound.
	4. Water contamination-Impacts on lake/river.	4. Ensure that the water bodies/flowing adjacent are not contaminated. Appropriate measures should be taken in case of accidental contamination. Install a wastewater treatment plant if feasible.

The initiative will provide locals and other Nepalese with both short and long-term job opportunities. Through its spin-off economic impacts, it will help other current businesses as well as bring up new investment prospects.

6

PRELIMINARY RISK ANALYSIS

The following are some of the most significant risks linked with the PPP project:

1. Risks related to construction and project completion delays, which might lead to cost overruns.
2. This project may pose a business risk since the demand and market trend must be properly analyzed in order for the project to be financially and commercially viable.
3. According to relevant legislation, the project would need to complete either an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA), which would identify possible environmental and socioeconomic implications as well as necessary mitigation measures.
4. Changes in the legislative framework and political risk might be some of the additional risks linked with the project.
5. Financial risks to the project include changes in interest and currency exchange rates, as well as changes in tax regulations.

7

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnerships (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investment.²⁶

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

The PPP model is appropriate in the current context of Amusement Park in Madhesh Province. According to the preliminary research done in these towns, the Local Government would give land for the construction of the amusement park.

26 World Bank, 2012, Public Private Partnership Policy

8

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. The amusement park will provide tourists with a variety of services and attractions, as well as natural beauty and a tranquil setting.
2. According to the study, Dhanusa is the best place for developing the amusement park in Karnali because of its climate, proximity to the border, accessibility, and other factors.
3. The project's business model was determined to be a Public Private Partnership.
4. With a total cost of USD 3,614,745 (including interest component throughout the

construction period) and an equity IRR of 18.09%, the project may be completed.

5. Payback period has been determined as 5.56 years.

8.2 Recommendations

The project appears to be technically and financially viable for a developer to invest, based on the findings. In the following step, however, environmental and social aspects, as well as a thorough examination of all other components, must be addressed.

Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.



ANNEX

9.1 Financial Report

Projected Profit and Loss Statement for Initial 10 years

Particulars	Amount in Dollar									
	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years
Food and Beverage	200,000	206,000	212,180	218,545	225,102	231,855	238,810	266,473	274,467	282,701
Others Amenities	8,333	8,583	8,841	9,106	9,379	9,661	9,950	13,324	13,723	14,135
Amusement park	760,000	782,800	806,284	830,473	855,387	881,048	907,480	1,051,542	1,083,088	1,115,581
Lease Property	12,000	12,360	12,731	13,113	13,506	13,911	14,329	18,448	19,002	19,572
Total Direct Income	980,333	1,009,743	1,040,036	1,071,237	1,103,374	1,136,475	1,170,569	1,349,787	1,390,280	1,431,989
Less: Direct Expenses										
Food and Beverage	80,000	82,400	84,872	87,418	90,041	92,742	95,524	106,589	109,787	113,080
Others Amenities	833	858	884	911	938	966	995	1,332	1,372	1,414
Amusement park	53,000	54,590	56,228	57,915	59,652	61,442	63,285	73,331	75,531	77,797
Lease Property	1,200	1,236	1,273	1,311	1,351	1,391	1,433	1,845	1,900	1,957
Total Indirect Income	135,033	139,084	143,257	147,555	151,981	156,541	161,237	183,097	188,590	194,248
Gross Profit	845,300	870,659	896,779	923,682	951,393	979,934	1,009,332	1,166,689	1,201,690	1,237,740
Add: Other Income	98,033	100,974	104,004	107,124	110,337	113,648	117,057	134,979	139,028	143,199
Profit before overhead and interest	943,333	971,633	1,000,782	1,030,806	1,061,730	1,093,582	1,126,389	1,301,668	1,340,718	1,380,939
Operating Expenses										
Depreciation	208,536	176,775	151,536	131,340	115,054	101,807	90,933	81,918	74,366	67,972
Salary Expenses	176,358	183,412	190,749	198,379	206,314	214,566	223,149	270,754	281,584	292,848
Overhead Expenses	135,000	140,400	146,016	151,857	157,931	164,248	170,818	207,259	215,550	224,172
O & M Expenses	75,187	78,194	81,322	84,575	87,958	91,476	95,135	98,941	102,898	107,014
Operating Profit	348,253	392,852	431,160	464,655	494,474	521,484	546,354	642,796	666,320	688,934
Interest Expenses	299,188	286,463	272,141	256,021	237,877	217,457	194,474	168,606	139,491	106,723
Profit	49,064	106,389	159,019	208,635	256,596	304,027	351,880	474,190	526,828	582,211
Provision for Staff Bonus	4,460	9,672	14,456	18,967	23,327	27,639	31,989	43,108	47,893	52,928
Income Tax	11,151	24,179	36,141	47,417	58,317	69,097	79,973	107,770	119,734	132,321
Net profit	33,453	72,538	108,422	142,251	174,952	207,291	239,918	323,311	359,201	396,962

Projected Balance Sheet for Initial 10 years

Amount in Dollar

Particulars	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years
Sources of Fund	-									
Shareholders Fund	-									
Share Capital	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423	1,084,423
Reserve and Surplus	33,453	105,991	214,413	356,664	531,616	738,907	978,825	1,302,136	1,661,337	2,058,299
Loan Fund	-									
Term Loan	2,428,932	2,314,817	2,186,380	2,041,822	1,879,122	1,696,001	1,489,897	1,257,925	996,839	702,983
Short Term Loan	-									
Total	3,546,808	3,505,231	3,485,216	3,482,910	3,495,161	3,519,331	3,553,146	3,644,485	3,742,599	3,845,706
Fixed Assets (Net)	2,095,864	1,919,090	1,767,554	1,636,213	1,521,160	1,419,353	1,328,420	1,246,502	1,172,136	1,104,164
Investment	-									
Current Assets	1,454,076	1,589,400	1,721,051	1,850,220	1,977,666	2,103,790	2,228,690	2,402,106	2,574,751	2,746,002
Sundry Debtors	78,611	80,969	83,399	85,900	88,477	91,132	93,866	108,472	111,726	115,078
Inventory	-	-	-	-	-	-	-	-	-	-
Cash & Bank Balance	1,375,465	1,508,430	1,637,652	1,764,320	1,889,189	2,012,658	2,134,824	2,293,633	2,463,025	2,630,923
Less: Current Liabilities	3,133	3,258	3,388	3,524	3,665	3,812	3,964	4,123	4,287	4,459
Net Current Assets	1,450,944	1,586,141	1,717,662	1,846,696	1,974,001	2,099,979	2,224,726	2,397,983	2,570,464	2,741,543
Total	3,546,808	3,505,231	3,485,216	3,482,910	3,495,161	3,519,331	3,553,146	3,644,485	3,742,599	3,845,706

Projected Cash flow for Initial 10 years

Particulars	Amount in Dollar									
	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years
Cash Flow from Operating Activity	-									
Net Profit before Interest and Tax	44,604	96,717	144,563	189,668	233,269	276,388	319,891	431,082	478,935	529,283
Add: Depreciation	208,536	176,775	151,536	131,340	115,054	101,807	90,933	81,918	74,366	67,972
Add: Interest	299,188	286,463	272,141	256,021	237,877	217,457	194,474	168,606	139,491	106,723
Operating Cash Flow before Working Capital Change	552,328	559,955	568,239	577,029	586,200	595,652	605,298	681,606	692,792	703,978
Increase/Decrease in Current Assets	(78,611)	(2,358)	(2,429)	(2,502)	(2,577)	(2,654)	(2,734)	(14,607)	(3,254)	(3,352)
Increase/Decrease in Current Liabilities	(2,443)	(6,389)	(5,850)	(5,503)	(5,309)	(5,243)	(5,285)	(13,740)	(5,817)	(6,122)
Payment of Tax	(5,575)	(17,665)	(30,160)	(41,779)	(52,867)	(63,707)	(74,535)	(93,872)	(113,752)	(126,027)
Net Cash Flow from Operating Activity	465,699	533,543	529,800	527,245	525,447	524,048	522,744	559,387	569,969	568,477
Cash Flow from Investing Activity	-									
Purchase of Fixed Assets	(2,304,400)	-	-	0	(0)	0	0	-	-	-
Increase/Decrease in Investment	-									
Less: Payment of Dividend	-									
Net Cash flow from Investing Activity	(2,304,400)	-	-	-	0	(0)	0	0	-	-
Cash flow from Financing Activity	-									
Increase in Share Capital	1,084,423	-	-	-	-	-	-	-	-	-
Increase in Borrowing Fund (Long Term Loan)	2,530,321									

Particulars	Amount in Dollar											
	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years		
Increase in short Term Loan												
Less: Repayment of Long Term Loan	(101,390)	(114,115)	(128,437)	(144,557)	(162,700)	(183,121)	(206,104)	(231,972)	(261,086)	(293,855)		
Less: Payment of Interest on Short Term Loan												
Less: Payment of Interest on Long Term Loan	(299,188)	(286,463)	(272,141)	(256,021)	(237,877)	(217,457)	(194,474)	(168,606)	(139,491)	(106,723)		
Net Cash Flow from Financing Activity	3,214,167	(400,578)	(400,578)	(400,578)	(400,578)	(400,578)	(400,578)	(400,578)	(400,578)	(400,578)		
Increase/Decrease in Cash and Cash Equivalent	1,375,465	132,965	129,222	126,668	124,869	123,470	122,166	158,809	169,391	167,899		
Cash & Bank Balance at the Beginning of the Period	-	1,375,465	1,508,430	1,637,652	1,764,320	1,889,189	2,012,658	2,134,824	2,293,633	2,463,025		
Cash Balance At the End of the Period	1,375,465	1,508,430	1,637,652	1,764,319	1,889,188	2,012,658	2,134,824	2,293,633	2,463,024	2,630,923		

PRE-FEASIBILITY STUDY OF
**BUSINESS COMPLEX (MULTI-STOREYED
BUILDING) IN JANAKPUR PROJECT**

EXECUTIVE SUMMARY

Business complex means a land parcel containing two or more buildings, each containing one or more individual business establishments. It means a development on a lot or lots under single ownership or control that combines two or more of the permitted, conditional, or special exception uses allowed in the district in which the development is located. The business complex at Madhesh Province near Janakpur Metropolitan city is a project that will attract more young investors as well as provide different facilities under the same roof to its local people and the visitors.

The study on the business complex in Madhesh Province project's major goal is to document the project's technical and financial viability. Secondary data gathering approaches were used in the study. Secondary data was gathered from a variety of sources, including

published papers, journal articles, and other verified and trustworthy online sources.

This project appears to be best suited for a Public Private Partnership (PPP) approach, in which GoN will assist in obtaining the necessary land for the project. The developer will then build all of the infrastructure required for the project's smooth implementation and will operate it for 30 years before handing it over to GoN in good working order.

The study looked into the technical and financial aspects of this project and concluded that the project is technically and financially viable with the total estimated cost to be around NPR.3,105,450,398.040 (including interest component during construction period) and Equity IRR of 14.39%.

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SALIENT FEATURES OF THE PROJECT

Table1: Salient features of the project

General information of the project		
1	Name of Project	Business Complex - Multi Storeyed Building in Janakpur (24-25 Floors)
2	Project Location	Province: 2 Location: Dhanusha District, Janakpur Sub-Metropolitan city.
3	Project Implementation Modality	☐ Public ☒ PPP ☐ Private ☐ Others/Please Specify
4	Category of Project	☒ Short term: 5 years and below ☐ Mid term: 6 – 10 years ☐ Long term: 11 – 15 years
5	Sector as per 1 st 5 years Provincial Plan	Physical Infrastructure
6	Type of Project (Sub Sector)	Infrastructure
7	Implementing/Facilitating Agencies	Private sector facilitated by the provincial Ministry of Physical Infrastructure Development.
8	Project Management (Implementation Mechanism)	BOOT concession period of 30 years Private sector will manage the project with support from the Federal, Provincial and Local Governments and local stakeholders.

Project specific information

1	Salient Features of Project	This project will construct a multiplex in Janakpur Sub-Metropolitan city. The Provincial Government would provide appropriate land on lease with 30 years of operation in the BOOT Model. Multiplexes would be constructed by the private sector and would be leased to various business houses, banks and hotels.
2	Affected Population, Land Requirement, Acquisition & Resettlement, Materials and Ease of Access	
	Affected Population	Local population where the building are built, including competing businesses; Unlikely to be affected a lot due to intentional choices of the locations.
	Land Requirement	2 Bighas
	Acquisition & Resettlement	No issue of resettlement.
	Materials and Ease of Access	The materials for constructing the business center are easily available. Access to the project site is not an issue since the project will be built across the national highway.
	Environmental and Social Management Plan (ESMP)	Careful consideration to be taken while establishing and operating such a business complex. No destruction of natural resources to be ensured. Initial Environmental Examination will need to be carried out to determine ESMP.
3	Project Document Available	☒ None (New/Rehabilitation) ☐ Concept Note/Desk Study ☐ Feasibility Study ☐ Detailed Engineering/DPR
4	Estimated Cost to Complete the Project	NPR.3,105,450,398.040
5	Estimated Time to Complete the Project	Feasibility Study/DPR: 6 months Approval and Financial Closure: 6 months Construction Period: 2 years Concession Period: 30 years
6	Project Financing Options	Majority investment of the private sector; Government to contribute to required infrastructure development.
7	Project Technology/Components	• Corporate building with multiple business houses • Departmental stores • Hotels and restaurants • Souvenir Shops for local handicraft and art • Hotels • Smart lighting
8	Contribution to SDG and Green Growth	This project will help attain the following sustainable development goals. Goal No. 8: Decent work and economic growth Goal No. 11: Sustainable cities and communities
9	Project Capacity (at 100%)	25 floors with almost 4 lakhs sq. feet
10	Project IRR	12.96%
11	Benefit Cost Ratio	1.53 times

12	Private Sector/Consumer Committee/Beneficiary Roles	Planning, designing, building and financing the project.
13	Government's Roles	- Facilitating various legal approvals/permits for the smooth operation of the project. (building design approvals, clearance from local levels) - Coordination for land acquisition and land leasing with Local Government.

Other project information

1	Target Beneficiaries	Consumers, traders and business houses
2	Market of Project's Service/Product	Corporate houses, hospitality industry, traders
3	Key risks and opportunities of Project Development & Operation	
	Strengths and Opportunities	- The project will be situated in the most strategic locations of Janakpur Sub-Metropolitan city. - This project will fill a significant market gap for corporate houses and businesses. - The project will also stimulate economic activity in the vicinity of the project site.
	Risks and Issues	- Solid waste management can be a potential issue with the project. However, this can be addressed with sustainable solid waste management projects in the province. - Local issues can arise during the construction of such high rise buildings

1

BACKGROUND

1.1 Introduction

The pre-feasibility study is primarily to facilitate potential entrepreneurs in project identification for investment. The project pre-feasibility may form the basis of an important investment decision and in order to serve this objective, the document/study covers various aspects of project concept development, start-up, and production, marketing, finance and business management.

Business complex means a land parcel containing two or more buildings, each containing one or more individual business establishments. It means a development on a lot or lots under single ownership or control that combines two or more of the permitted, conditional, or special exception uses allowed in the district in which the development is located. It is designed as an expansion of an existing business site and starts for the completion of the third phase of the business site. The premise for the design will, on the one hand, to create a landmark, but on the other hand, will be to create modularity and flexibility, accessibility and sustainability. The existence of the complexes will be one of the sectors supporting the economic backbone of the nation indirectly or directly. According to Finn and Louviere (1996) shopping malls are playing a key role in the modern retailing and marketing system, furthermore they still dominate the distribution system of goods. In the modern world, a consumer

expects the best service within a short time and under one shelter. Business complexes fulfill this requirement of the consumer. These shopping malls not only contain shops but also provide other important services such as banks and libraries. Nowadays a modern shopping mall provides a vast range of entertainment for the consumer such as restaurants and cinemas (NCSC, 2009).

Nepal has several commercial complexes which are spread out all over the country. Not only important cities like Kathmandu, Pokhara, Biratnagar, Birgunj, but also other common cities in Nepal have commercial complexes. People can shop for their daily needs in a single place and where people are satisfied by the services provided. There are numerous commercial complexes already up and running in Nepal. Nepalese people are aware and are motivated toward buying the products in these complexes, some are lured by the hospitality and entertainment platform of the place. Some of the most famous commercial complexes are Bhatbhateni Supermarket, Civil Mall, Pokhara Trade Mall, Labim Mall, Tamrakar Complex and so on.

The importance of a business complex is mainly for people to get out of the house for a while and do something entertaining. Such complexes can provide the best shopping experiences such as social gatherings,

entertainment, performances, product launches, promotions and festivals. The events list at shopping malls goes on and on for any particular person to be entertained for a number of hours.

1.2 Business Complexes in Nepal

Business complex is a privately owned building that contains a number of shops under the same roof. It is a marketplace providing a wide range of products and services under the same building. The main advantage of shopping in a commercial complex is that you can find a wide range of products, compare different products in different shops, save your time and effort and also get quality service at the same time.

In Nepal, different complexes are being built where thousands of people are benefitted as they are shopping and having fun under the same roof with their friends and families. People are happier to have found all the services and facilities under the same roof within their time frame. Successful commercial complexes like Bhatbhateni, Civil Mall, Kathmandu Mall and so on are attracting more customers as customers are found to be fully satisfied by the services provided. The good quality products, services and availability provided along with the other facilities like wide area of parking, professional management team, fire fighting system, escalators and lifts, security systems and air conditioned rooms and corridors, unique architecture of the mall, wide open hall inside the mall and modern shops so on has been influencing more number of customers.

Not only, the individual businesses getting successful but also the areas around them are getting popular because of the increase in the number of the customers as well. Local businesses as well as the markets are getting some sort of attention for being situated near those buildings. The local and non-locals are also getting the chances of being employed with such big complexes because a big complex might be a single building but consists of various story buildings. All those complexes are helping directly or indirectly in the development of economic growth of the country

1.3 Objectives

This study will be conducted for the following objectives:

- i. To understand the demand of as well as the possibility of business complex at Janakpur.
- ii. To analyze the locations of business complexes in terms of catchments, surroundings, and macro/micro accessibility.
- iii. To study the technical and financial viability of the project in the proposed location

1.4 Scope of Work

The pre-feasibility study aims to reflect the current scenario of the business complex in the proposed location and to document the technical and financial feasibility of the project. Ultimately, study will help to get an overall idea of possibilities of investment in this specific sector and area. Some of the major scope of the study are:

- To collect secondary data and all the required information for the development of the said project.
- Carry out the analysis of the gathered information for different aspects such as technical, financial, social and environmental.
- Develop the best suitable investment model i.e. Private or PPP or Blended Finance.
- And provide recommendations based on the findings.

1.5 Approach and Methodology

The various approaches and methodologies were considered while collecting the data. Firstly, the background information was collected from the secondary data which were already existing. Secondary data was collected from different sources like published reports, journal articles and other verifiable and credible internet sources. Also, Financial, technical, social and environmental analysis were carried out and based on the analysis, a suitable investment model has been recommended.

2

PROJECT DETAILS

2.1 Project Background and Description

Commercial complexes are designed to provide all sorts of facilities in a one-stop shop. They have been constructed in the center of the city so that there is no transportation problem for the people. As the basic feature of commercial malls is availability of all goods like trendy clothes, accessories, gadgets, food, all under one roof, it saves time and gives a sense of security. Ample parking spaces, means of entertainment like restaurants, pools and exclusive showrooms are other features of attractions. People visit malls not only to shop but also spend quality time with friends and family. At the end of the day it is the convenience that matters. Another factor is customers can exercise their consumer rights. The trade associations joining hands with the management of the malls has not only solved shop owners' problems, it has also created greater customer satisfaction.

This growing shopping mall culture is also likely to attract more foreign customers. The trend of shopping malls started with the establishment of Bishal Bazar that opened with 275 shops in 1969. Bishal Bazar is the oldest mall in Kathmandu. This shopping center was, however, opened targeting foreigners initially but later on it became a favorite shopping destination for Nepalese too. Currently, shopping malls are an inevitable part of Kathmandu's lives. Bhatbhateni, Kathmandu Mall,

Pashupati Plaza, Blue Bird, Kasthamandap Bazaar, United World Trade Center are only some of them.

Similarly, the complex construction idea in Janakpur has been confronted first with the long term view that the people in Janakpur will have better accessibility to the new services and the new entrepreneurs could have the opportunities to do something better in Janakpur leading to the successful cooperation between the government and private sectors. With the implementation of this project, the land will be provided on lease for 30 years, whereby the new investors as well as the young entrepreneurs can invest in the project for building the complex with the hope of something in return of their investment.

Janaki Mandir, one of the most famous religious places situated at Janakpur, Dhanusa district is one of the factors that is attracting more people for its beauty. With the establishment of the complex, the local people will be benefited a lot through this project. More customers including the local people can easily spend their time in the malls without any hesitation. The government will also be benefitted by the leasing the land to the private sector for its establishment, may be in the starting of the two–three years the government might not get the return they desire for, but after some the government as well

the as the investor can get some level of returns by the leasing the each floors to different sectors. This place will create a new diversion to Janakpur for its development.

2.2 Project Features

Key features of the project

- A building with 25 stories
- Various malls, stores, departments and services under the same rooftop.
- Create a space that invites all categories of people.
- Easy connectivity to important streets and roads.
- Fully secured power backup system.
- Provides consumers with ultimate levels of convenience.
- Evolve the offering by defining a clear value proposition for both consumers and retailers, anchoring it on deep consumer insights and bullet-proof economics.
- Increase productivity and efficiency of the current mall base through a strategic review of the tenant mix, taking into account consumer needs and retailer economics.

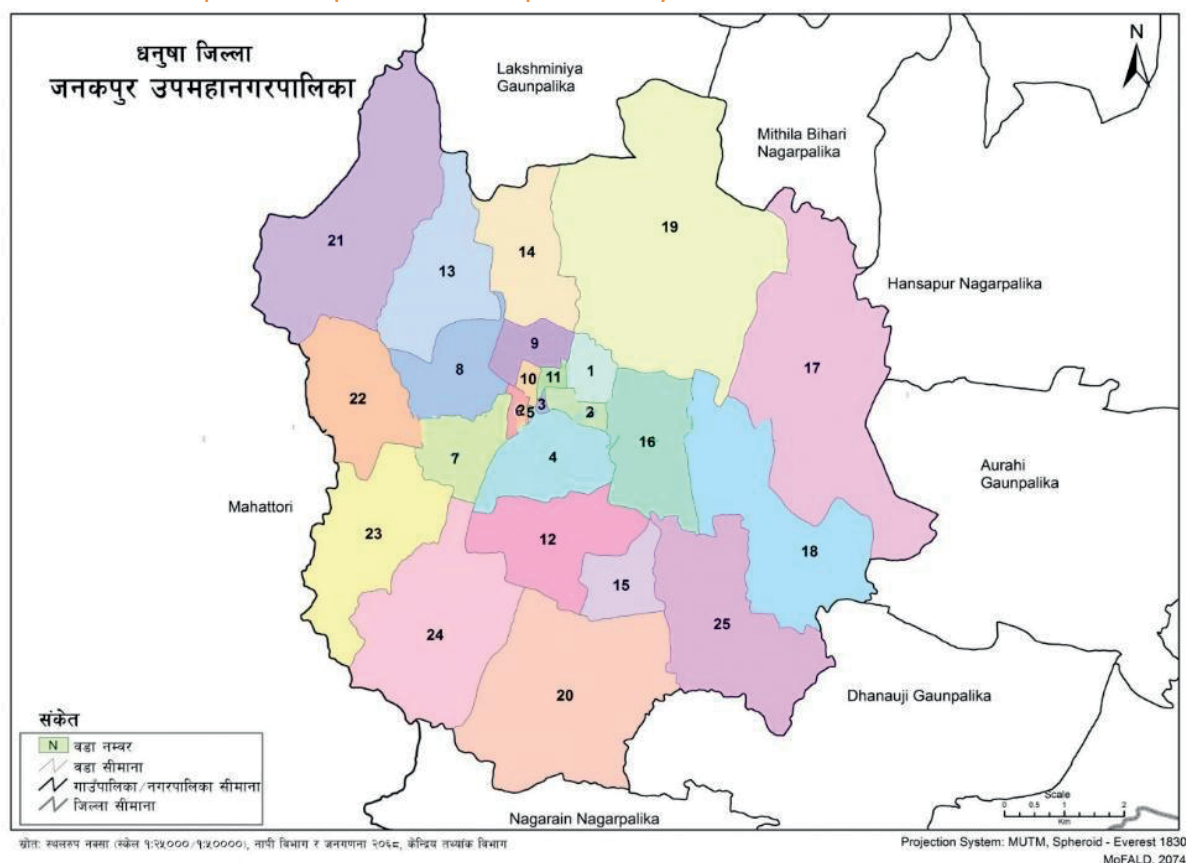
2.3 Overview of the Area

Dhanusha District, a part of Province No. 2, is one of the seventy-seven districts of Nepal. It is situated in the outer Terai. The district's headquarters is Janakpur which covers an area of 1,180 km² (460 sq. mi) and has a population (2011) of 754,777.

The most common language spoken in Dhanusha is Maithili. Tourist attractions in Dhanusha include its temples and ponds, mostly situated in Janakpur. These include the Janaki Temple, Dhanusadham, where according to Hindu mythology, a part of Shiva's bow that Lord Rama broke is said to have fallen. A Mithila Women's Art Center is also a tourist attraction in the area.

Dhanusha district has an airport and the only railway system of Nepal which connects Janakpur with an Indian town, Jayanagar. It has several good hotels like Hotel Rama, Hotel Sita Palace, including the starred hotel, Hotel Welcome, Sita Sharan hotel and Happy hotel. It also has the Janakpur Zonal Hospital and several private hospitals.

Fig. 1: Location map of Janakpur Sub-Metropolitan City



2.4 Brief Description of Product/Composition of the Product

This topic briefs you about the products being provided to the people once the business complex is being built in Janakpur Sub-Metropolitan city.

A. 3D Cinema in Business Complex

Establishing a 3D cinema is proposed to be one of the most prominent sectors to be invested in. The prevalence of such facilities would add economic benefits in the country and would increase the number of direct and indirect employment. Moreover, features like low cost & less complexity associated with installation of a 3D cinema over a business complex makes it a more attractive project as compared to a separate full sized cinema.

The 3D cinema has the capacity of selling approximately 198,000 tickets annually and will be operational for 330 days a year and 2 shows a day. Initially, 3D will be operated at 65% of capital utilization and will increase it by 5% annually. The maximum capacity utilization will be 95%. Keeping in view the market demand and characteristics displaying

3D movies for entertainment to be the final product of the proposed prefeasibility. 3D Hollywood, Bollywood, Kollywood and Tollywood movies to be displayed.

B. Travel and Tour Agency

Travel and tour operators are registered firms who provide the services of managing all the operations starting from visa applications, ticketing, boarding & lodging and domestic travel to destination places. The tour operators generally buy these tour components from their suppliers and combine them into a package tour. More precise tour operators are primarily responsible for delivering and performing the services specified in a given package tour.

Travel and tour agencies are the most important factors that should be given priority as demand for those institutions are high. Establishing a travel agency can help to facilitate potential investors in travel and tour

agencies by providing them with a general understanding of the business with the intention of supporting potential investors in crucial investment decisions.

C. Virtual Reality Gaming Zone

In Nepal, teenagers nowadays are fully into online games due to online platforms are earning in a massive way. VR Gaming is the term used to describe a new generation of computer games involving Virtual Reality (VR) technology, which provides simulation of a three dimensional image or environment that can be interacted with in a seemingly real or physical way by the players using special electronic equipment. Participants can both experience and influence the game environment through a variety of gaming devices and accessories, including VR headsets, sensor-equipped gloves and hand controllers.

Developing our own gaming industry in the business complex of Dhanusha district could be a golden opportunity for all the young entrepreneurs. For young adults and teen aged children gaming zones are virtually becoming a commonplace for entertainment purposes. Virtual Reality (VR) gaming zones are specifically set up to provide an innovative and aesthetically vibrant place to play online games with friends, family and co-workers.

D. Food Retailers

Dhanusa is located in the Terai region where there are a large number and variety of retailers in the food-retailing sector. Nepal being an agricultural country, most of the food products come from the Terai region. Traditional types of retailers, who operate small single-outlet businesses mainly using family labor, dominate this sector. In comparison, some super markets account for a small proportion of food sales in Nepal. But in the case of Janakpur, there are not such supermarkets where the farmers could sell their product directly to their customers. Therefore, providing one whole floor to the food retailers for providing fresh vegetables from the agricultural farm to the customers. This will not only benefit the business complex by leasing the floor, but also the farmers will have the opportunities to get the real price of their agricultural products.

E. Health and Beauty Products

Nowadays, people are being more and more cautious about their health related issues, due to which health related products are on the rise. Also, due to which Nepalese people are spending more on health and beauty products. In well-facilitated city areas, there are different retailers providing such services in different places and have dominated the market. Such retailers are expected to grow significantly in the future due to the growing quality consciousness of buyers of these products.

However, Dhanusa district seems to lack such retailers. If such products are being provided to the people of Dhanusa districts under the same business complex, it will attract more customers- which is a good sign for growing businesses in such sectors.

F. Shopping Mall- Clothing & Footwear

A shopping mall providing all sorts of clothing and footwear can actually be the prominent factor where the customers might feel delighted to shop all the necessary items under the same roof top. The small investors can start their business from investing in clothing and footwear sectors, as numerous clothing and footwear shops are operating in large numbers. Having a shopping mall is a good idea in the business complex in Janakpur Sub-Metropolitan city.

G. Home Furniture and Household Goods

In the case of these sectors, small retailers dominate this sector. Despite the large size of this market, very few large and modern retailers have established stores for these products in their own buildings. However, leasing one of the floors or 2-3 stores to home furniture & household goods can be the better cause nowadays people are more interested in buying the wood stuff with quality under the same roof top to save their time and effort to run from one store to another searching for the best quality. So, the people of Janakpur Sub-Metropolitan city will also not be in a rush while selecting the best materials for their home.

2.5 Market Assessment

There are supermarkets and the small retailers' stores that are providing the services to their customers. However, there are not any business complexes providing all sorts of products and services under the same rooftop by the particular project from the initiation of both the government and the private sectors. Malls tend to be a major tourist attraction. The mall can be more convenient, for a tourist, to have one central location to do all their shopping; rather than to have to drive many miles just to buy different types of products for their personal needs. Business complexes are being held with priority nowadays in different parts of our country. Not many of the investors are eager to build such business malls on their own, as the expenses as well as the investment amount is too high to afford. However, with the help of the government leasing the land for 30 years and a certain level of investment, the young investors from Janakpur can have opportunities to invest and encourage other investors too. Moreover, there are no such malls which could provide competition to the mall, due to which one can have a monopoly market under the mall. There are only a handful of business complexes that could offer unique and qualitative product services. Almost all of these are either in Kathmandu or in neighboring places. They do not cater to the growing population of eastern and south eastern cities. Moreover, lack of such facilities in Madhesh Province has meant that the province is losing out on the potential to develop the business by involving the young entrepreneurs from neighboring cities and towns.

2.6 SWOT Analysis

SWOT analysis is a strategic planning and strategic management technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to business competition or project planning. It is sometimes called situational assessment or situational analysis.

SWOT Analysis for Amusement Park in Madhesh Province

Strength	Weakness	Opportunities	Threats
- The project will be situated in the most strategic locations of Janakpur Sub-Metropolitan city.	- Lack of complimenting quality infrastructure like airports, etc.	- Project to boost the economic and commercial development in the region.	- Local issues can arise during the construction of such high rise buildings.
- Janaki Temple is one of the religious places attracting more and more number of customers	- Poor solid waste management.	- Fill a significant market gap for corporate houses and businesses.	- No proper availability of the necessary materials
- Land availability.	- Probability of difficulty in project plan execution due to lack of hospitality industry expertise and skilled labor.	- Stimulate economic activity in the vicinity of the project site.	- Lack human resources.
- Support from government and public partnerships.			

2.7 Relevant Case Studies

Case Study 1

Project Type: The Grove Mall

Location: Los Angeles, California

It was established in 1934 and since then has grown and expanded to become world-famous. The Grove, which came along in 2002, has become known for high-end shopping and dining. The two spots complement each other, allowing visitors to spend lots of quality time.

Featuring the Grove Trolley, a free electric trolley, The Grove shopping mall is a breeze to get around. With a number of stylish and high-end shops available, shoppers can enjoy the newest fashion trends. Hollywood celebrities are also often seen perusing the fashionable shops of The Grove. It has been attracting more and more customers, be it families, celebrities or local people.

Case Study 2

Project Type: Bishal Bazar

Location: Kathmandu, Nepal

The trend of shopping malls started with the establishment of Bishal Bazar that opened with 275 shops in 1969. Bishal Bazar is the oldest mall in Kathmandu. This shopping center was, however, opened targeting foreigners initially but later on it became a favorite shopping destination for Nepalese too.

It's the oldest shopping complex of Kathmandu and it really looks old as compared to other new shopping malls in Kathmandu. Around 15 years back, it was one of the attractions of Kathmandu. When you visit Kathmandu, people would ask if you went to Bishal Bazaar. Nowadays, no one cares as shopping malls have been common and there are many better ones. The main specialty of this mall is that there are many jewelry and gem shops in and around this mall.

3

FINANCIAL ANALYSIS

3.1 Pre-Feasibility Approaches & Assumptions

Project Cost

Total cost of the project amounted to NPR. 2,661,825,400. excluding interest during construction and minimum payment for taking bids (Rs.1,00,00,00,000.00). The total cost, including interest and payment for the bid to NPR.3,105,450,398.040

itself. Based on the structure, The total investment pattern has been tabulated below:

Component	Percentage	Amount in Dollars
Equity	30.00%	931,635,119.4
Debt	70.00%	2,173,815,279.00
Total		3,105,450,398.04

S. No.	Particulars	Amount in Dollars	Remarks
1.	Civil Cost	2,661,825,400.00	409511.6 Sq. Feet @ 6500 per Square Feet.
2.	Minimum Bid Amount to be Deposited Upfront	1,000,000,000.00	Minimum amount to be deposited for getting the project.
3.	Interest During Construction	343,624,998.040489	Interest computed based on the assumption for three years of construction period.
Total Cost			

The portion of the interest during construction is capitalized in the individual assets on a proportionate basis.

Capital Structure

The project is proposed to be financed in a 70:30 debt equity ratio on the total cost of the project including Interest During Construction (IDC). The requirement of working capital would be financed by internal resources

Project Construction and Operation Period

The project is expected to be completed in three years. After the construction stage, the entire operation term would be 30 years. After the operation term is through, the project will be handed over to the government.

Tax, Staff Bonus, and Depreciation Assumptions

The tax rate for the project is assumed at 25% on profit earned during the year. Further the loss carryforward has been taken for 10 years in due consonance with the provisions of Income Tax Act 2058. Further, the staff bonus is assumed at 10% on taxable income earned during any year of the operation as required by the Bonus Act.

Also, the rate of depreciation on SLM basis for 30 years. i.e. rate of depreciation is 3.333%p.a. on all assets.

Direct Income and Direct Expense

The income has been classified majorly in five categories:

1. Rent from parking
2. Rent from upto 6th Floor
3. 6-14 Floor
4. Residential
5. Rooftop

Annual estimation of revenue has been shown in tabular Form.

S.No.	Floor Description	Plan Area (Sq.ft/floor)	Type	Rentable Space (Sq.ft)	Rate per Sq.ft	Total Initial Rent Amount (90% Occupancy Considered)
1	Basement	18634.8	Parking	17703.06	500	7966377
2	Basement 1	18634.8	Parking	17703.06	500	7966377
3	Ground Floor	18634.8	Shopping	14907.84	1700	22808995.2
4	1 st Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
5	2 nd Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
6	3 rd Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
7	4 th Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
8	5 th Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
9	6 th Floor Plan	18634.8	Shopping	14907.84	1700	22808995.2
10	7 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
11	8 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
12	9 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
13	10 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
14	11 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
15	12 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
16	13 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
17	14 th Floor Plan	18634.8	Corp. Office	16771.32	1500	22641282
18	15 th Floor Plan	9272	Residential	8344.8	600	4506192
19	16 th Floor Plan	9272	Residential	8344.8	600	4506192
20	17 th Floor Plan	9272	Residential	8344.8	600	4506192
21	18 th Floor Plan	9272	Residential	8344.8	600	4506192
22	19 th Floor Plan	9272	Residential	8344.8	1000	7510320
23	20 th Floor Plan	9272	Residential	8344.8	600	4506192
24	21 st Floor Plan	9272	Residential	8344.8	600	4506192
25	22 nd Floor Plan	9272	Residential	8344.8	600	4506192
26	23 rd Floor Plan	9272	Residential	8344.8	600	4506192
27	24 th Floor Plan	9272	Penthouse	8344.8	1000	7510320
Total		409511.6				

The Operational Efficiency

The operational efficiency of each component in various years has been estimated as below:

From	To	Efficiency Level
0 year	3 years	0%
4 years	8 years	80%
9 years	20 years	90%
21 years	30 years	95%

Direct and Administrative Expenses

Direct cost is estimated based on the revenue as follows-

Particulars	Details
All Floors Maintenances and Management fees	7% of Revenue in initial 10 years of operation and 15% for further years

Loan Payment Schedule

Total of the lending amount NPR 2,173,815,278.63 is amortized for 10 years of operation. The rate of interest is 10% p.a. and each installment amounts to NPR 353,778,425.92. The loan repayment schedule is as under:

Year	Payment	Interest	Principal	Remaining
Years 4	353,778,425.92	217,381,527.86	136,396,898.06	2,037,418,380.57
Years 5	353,778,425.92	203,741,838.06	150,036,587.87	1,887,381,792.70
Years 6	353,778,425.92	188,738,179.27	165,040,246.65	1,722,341,546.05
Years 7	353,778,425.92	172,234,154.61	181,544,271.32	1,540,797,274.74
Years 8	353,778,425.92	154,079,727.47	199,698,698.45	1,341,098,576.29
Years 9	353,778,425.92	134,109,857.63	219,668,568.29	1,121,430,007.99
Years 10	353,778,425.92	112,143,000.80	241,635,425.12	879,794,582.87
Years 11	353,778,425.92	87,979,458.29	265,798,967.63	613,995,615.24
Years 12	353,778,425.92	61,399,561.52	292,378,864.40	321,616,750.84
Years 13	353,778,425.92	32,161,675.08	321,616,750.84	(0.00)

Other Assumptions

The administrative expenses are likely to increase at the inflation of 5% with the cap of 200%. As discussed in the earlier paragraph, the project would be financed by 70% debt. The interest rate that has been taken into calculation is 10% which would be repaid in 10 equal installments in the period of 10 years.

The cash outflow for the estimated cost would flow evenly for the construction period.

Also, the revenue has been estimated to be inflated at the rate of 2% per annum which is capped at 150%. The income tax rate for the project is 25% and the loss carry forward period for the project is taken for 7 years of operation.

It is assumed that the government would provide required land for the project. Total operation period of the project is assumed to be 30 years and 3 years is considered as the preoperative period.

Financial Analysis

The project cost for the business complex in Janakpur, assumed to be estimated in line with the current cost structure. It is also assumed that the project development cost was prepared based on the district rates and prevailing market rates.

The total cost of the project is NPR 3.105 Arba of which NPR 0.3436 Arba is an interest component during construction. The total project excluding working capital has been financed by 70% debt and the remaining by equity.

The Equity IRR of the project is calculated to be 14.39 %, the rate of which is fully justified for the project.

The NPV of the project is estimated to be NPR 490,921,470.76 and the BC ratio to be 1.53. The Project Simple Payback Period is 6.04 years whereas the Discounted Payback Period is 11.09 years.

Major Financial Indicators

Parameters	Results
Firm IRR	12.96%
Equity IRR	14.39%
Simple Payback Period	6.04 years
Discounted Payback Period	11.09 years

Cash Flow for Project

Year	Cash Flow for Equity	Cash Flow for Project	Year	Cash Flow for Equity	Cash Flow for Project
Year 1	(310,004,392)	(987,275,133)	Year 17	257,753,168	255,235,691
Year 2	(310,004,392)	(987,275,133)	Year 18	257,753,168	255,235,691
Year 3	(310,004,392)	(987,275,133)	Year 19	257,753,168	255,235,691
Year 4	(310,004,392)	(987,275,133)	Year 20	257,753,168	255,235,691
Year 5	(310,004,392)	(987,275,133)	Year 21	257,753,168	255,235,691
Year 6	(310,004,392)	(987,275,133)	Year 22	257,753,168	255,235,691
Year 7	(310,004,392)	(987,275,133)	Year 23	257,753,168	255,235,691
Year 8	(310,004,392)	(987,275,133)	Year 24	257,753,168	255,235,691
Year 9	(310,004,392)	(987,275,133)	Year 25	257,753,168	255,235,691
Year 10	(310,004,392)	(987,275,133)	Year 26	257,753,168	255,235,691
Year 11	(310,004,392)	(987,275,133)	Year 27	257,753,168	255,235,691
Year 12	(310,004,392)	(987,275,133)	Year 28	257,753,168	255,235,691
Year 13	(310,004,392)	(987,275,133)	Year 29	257,753,168	255,235,691
Year 14	(310,004,392)	(987,275,133)	Year 30	257,753,168	255,235,691
Year 15	(310,004,392)	(987,275,133)	Year 31	257,753,168	255,235,691
Year 16	(310,004,392)	(987,275,133)	Year 32	257,753,168	255,235,691
			Year 33	257,753,168	255,235,691

STATUTORY AND LEGAL FRAMEWORK

4.1 Statutory and Legal Framework

Before forming a corporation or conducting business in Nepal, foreign investors must first get clearance. Depending on the magnitude of the investment, an application should be filed to the Department of Industry or the Investment Board Nepal.

5

PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

A preliminary desktop-based environmental and social impact assessment has been done, which is described in the table below. It includes some of the possible impacts which could occur during pre-construction, construction and operation phases of the project as

well as possible mitigation measures associated with each impact. A comprehensive assessment, through Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) will be conducted during later phases of the project cycle, as per applicable laws.

Activity	Possible Environment Impact	Possible Mitigation Measure
Pre-construction Phase	1. Distress to the micro-habitat and natural fauna due to tree felling.	1. Cutting of trees shall be avoided to the extent possible and natural vegetation present on the site shall be kept in mind while preparing the architectural and landscape designs of the project. Compensatory plantations should be carried out.
Construction Phase- Construction activities for the development of the project	1. Air pollution due to earth work excavation and other construction activities	1. Frequent spraying of water at construction sites to suppress dust emission. Soil, muck and other construction materials should be covered during transport by vehicles.
	2. Soil contamination.	2. Preventive measures should be taken to minimize spillage of oil/ diesel from the construction equipment. Appropriate measures should be taken in case of accidental contamination.
	3. Water pollution/ contamination-Impact on lake	3. It should be ensured that the water bodies- surface and groundwater, are not polluted due to the project. Appropriate measures should be taken in case of accidental contamination. Particular attention should be given to avoid pollution in the lake due to the project.
	4. Disposal of excess earth	4. The excess earth should be transported to a designated place and shall be used for filling and covers.

Activity	Possible Environment Impact	Possible Mitigation Measure
	5. Disturbance to other services	5. Any shifting of cable/utility lines should be attended to with a minimum period of disturbance.
	6. Safety of road users in the project area.	6. Provision of temporary crossings/bridges as well as warning signs wherever necessary to facilitate normal movement.
	7. Noise pollution due to the use of machinery and movement of traffic.	7. Use of less noise generating equipment and avoiding activities during night.
	8. Impacts due to hazardous waste.	8. Hazardous waste will be managed as per applicable laws of Nepal.
	9. Impacts due to construction waste.	9. Construction debris will be managed/disposed of properly.
Operation Phase	1. Impact on water resources supply to nearby residents due to possible extraction of ground-water.	1. This will be a residual impact if water is sourced from well/ boring in the project area. However, possible mitigation measures can be recharging of the groundwater by installation of a well-designed rain-water harvesting system, which is already envisioned by the project as one of its components. Similarly, water saving features could be installed where feasible. In addition, wastewater treatment plants or biological treatment systems (reed-bed) could be installed, if feasible, to treat gray water with utilization of the treated water for watering plants, etc.
	2. Contribution to GHG emissions from use of machines and equipment (heating, air conditioning, etc) in the building, etc.	2. Efforts will be taken to offset carbon emissions by incorporating a green/sustainable building design, including installation of solar power and energy-efficient equipment, as well as ensuring that natural light is received for maximum duration.
	3. Increased solid waste generation, if not managed well can be a nuisance to surrounding communities and may create health hazard .	3. Segregate wastes and ensure they are collected frequently by waste collection companies/facilities. Build a compost facility, if feasible, and use the compost in the green spaces/plants inside the project compound.
	4. Water contamination- Impacts on Lake/River	4. Ensure that the water bodies/flowing adjacent are not contaminated. Appropriate measures should be taken in case of accidental contamination. Install a wastewater treatment plant if feasible.

This initiative will provide locals and other Nepalese with both short and long-term employment opportunities. Through its spin-off economic impacts, it will benefit other existing businesses as well as bring up new investment prospects. For land purchase, a reasonable remuneration based on market value must be provided. According

to the feasibility study, the project will not require any household resettlement; however, if households are required to be resettled at the time of project initiation, this will be accomplished through a fair compensation package and the application of national and international best practice

PRELIMINARY RISK ANALYSIS

The following are some of the most significant risks linked with the PPP project:

1. Risks related to construction and project completion delays, which might lead to cost overruns.
2. This project may pose a business risk since the demand and market trend must be properly analyzed in order for the project to be financially and commercially viable.
3. According to relevant legislation, the project would need to complete either an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA), which would identify possible environmental and socioeconomic implications as well as necessary mitigation measures.
4. Changes in the legislative framework and political risk might be some of the additional risks linked with the project.
5. Financial risks to the project include changes in interest and currency exchange rates, as well as changes in tax regulations.

PROJECT STRUCTURE AND IMPLEMENTATION MODEL

Public Private Partnership (PPP)

A Public Private Partnership (PPP) is an agreement between public and private entities for a certain length of time in which private businesses agree to take on the risk of all or part of the funding, construction, operation, repair, and maintenance of projects under the PPP model. Such an entity may generate a fair profit by providing public services directly or indirectly through the building, operation, repair, and maintenance of public or private assets. Through legislative, legal, institutional, and economic arrangements, public institutions must establish an environment that encourages private sector investment.¹

It will be suitable to develop a project using the PPP model, which involves both public and private entities. When national treasury resources are insufficient, assets of public utility and less expensive operation of public services, as well as resources, skills, and technology accessible in the private sector, must be drawn to nation-building projects based on the PPP idea.

In the present context of the business complex, the PPP model is suitable. The preliminary study conducted in the areas near Janakpur Sub-Metropolitan city gave the information that the land will be provided by the Local Government for the development of the project.

1 World Bank, 2072, Public Private Partnership Policy

FINDINGS AND RECOMMENDATIONS

8.1 Findings

The following are some of the study's significant findings:

1. Janakpur Sub-Metropolitan city with a business complex project will provide various facilities and attractions to visitors as well as locals.
2. The mall will be of 25 floors with almost 4 lakh sq. feet.
3. Based on the study, Janakpur Sub-Metropolitan city seemed to be near the border, which adds up to the easy accessibility of the goods imported.
4. The Public Private Partnership business model was found to be suitable for the project.
5. The project can be completed with a total cost of NPR. 3,105,450,398.040 and Equity IRR of 14.39%.
6. Benefit cost ratio is 1.53 times.
7. Achieve sustainable development goals of Goal No. 8 and 11.

8.2 Recommendations

Based on the findings, the project sounds to be technically as well as financially viable for developers to invest in. Whereas, study of environmental and social aspects as well as in-depth study of all other components needs to be further considered in the next stage.

Some of the recommendations are listed as below:

1. Encourage and support new and existing uses around the road front that continue to make the area a focal point in the surrounding catchment.
2. Encourage the development of high quality entertainment and retail uses that attract customers from beyond the intermediate market areas, as well as attracting local residents.
3. Well defined and adequate parking and landscaped spaces.

Disclaimer

This project profile is based on preliminary study to facilitate prospective developers to assess possible scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.



ANNEX

Annual Financial Statement

Projected Profit and Loss Statement for Initial 10 years

Particulars	Amount in NPR											
	4 years	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years-		
Revenue	339,787,613	346,583,365	353,515,032	360,585,333	367,797,040	422,047,103	430,488,045	439,097,806	447,879,762	456,837,357		
Total Income	339,787,613	346,583,365	353,515,032	360,585,333	367,797,040	422,047,103	430,488,045	439,097,806	447,879,762	456,837,357		
Less: Direct Expenses	23,785,133	24,260,836	24,746,052	25,240,973	25,745,793	29,543,297	30,134,163	65,864,671	67,181,964	68,525,604		
Total Direct cost	23,785,133	24,260,836	24,746,052	25,240,973	25,745,793	29,543,297	30,134,163	65,864,671	67,181,964	68,525,604		
Gross Profit	316,002,480	322,322,530	328,768,980	335,344,360	342,051,247	392,503,806	400,353,882	373,233,135	380,697,798	388,311,754		
Administrative Expense	-	-	-	-	-	-	-	-	-	-		
Cash Admin Expenses	-	-	-	-	-	-	-	-	-	-		
Land Lease Rental	50,000,000	52,500,000	55,125,000	57,881,250	60,775,313	63,814,078	67,004,782	70,355,021	73,872,772	77,566,411		
Depreciation Expenses	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013	103,515,013		
Operating Profit	162,487,467	166,307,516	170,128,967	173,948,096	177,760,921	225,174,714	229,834,087	199,363,101	203,310,012	207,230,330		
Interest Expenses	217,381,528	203,741,838	188,738,179	172,234,155	154,079,727	134,109,858	112,143,001	87,979,458	61,399,562	32,161,675		
Profit	(54,894,061)	(37,434,322)	(18,609,212)	1,713,942	23,681,194	91,064,857	117,691,086	111,383,642	141,910,451	175,068,655		
Provision for Staff Bonus	-	-	-	155,813	2,152,836	8,278,623	10,699,190	10,125,786	12,900,950	15,915,332		
Income Tax	-	-	-	-	-	-	25,481,755	25,314,464	32,252,375	39,788,331		
Net profit	(54,894,061)	(37,434,322)	(18,609,212)	1,558,129	21,528,358	82,786,233	81,510,141	75,943,393	96,757,126	119,364,992		