

Collation and Presentation of Data

Financial and Economic Viability of Kalpasar Project

Submitted by:
Grant Thornton Bharat LLP
&
G Tech Infrastructure Pvt. Ltd.

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Financial and Economic Viability Analysis

The present Chapter describes the Financial and Economic Viability Analysis of the Kalpasar Dyke project as per the Scope of Work set forth in the following section.

National Centre for Coastal Research (NCCR) vide File No. MoES/NCCR/47/Kalpasar/Financial/2022, dated: 12.07.2022 issued Letter of Acceptance (LOA) to Grant Thornton Bharat LLP (Lead Partner undertaking the Assignment in Association with G Tech Infrastructure Pvt. Ltd.), hereinafter referred to as 'GT or the Consultant'.

32.1 Data Sources

The Financial and Economic Viability Analysis is based on collection of data from various existing reports to be shared by NCCR, secondary data (comparable benchmarks from similar projects) and literature review. Since primary data collection is outside the purview of the Financial and Economic Analysts, no primary data collection has been undertaken. As and when felt necessary, the team might have interacted with NCCR and the Kalpasar Department of the Government of Gujarat for a better understanding and appreciation of the complexities involved.

This data is being used in building the financial and economic model to assess the financial and economic feasibility of the project. To this end, several parameters are being analysed. A more detailed description of these parameters is provided in the relevant sections which follow. Given the scale and scope of the project, a number of direct and indirect benefits are expected to accrue to all the stakeholders of the project (Government, financiers and local population, among others). In particular, the lower strata of the society (e.g., daily wage earners, agricultural economy) is expected to particularly benefit from various aspects of this project. The proposed analysis aims to capture these financial and economic benefits, which will also comprise Social Cost Benefit Analysis.

32.2 Important Considerations

In understanding the Financial and Economic Viability Analysis presented in this chapter, following considerations are important:

- a. Cost phasing is based on the Project Structure (Capital Budgeting structure) as suggested by the Authorities.
- b. The Project Cost Estimate is as per the Detailed Project Report. GT has not prepared/revised the same. However, in such cases where necessary information has not been shared, certain assumptions have been made. These are mentioned in Section 32.8 (a)
- c. Opex as mentioned in the DPR forms the basis of calculating the Operational Cash Outflow. In case of any gross mismatch from established standards, GT has discussed the same with the Authorities. The authorities in turn have done the necessary corrections/modifications and shared it with GT. As and where necessary, suitable market led assumptions have been incorporated.
- d. For the purpose of conducting economic analysis, GT is mostly relying on the data made available by the Authorities in the form of EIA, SIA Reports and other information as received from the Kalpasar Department. Apart from physical inspection of the project site and project-benefit area, GT shall not conduct any primary data collection activities.

32.3 Financing options

An indicative list of the possible financing options is given in the table 32.3.1 below.

Table 32.1 : Indicative List of Possible Financing Options

Equity	Debt
<p>Domestic</p> <ul style="list-style-type: none"> • State Government / Public Utilities • Central Government • Private Corporates • Other institutional investors • Viability Gap Funding by Govt. • Revenue from real estate development rights 	<p>Domestic</p> <ul style="list-style-type: none"> • Banks / FIs • Government bonds • Specialised infrastructure financing institutions
<p>Foreign</p> <ol style="list-style-type: none"> (1) International developers (2) Equipment suppliers (3) Dedicated infrastructure funds (4) Other international equity investors (5) Multilateral agencies 	<p>Foreign</p> <ol style="list-style-type: none"> (1) International commercial banks (2) Export Credit Agencies (3) International Bond markets (4) Multilateral agencies (5) Bilateral aid agencies

32.3.1 Key Considerations for Government

- (1) Such projects are highly capital intensive with long gestation periods
- (2) Construction period is generally 5-8 years and much longer periods of the order of 30-50 years are necessary for debt servicing;
- (3) Such projects are undertaken by governments in view of its social responsibility to provide sustainable infrastructure; returns are not the prime drivers;
- (4) Other drivers for such government supported projects are economic development of the area, reduction in traffic, reduction of emissions etc., which cannot always be expressed in purely financial terms, but have a positive economic effect
- (5) Government subsidies and support in the form of equity and viability gap funding are an important part of project during construction as well as during operation of the project;
- (6) Government of Gujarat (GoG)/ Government of India (GoI) as Co-sponsors may jointly; contribute to the equity of the project;
- (7) Both GoG and GoI may allow certain policy incentives (rebates in taxes payable apart from GST ITC) during the construction and concession period
- (8) GoG may facilitate the acquisition of land at subsidised rates for development of the reclaimed land

- (9) GoG/ GoI may provide equity support through Viability Gap Funding if necessary for Initial cash losses;
- (10) GoG may consider ensuring electricity supply to the project on a no profit-no-loss basis;
- (11) GoG may have to provide guarantee for refinancing domestic loans for the bullet portion to be paid at the end of 15th year;
- (12) Sale of property development rights will also form a source of funding for the project;
- (13) GoI may also provide guarantee for raising funds through bonds.

32.3.2 Key Considerations for Debt Financing

- (1) Project would require debt funding spread over at least 30 - 50 years;
- (2) Quantum of debt and repayment profile will depend upon the projected revenues over 30-50 year period;
- (3) Debt would be funded through various instruments i.e., External Credit Agency (ECA)/Multilateral funds, Govt. guaranteed bonds and domestic Rupee loan;
- (4) Funding from ECA/Multilateral institutions will provide cheap and long-term source of funds spread over 30 years and hence it is to be maximised depending upon their comfort and import level from their countries;
- (5) Raising of funds through bonds (including Local Area Bonds / Municipal Bonds) will require Government guarantee as the project SPV will not get desired rating on standalone basis;
- (6) Part of funds can be raised from domestic lenders for tenor up to 15 - 25 years with structured repayment keeping a portion as bullet repayment at the end of tenor to be refinanced later;
- (7) Being long gestation and capital-intensive project there may be cash losses in the initial years and government may have to fund the same by way of viability gap funding.

32.3.3 Debt Financing options

a. Funding from ECAs / International Cooperative Agency

- (1) ECAs like JICA, Korean Exim, KFW etc. can provide cheap long term funding i.e. 30 – 50 years plus for such projects;
- (2) Repayment would be spread over 30 - 50 years after construction and moratorium period of 5 to 8 years;
- (3) Low interest rate during construction which will increase after moratorium to match with cash flow projections. Similarly principal repayment can also be structured as per the cash flow projections.

b. Funding from Multilateral / Development Agencies

- (1) ADB and World Bank can provide long term funding at attractive rates;
- (2) Repayment would be spread over 15 - 20 years after construction and moratorium period of 10 years
- (3) MFAs / Development agencies generally provide fixed rate loans

c. Government Guaranteed Bonds

- (1) The SPV can raise 10-15 years funds by issue of government guaranteed bonds;
- (2) Tax free features can make them more attractive;
- (3) SPV can repay these bonds by raising fresh debt once operations are stabilised.

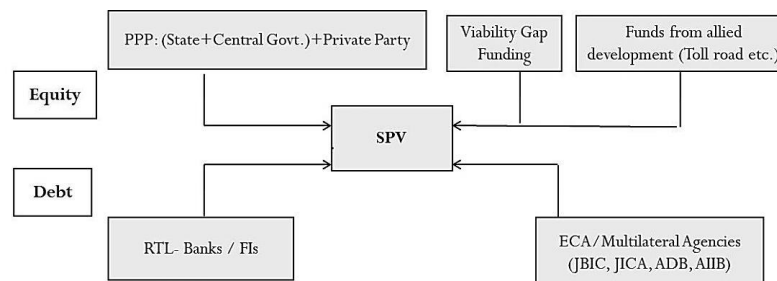
d. Rupee Term Loans

- (1) Indian banks can provide debt up to 15 years with 6 to 8 years of construction and moratorium period and 8-9 years of repayment period;
- (2) Repayment will be step-up to match the cash flows;
- (3) Step up repayment with full amortisation of Rupee loan at the end of 15 years;
or
- (4) 30%-40% of loan repayment over 15 years and balance bullet repayment at the end of tenor to be refinanced by fresh debt.

32.4 Project Structuring

Modalities for Project Structuring are currently being explored. Possible project structures with necessary caveats will be discussed with the Authorities in the next stage. For now, presented below is a schematic representation of one possible structure which can be considered. Further, a list of comparable project structuring is given in Table 32.2 for the analyst team to draw necessary references.

Figure 32.1: Indicative Financing Structure



32.4.1 Key Financing Attributes

The equity portion (~30% of total project cost) is expected to be partly contributed by state/central governments. Also, the project SPV is expected to be provided a sovereign guarantee by central government thereby providing additional comfort to the lender consortium. In its traditional form, the debt financing (70% of the project cost) can be provided by a consortium of Multilateral Funding Agencies such as ADB, AIIB etc at all-in-cost of LIBOR+3% – LIBOR+5%. That is an all-in-cost of 5.3%-7.3%. As per IMF forecasts, India is expected to witness GDP growth rates of 8.5%-9.5% over the next 2-3 years. Given these growth rates, the rating is expected to witness upwards movement. Also, given the sovereign guarantee by the central government, the rupee term loans are expected to cost 7%-9%. Thus, depending upon the Rupee-Dollar funding mix, the borrowing costs are expected to range from 7%-8%.

32.4.2 Estimation of Weighted Average Cost of Capital (WACC)

For estimation of WACC, the cost of equity and cost of debt will be sourced from the publicly available DPRs of similar large infrastructure projects. Some of the comparable projects are provided here at Table 32.2.

32.4.3 Loan Tenor

The project is expected to be a very long-gestation project (30-50 years) with ballooning revenues during the last 15 years of the project. The debt component may carry a 5-year moratorium during which interest may be capitalised with a 25-year (Approximate that could be further extended) repayment period. That is an overall door-to-door tenor of 30 - 50 years. A ballooning repayment structure is proposed to match the project cash flow profile. Once the construction period is over, the execution risk will decrease considerably, and the debt may be refinanced at a lower cost and longer tenors (from ADB/ECA/Multilateral funds). This would require cash-flow securitisation of project cash flows from allied sources such as toll revenues, wind & solar power generation, industrial and domestic water connections, revenues from state tourism, etc., through TRA/Escrow mechanism. Additionally, long-term tax-free bond options can be explored to refinance the loans.

Table: 32.2: Comparable Projects for Project Financial Structuring

	Project Name	Total Cost (Rs Crore)	Model	Financing Structure (As per the DPR)	
1	Semi High Speed Rail Corridor Thiruvananthapuram to Kasargod	63940	SPV Model	Equity (20%-30%): Govt. of Karnataka and Ministry of Railways	Loan (70%-80%): Soft loans from Bi/Multilaterals
2	Metro: Delhi – Ghaziabad - Meerut	16592	PPP Mode	Equity (30%-50%): Govt of Delhi, Govt of India, Govt of Haryana, Private Partner	Loan (50%-70%): Soft loans from Bi/Multilaterals
3	Bengaluru Suburban Railway Corridors	15767	SPV Model	Equity (40%): Govt of India, Govt of Karnataka, Private Partner	Loan (60%): Soft loans from Bi/Multilaterals
4	Pune Metro	10700	SPV Model	Equity (50%): Govt of India and Govt of Maharashtra	Loan (50%): Soft loans from Bi/Multilaterals
5	J&K Metro	10600	PPP Model	Equity (40%): Govt of India, Govt. of Jammu and Kashmir, Private Partner	Loan (60%): Soft loans from Bi/Multilaterals
6	Chennai Metro (3+4+5)	29192+14761+16382=60335	SPV Model	Equity (40%): Govt of India and Govt of Tamil Nadu	Loan (60%): Soft loans from Bi/Multilaterals
7	Jaipur Metro	3349	BOT Model	Equity (50%): Govt of India and Govt of Rajasthan, Private Partner as Concessionaire	Loan (60%): Taken by Concessionaire
8	Uttar Pradesh Major District Roads Improvement Project	3531	SPV Model	Equity (30%): Govt of India and Govt of UP	Loan (70%): ADB
9	Rajasthan state highway project	11707	PPP Model	Equity (65%): Govt. of Rajasthan and Concessionaire	Loan (35%): ADB
10	Maharashtra State Road Improvement Project	4142	SPV Model	Equity (30%): Govt. of Maharashtra	Loan (70%): ADB
11	Karnataka State Highway Improvement III Project	5334	PPP model (hybrid annuity contract)	Equity (40%-50%): Govt. of Karnataka and Concessionaire	Loan (50%-60%): ADB

32.5 Methodology for Conducting Financial Analysis

32.5.1 Objectives of the Financial Analysis

- (1) Phasing of costs as per the Detailed Project Report;
- (2) Phasing of operational expenses as per the implementation schedule proposed in the DPR;
- (3) Identifying the various sources of revenue accruing to the project;
- (4) Quantification of the revenue as per Industry standards;
- (5) Preparing a Cash Inflow – Outflow statement based on accounting principles;
- (6) Preparing a functional Financial Model for necessary Financial Analysis to arrive at the Project NPV, Project IRR under different scenarios;
- (7) Identifying the critical parameters affecting the Financial returns from the project and conduct a Sensitivity Analysis;
- (8) Suggesting a few (at least two) project financing structures based on experience; market intelligence and other relevant information.

A project financing structure shall lay out all the components of the capital to be raised for the project with specific details on the amount, timing, interest rates, moratorium, indicative repayment schedules and any other commercial terms likely to affect the financial viability under the relevant financing structure . However, in detailing such commercial terms, GT is not expected to approach any of the Funding Agencies.

GT will analyse the feasibility of each financing structure suggested. The feasibility analysis will incorporate-

- Viability of the financing structure from a cash flow perspective under various economic scenarios being considered in the financial model. To the extent possible, the Consultant shall consider the possibility of cost and time escalations, as well. Specific focus on the ability to service debt and ensure adherence to various financial covenants likely to be in place (e.g. DSCR, EBITDA ratios etc.)
- Viability of the financing structure from a commercial perspective. To the extent possible, highlight precedents of projects having similar structures / components.
- Pros and cons of each structure beyond items covered in (i) and (ii)
- For each financing structure, identify the optimal mix of the components taking into account the intended social outcomes from the project as well as maximisation of revenue potential from the various sub-components.

32.5.2 Cash Flow Analysis

This will include cash flow projections over the potential life cycle of the project. The cash flows (inflows and outflows) will be projected considering inflows and outflows that are tangible (occurring directly on account of the project) and those that are intangible (social economic cost and benefits). These are discussed in detail in the subsequent sections. The cash flow projections will be employed for the computation of various profitability measures and indicators of project financial and economic viability. The cash flow project will also entail project cost estimates and schedule of principal and interest repayment.

32.5.3 Capitalisation and Coverage indicators

It is customary for such projects to be supported by debt. Therefore, the ability of projected cash flows and other benefits to support the debt servicing ability is important. This will be examined through various capitalisation and coverage indicators such as Debt-to-Equity ratio, EBITDA/Interest, EBITDA/ (Interest+Principal), Debt-to-EBITDA, NCA/Debt, among others.

32.5.4 Net Present Value (NPV) Analysis

The first and one of the most important indicators to examine the viability of the project is NPV analysis. We propose to compute NPV of the project at different rates of opportunity costs (or weighted average cost of capital) that reflect the risk of the project. This would account for the fact that project investors should be able to earn commensurate returns; sensitivity analysis at different opportunity costs will highlight the value of the project, and also accounts for differing risk-perceptions.

32.5.5 Project and Equity IRR

The project financial analysis will involve project and equity IRRs for the project. Project IRR is the Internal Rate of Return for the project at which the discounted NPV of cash inflows is equal to cash outflows. In addition, we also propose to estimate Equity IRRs that will examine the returns specifically to equity providers. Projects that involve debt have Equity IRRs that are different from project IRRs. Thus it is important to examine the returns from equity investors perspective.

This is so because returns from debt holders' perspective are specifically mentioned in the form of the interest cost.

32.5.6 Project Viability Gap Funding (VGF)

Kalpasar project is expected to make a sizable contribution to the local region in the form of agri-economy, employment generation, connectivity to metro cities, tourism, and fisheries, socio-economic development and welfare (education, per capital availability of drinking water, etc.). A sizable component of such benefits do not directly accrue to government. To make such projects financially feasible, government support is required in the initial stages, in the form of viability gap funding. The NPV analysis and IRR analysis is expected to highlight the VGF support which might be necessary to be provided to the project by the government to make it sustainable.

32.6 Methodology pertinent to the Kalpasar Project

32.6.1 Land Reclamation and Development

Consequent to the construction of the dyke across the Gulf and creation of the fresh water reservoir, the presently tidal affected land between EL + 5.0 m MSL and EL + 8.0 m MSL in the periphery of the proposed reservoir will open up for reclamation and development. Based on a reconnaissance field survey of the peripheral areas reinforced with computer-based estimation, such land areas are 2,38,464 ha, which are mostly governmental lands. Because of the project-induced development in the region as well as several upcoming developments in the neighboring areas, like Dholera Special Investment Region (SIR), Petrochemical Petroleum Investment Region (PCPIR), etc., there is a high value-additive setting for these lands to be appropriately reclaimed and developed towards value-based land utilisation.

Revenue Estimation

To estimate revenue generation from the reclaimed land, the following methodology has been followed:

The government portion of the land reclaimed shall be valued considering the jantri rate for the nearby Survey Numbers, appropriately appreciated by a multiplication factor approximately equivalent to the appreciation factor calculated for the pre and post development of land in Dholera SIR.

The said value of the land has been monetised in a phase wise manner over a period of 30 years (standard PPP concession period) with a tentative schedule. The schedule is considered perusing other comparable similar projects.

32.6.2 Provision for Toll Road Construction

For toll road construction two main components of cost need to be suitably accounted: CAPEX and OPEX.

These are long-gestation projects (e.g., 40 years). Assuming a 10-year construction period, the capital expenditure can be phased at 10% for each of the years (Typically though, Capex Projects follow a S Curve). Given the useful economic life of the project, the project costs need to be depreciated over the long gestation period. Through appropriate securitisation structure, the revenues from toll can be used to service debt. The proposed financing may include 70:30 of debt equity ratio. Debt may come with a moratorium period of 5-8 years.

First phase of debt financing may be costly, however, once the construction period is over and toll revenues start, cheaper debt can be obtained through refinancing as most of the project construction and execution risk will be over.

The financial costs such as taxes, interests, and depreciation charges can be considered as transfer payments and adjusted in the financial costs to convert into economic costs.

The main operating and maintenance (O&M) costs include all costs and opex items as mentioned by L&T in their latest report submitted in November, 2022

Revenue Estimation

Under the broad umbrella rules of Govt of Gujarat toll policy, the following factors have been considered to estimate the toll revenues. Willingness to pay will be a factor of

time and fuel cost savings depending upon vehicle mileage (commercial light and heavy vehicles, private transport, etc.). This aspect will help in establishing the toll tax. Toll tax, coupled with traffic volume and composition, will help in estimating the average revenue profile. For example, TAS report offers two scenarios (Table 2-26 and 2-27) with distance savings, perceived travel cost savings, and accordingly, the proposed toll rates for bus, car, truck, LCV, and MAVs. The resulting number needs to be multiplied by expected annual/5-year/or 10-year traffic growth rates (TAS Table 3-24). Revenue forecasts to be obtained from TAS (Refer Table 4-19), these can be suitably revised to reflect the present conditions.

32.6.3 Provision for Generation of Renewable Energy

a) Wind Power Generation

The area where a number of Wind Turbine Generators are installed is called as Wind Farm. The essential requirements for establishing a wind farm for optimal exploitation of wind are as under

- (1) Wind resource at site
- (2) Adequate open land availability
- (3) Suitable Terrain and Topography
- (4) Proper Approach to the site
- (5) Suitable power evacuation Facility
- (6) Micro siting Layout

All the above written parameters are easily met at Kalpasar.

The governing feature of the wind climatology in India is the monsoon circulations. Winds in India are influenced by the strong South-West summer monsoon winds which start in May-June and weaker North-East winter winds in December-January. Wind energy is intermittent and highly site specific; therefore an extensive wind resource assessment is essential for deciding potential sites. The locations having annual mean power density greater than 200Watts/m² at 50 meter height are considered suitable for commercial wind power development.

On the basis of Annual mean power density, Vadgam and Jambusar Nada have been selected for the erection of Wind Farm. These areas are at the periphery of proposed reservoir and near to the power evacuation facility.

It is proposed to have 700 turbines of S120, 2100 kW capacity with a hub height of 105 Meter along the coast of Gulf of Khambhat. Hence total of 1470 MW is proposed.

Total 1470 MW will be installed in three clusters of Vadgam1, Vadgam2, and Jambusar region.

716.1 MW, 390.6 MW, 363.30 MW respectively will remain the installed capacity of the three clusters.

Wind power output for Kalpasar project is presented below:

Table 32.3: Wind power output for Kalpasar project

Site Location	Total Wind Turbine No	Capacity MW	Total Installed Capacity	Estimated Output KWH/WTG/YE AR	Total Annual output KWH in Lacs.
VADGAM I	341	2.1 MW	716.1 MW	39.25 Lacs	13384.25 Units
VADGAM II	186	2.1 MW	390.6 MW	39.25 Lacs	7300.50 Units
JAMBUSAR	173	2.1 MW	363.30 MW	47.50 Lacs	8217.50 Units
TOTAL	700		1470 MW		28902.25 Lacs Units
Grid Level Availability		0.97*28902.25 Lacs Units		=28035.18 Lacs Units	
Power availability to Kalpasar Project Per Year (After 10% Wheeling Charges)				0.90*28035.18=2523.15 Million Units	
Power Required for Irrigation Water Pumping/Year				2500 Million Units	

Total Cost of the Project

As per the prefeasibility study and six specific studies of Kalpasar Project, for pumping of 6,500 Mm³ water from the reservoir at elevation at 70 metre (660 km long canal), required annually is 2500 million units. Considering this much power requirement for the project, and also the availability of huge land area as well as positive parameters of wind energy, it is proposed to install 1470 MW capacity wind turbines which will generate net annual 2523 million units. Hence total cost of 700 Wind turbine generators is given in the Table below.

Table 32.4: Costing for Wind Turbine Generators

Total No of Wind Turbine Generators	Cost of One WTG (In Rs. Crore)	Total Cost (In Crore)
700	17	11900

Note : Above cost has been given in account for surge in steel and iron ore prices in recent past.

The useful life of the WTG is 25 Years.

Operation and Maintenance -

Per MW Operation and Maintenance cost will be Rs. 1,000,000 at an Annual Escalation of 5.72%. (As per CERC Norms)

Power generated through this plant will be used for captive purpose.

b) Solar Power Plant

A Feasibility study has been done in Vadgam and Jambusar region wherein it has been found average solar radiation at 5.8 Kw-hr/m²/day.

Parameters which are required to commission a solar power plant are available in this area as given below:

Solar insolation in this area is 5.8 kWh/m²/day

3 Hectare land is required to install 1MW of Solar Project

3000 Hectare of land is available in this area without shadow effect wherein 1000 MW of Solar Power plant can be installed.

Easy supply of adequate fresh water from Kalpasar reservoir for cleaning of solar panels.

Distribution Network/Infrastructure available for wind can be used for solar power.

Power Generation from the plant-

We know that at the given solar insolation level, 1.5 Million Units of electricity can be generated from 1 MW Solar plant in a year. Therefore 1000MW of solar will generate 1500 Million Units of electricity in a year.

Components of Solar Power Plant

The main components of solar power plant are as under:

- (1) Solar Panel;
- (2) Solar Inverter;
- (3) Combiners & Junction Box;
- (4) Land Bank;
- (5) Erection of Project;
- (6) SCADA and Data Logger System;
- (7) Robotic Cleaning

The overall project cost will be the summation of individual cost of the above written components.

The overall project cost is given in the Table below:

Table 32.5: Overall Project Cost

S.No.	Component Name	Cost (in Crore)
1	Solar Panel(Mono Crystalline Perk Half Cut)540watt Peak	2800
2	Solar Inverter(1MW,10MPPT)	225
3	Combiners and Junction Box	200
4	Protective Gears Arrangement	100
5	Erection	500
6	SCADA and data logger system	70
7	Robotic Cleaning	500
8	Total cost	4395

Note: Here we have assumed that land for the project will be provided by state authorities therefore we have not accounted the land cost.

Operation and Maintenance –

Operation and Maintenance will be done with the help of Robotic Cleaning which has been accounted for in the Capital Cost. For O&M we are taking Rs.2.5Lacs/MW as O&M cost with 5.72% escalation(As per CERC Norms) on annual basis.

Other necessary assumptions

Given the capacity of wind and solar power projects, assumptions (or estimates) can be obtained for comparable projects across India. These include project cost estimates based on plant capacity. Opex related estimates as a percentage of plant capacity. Competitive tariff rates for power can be employed to estimate the revenues.

Such projects are usually 70: 30 or 75:25 debt equity financed. Thus, financial projections can be obtained using these line items. Indicative broad project and financing assumptions are provided in Sec 20 (DPR).

32.6.4 Increase in availability of Industrial and Drinking water

Total water available for storage in Kalpasar reservoir is 10,000 MCM at 50% dependability, of which 6568 MCM water is proposed to be allocated for irrigation in the Saurashtra region covering 39 talukas in six coastal districts viz. Bhavnagar (7 talukas), Amreli (3 talukas), Junagadh (12 talukas), Porbandar (3 talukas), Jamnagar (10 talukas) and Rajkot (4 talukas). Details of net-water availability (after accounting for losses) for these three major causes (industry, agriculture, and domestic) are provided in the reports. GT is in the process of estimating the direct financial benefit generated due to the provision of water for domestic, industrial, and agricultural purposes based on benchmarking of unit cost/MCM of water supply in similar projects. The preliminary estimations are given in Section 32.8 (b)

Sources for Calculation: Data provided by the authorities and conceptual structural plan report (CEPT University)

32.6.5 Leasing of reservoirs for freshwater fishing

While the DPR does not mention leasing of the reservoir for the freshwater fishing activity, this may well be an important source of direct revenues to the project. This can be estimated as a percentage of the fish harvest on an annual basis.

Sources for Calculation: Data provided in the conceptual structural plan report (CEPT University). Some initial computations are provided in Section 32.8 (Table 32.37-28). In addition, benchmarking from similar projects/studies may also be explored

32.6.6 Design Life of various Components

Table 32.6: Design Life of various components

S.No.	Component	Design Life
1	Structural Components	Minimum 100 Years
2	All fixed, cast-in, or non-replaceable components	Minimum 100 Years
3	Replaceable Mechanical and Electrical components	Minimum 25 Years
4	Hydromechanical Steel Structures (Gates and Valves)	Minimum 40 Years

Source: DPR, Version June 2022 Table 14.1

32.7 Methodology for Conducting Economic Analysis

32.7.1 Objectives of the Economic Analysis

- (1) Conversion of Financial Project Cost Estimates into economic costs,
- (2) Conversion of Opex estimates into economic costs;
- (3) Identification of tangible economic benefits accruing due to the project (Economic benefits as already identified in the DPR shall be considered as the base; however, in case any other benefits have not been identified, the Consultant shall propose the same, subject to final acceptance of the Authorities);
- (4) Review of population projection as per accepted standards and identification of beneficiary population out of the same (based on population projection and demographics as mentioned in the Social Impact Analysis);
- (5) Quantification of the tangible economic benefits based on sound economic principles – To the extent possible, the quantifications shall be based on benefits accrued due to similar projects implemented nationally or globally;
- (6) Conducting an economic analysis of the Present Value of Economic Benefits and Economic Return from the project;
- (7) Sequencing of economic benefits which are likely to accrue – An informed estimate of commencement of the economic benefits aligned with the Construction and Implementation Schedules is being used to carry out the necessary analysis

32.7.2 Fundamentals of Economic Analysis

The socio-economic impact of the project can be classified into tangible and intangible benefits. The tangible benefits (or tangible outputs) can be further classified as Traded and Non Traded Outputs in the nature of Incremental and Nonincremental outputs. Similarly, inputs or project (and associated) costs can be classified as Traded/Non Traded, further classified into Incremental and Nonincremental inputs.

Economic cost-benefit analysis establishes the overall economic merit of the project. Economic assessment includes monetizing benefits, such as time savings, decongestion benefits, environmental impact, accident cost savings, etc. This analysis is the central tool for measuring the net economic gain that can be achieved through the development of the project.

Economic valuation of project benefits and costs involves converting their financial values into economic values, also known as “shadow pricing.” This conversion requires economic prices of project outputs and inputs to be estimated. Economic prices reflect values of goods, services, and other project effects on the national economy. The basis for estimating economic prices differs between internationally traded and nontraded goods and services, between project outputs and inputs, and between incremental and non-incremental outputs and inputs.

Based on the above principles, input costs and outputs shall be converted into shadow prices. Further analysis and calculation of EIRR / ENPV follows the same method as is used for the calculation of FIRR.

32.7.3 Calculation of Economic Feasibility

Economic Internal Rate of Return (EIRR) will be computed based on sound economic principles and globally accepted norms of conducting Economic Analysis of the Project (also known as Social Cost Benefit Analysis) to arrive at the economic feasibility of the project. The EIRR indicates the rate of return at which the present value of the economic costs and benefits of the project are equal. In other words, it is the discount rate for which the net present value of the net effect on the economy (ENPV) is zero. The EIRR should be compared with the socially required rate of return. Projects that are found to have an EIRR that is higher than the socially required rate of return would be said to be feasible economic investments. These may then proceed for a detailed analysis of their viability as PPPs.

FIRR and EIRR give different sorts of information about a project. FIRR provides a decision criterion on whether the project generates enough return to cover the cost of funds (or in other words generates a positive Net Present Value of Net Cash Flow during the project period) On the other hand, the EIRR is better suited to being a decision criterion from the socially beneficial purpose. By allowing a project to be compared against a required rate of return it gives a yes or no answer about whether it is economically feasible. EIRR includes aspects such as socio-economic perspective and positive and negative externalities of the project to society.

32.7.4 Methodology adopted for Economic Feasibility of Kalpasar Project

a) Net Economic Benefit

Economic appraisal is done by estimating net project gains by comparing the ‘With Kalpasar’ scenario and ‘Without Kalpasar’ scenario. Stream of costs and benefits, as estimated in market values are then converted into economic values by using appropriate shadow cost factors.

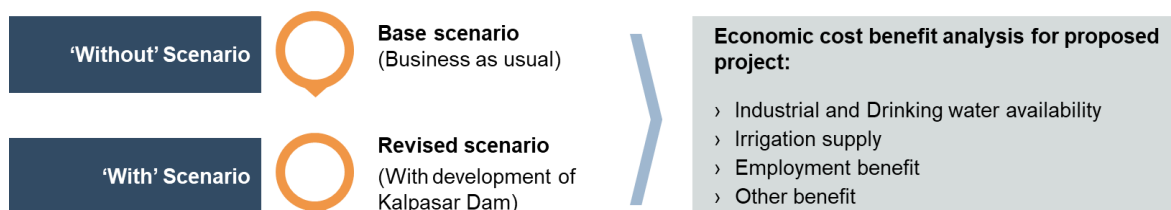
The annual stream of project costs and benefits are compared over the entire analysis period for estimating the net benefit and economic viability of the project. These benefits are presented in terms of the Economic Internal Rate of Return (EIRR).

EIRR represents the discount rate at which ENPV of the project is equal to zero; in other terms where the Net Present Value of all economic cash flows is equal to zero. The higher the value of EIRR, the greater the net economic returns from the project.

b) Economic assessment – Approach and framework

As highlighted, economic cost-benefit analysis analyses overall costs and benefits from the development of the Kalpasar Dyke. The assessment includes monetizing non-market benefits from the development of the dyke, such as availability of water drinking, industrial, and irrigational purposes, hydropower generation, employment generation, travel time savings, decongestion benefits, environmental impact savings, etc.

Figure 32.2:



Economic appraisal of this project evaluates social cost-benefit and compares project benefit and costs under “With” and “Without” project cases.

“With” case considers the possible benefits achieved with the development of Kalpasar Dyke whereas “Without project” case considers the existing base case. The Economic Internal Rate of Return (EIRR) would be calculated as-

$$\text{EIRR} = \text{Private Returns} + \text{Cost Gains}$$

Where, Private Returns = Actual Revenues – Actual Costs

Cost Gains = Actual Cost – Opportunity Cost

All taxes and subsidies are excluded from the computation of EIRR

The financial analysis only looks at the project from the perspective of the implementing agency. Also, financial analysis is only concerned with line items that entail monetary outlays. Economic analysis, on the other hand, considers cost and associated benefits to the economy.

Economic analysis requires quantification of various costs and benefits converted to ‘economic equivalent’ terms. EIRR also requires identification of ‘externalities and valuation of inputs and outputs at their true economic prices, or the ‘opportunity costs’. These externalities would be estimated as the Shadow Cost Factor, as explained in the following Section.

c) Shadow Cost Factor Estimation

In order to estimate the economic benefits of the Kalpasar Dyke, the actual financial value of construction and operational costs would be estimated including the Shadow Cost Factor. The Shadow Prices are adjusted financial prices, which discount the effects of government taxation and subsidies, the opportunity cost of resources, environmental externalities, and market distortions.

The Shadow Exchange Rate Factor determines the domestic currency value converted at the official exchange rate, and as per the Asian Development Bank’s (ADB) guidelines it is determined as per the formula below.

$$\text{SERF} = \text{RER} / \text{OER} * (1 + T - S)$$

Where, SERF = Shadow Cost Factor,

RER = Long-run Real Exchange Rate for the Economy,

OER = Original Exchange Rate (Actual) of the economy,

T = Average rate of tax on infrastructure investment, and

S = Average rate of subsidy on infrastructure investment

Shadow Wage Rate Factor (SWRF) determines the opportunity cost of labour. For skilled labour, SWRF is considered equal to 1, whereas, for unskilled labour, SWRF varies between 0-0.75 implying a loss of output.

The relevant shadow factors for the economic assessment of Kalpasar Dyke would be derived using the ADB or similar Guidelines.

a) Benchmark EIRR

For all investment projects such as transportation, energy, urban development, and agriculture, Multilateral Funding Agencies use a discount rate of between 9% to 12% as the minimum required EIRR to accept or reject a project and to choose the least-cost (or most efficient) project choice. This rate serves as a rationing rate to maintain resource efficiency and as a stand-in for the opportunity cost of capital in each of the member countries that are developing (DMCs). However, lower discount rates of about 6% can be used as the minimum required EIRR for social sector projects, specific poverty-targeting projects (like rural roads and rural electrification), and projects that primarily generate environmental benefits (like pollution control, ecosystem protection, flood control, control of deforestation, and disaster risk management).

These projects can be justified by using a lower social discount rate for the following reasons: Numerous environmental protection and conservation initiatives have very long-term effects that justify a lower discount rate, and many social sector and poverty-targeting projects frequently have many advantages that cannot be quantified.

32.7.5 Understanding the Socio-Economic Impact of the Project

Given the scale of the project, we understand that substantial socio-economic benefits, both tangible (revenue generation, income from assets likely to be generated, increase in Gross Domestic Product i.e. GDP, improvement in groundwater quality etc.) and intangible (improved quality of life, improvement in flora and fauna etc.) are expected to accrue to the project. In order to carry out the economic feasibility analysis, we shall strive to understand these and categorise them in to tangible and intangible benefits. The tangible benefits shall then be quantified to conduct the feasibility analysis and the intangible benefits shall be mentioned separately.

Following are some of the likely benefits expected to accrue, divided into two broad categories-

- (1) Direct benefits, and
- (2) Indirect benefits

Table 32.7: Direct and Indirect Benefits

Direct Benefits	Reduction in passenger transport and freight haulage cost
	Generation of Sustainable Energy
	Land Reclamation and Development
	Water availability for industry, agriculture (irrigation), and domestic/municipal applications
	Tourism and recreation
Indirect Benefits	Increase in Agri Gross Regional Product
	Reduction in siltation along the coastal shipping route
	Reduction in air pollution and Consequent Carbon Credit
	Additional Employment Generation
	Improved navigation for coastal shipping
	Negative Impact on Fauna

Most of these benefits are briefly discussed below. Few of the indirect benefits have been directly covered in the Section on Methodology for Estimation of the respective benefits

a. Reduction in passenger transport cost and freight haulage cost

Direct connectivity between the Saurashtra region and South Gujarat (Bharuch, Surat) has been a long-felt requirement of Gujarat. Construction of dyke road across the Gulf of Khambhat will fulfill that requirement by connecting the Saurashtra region with South Gujarat; thus, transport distance will be reduced significantly, thereby reducing the transport costs. The road transport benefits will accrue largely through the diverted and generated traffic. While the traffic will be diverted to the dyke road from other modes of transport or other routes in view of the differences between the transport costs incurred in the dyke; the generated traffic will be consequential to the new road connection and the reduced costs between the Saurashtra region and South Gujarat, and to the demand of transport on account of various projects in the region, viz Petrochemical and Petroleum Investment Region (PCPIR), Delhi-Mumbai Industrial Corridor (DMIC), Dholera Special Investment Region (Dholera SIR), Fedra (Dholera) International Airport, Port activities, etc. Moreover the transport component within the project will stimulate the regional economic development.

Presently, we have estimates of major district connectivity with and without dyke (details in TAS Table 1) and therefore savings in distances. For example, savings in distance from Bhavnagar to Bharuch is 137 km. As per the savings matrix Table, across different districts, the savings range from 50-150 kms. Moreover, the expected travel time savings is estimated to be between 30-minutes to more than 6 hours. Estimates of traffic volumes and traffic composition for different vehicle movements in the project influence area (heavy and light commercial vehicles, passenger cars, auto rickshaws etc.,) are similar to those provided in TAS (Oct, 2013). [The corresponding train traffic volume details are provided in Table 5&6 (CEPT)]. These estimates of cost and time (road user benefits) are categorised as Savings in Vehicle Operation Costs (VOC) and Savings in Value of Passenger Time (VOT) and are provided in Table 5-6 (TAS).

The overall benefits (both quantifiable and non-quantifiable) can be summarised as under-

- (1) Reduction in operating expenses, both for the users of the new highway on the dyke, but equally for traffic that continues to use the existing routes, which may become less congested;
- (2) Time savings for both passengers and freight;
- (3) Reduction in accidents;
- (4) Increased comfort and convenience;
- (5) Secondary benefits like savings in foreign exchange as consequence of reduction in transport timing of fuel imports.

b. Generation of Sustainable Energy

Owing to environmental concerns and rapidly depleting fossil fuel reserves, renewable sources of energy like Wind, Solar etc. have been the preferred option. Wind power is non polluting and causes no ecological imbalance, no throughput fuel. It has low gestation periods and is having rapid technological advancements.

One of the objectives of Gulf of Khambhat Development Project is to explore the possibility of power generation through renewable energy sources like Wind and Solar to meet the power requirement for pumping of water into canals.

Under the ambit of the Gulf of Khambhat Development Project, the power requirement for pumping of water from the proposed freshwater reservoir is planned to be achieved through renewable energy sources by setting up wind power farms along the periphery of the reservoir.

The annual power requirement for water pumping of the project would be approximately 2500 Million Units (TEFR). As per TEFR and Suzlon study (pre-feasibility survey), the wind energy potential is the estimated energy assessment of 700 turbines each of 2.1 MW capacity, aggregating to a total of 1470 MW capacity.

Along with wind power, solar power is planned to be developed collaterally. Basic parameters for the feasibility of solar power development are aligned to wind-farm are provided as follows: 4500 ha land area is proposed to be made available for wind park, of which 3000 ha land area (without any shadow effect) can be available for solar power development.

c. Land Reclamation and Development

Consequent to the construction of the dyke across the Gulf and creation of the fresh water reservoir, the presently tidal affected land between EL + 5.0 m MSL and EL + 8.0 m MSL in the periphery of the proposed reservoir will open up for reclamation and development. Based on a reconnaissance field survey of the peripheral areas reinforced with computer-based estimation, such land areas are 2,38,464 ha, which are mostly governmental lands. Because of the project-induced development in the region as well as several upcoming developments in the neighboring areas, like Dholera Special Investment Region (SIR), Petrochemical Petroleum Investment Region (PCPIR), etc., there is a high value-additive setting for these lands to be appropriately reclaimed and developed towards value-based land utilisation.

d. Water availability for industry, agriculture (irrigation), and domestic/municipal applications

Total water available for storage in Kalpasar reservoir is 10,000 MCM at 50% dependability, of which 6568 MCM water is proposed to be allocated for irrigation in Saurashtra region covering 39 talukas in six coastal districts viz. Bhavnagar (7 talukas), Amreli (3 talukas), Junagadh (12 talukas), Porbandar (3 talukas), Jamnagar (10 talukas) and Rajkot (4 talukas). Details of net-water availability (after accounting for losses) for these three major causes (industry, agriculture, and domestic) are provided in Table 9.2 (DPR). For drinking water a reservation of 1000 MCM from proposed Kalpasar Reservoir has been planned. It will be provided to Water Supply Department of GoG to cover deficit of drinking water in the entire Kalpasar command area. Also, 100 Mm³ of water for industrial use from the freshwater Kalpasar lake. A good part of this can be reused for irrigation after proper treatment. Appropriate water tariffs can be employed to value the additional water resource generated by the project. Moreover, surface irrigation would recharge the ground water in the command area, as a result of which the additional irrigation has been planned using the groundwater.

e. Tourism and Recreation

Tourism will be one of the relatively new economic activities in the region. The Kalpasar lake will offer avenues of recreation along the waterfront. Hence recreation has been proposed as a separate land use zone in the Final Structure Plan of the Gulf of Khambhat Development Project Report prepared by CEPT University in January 2019, which includes tourism and recreation-based activities depending on the location and environmental sensitivity. To promote tourism activities, riverfront is proposed at strategic locations to create Entertainment for heterogeneous group of people, it will also increase the degree of tourism development in the area.

Benefits from tourism shall be estimated basis a certain percentage of the average expected per capita expenses incurred by the estimated tourist volume on fooding, lodging etc. basis comparable per capita expenses incurred by tourists in similar or near similar tourism projects.

Apart from revenue generation potential, this will also create new jobs in the form of hotel management, guides, drivers, hotel staff, craftsmen, agents, trade and commerce, transport and logistics, locals etc. This includes a mix of skilled, semi-skilled, and daily wage earners.

f. Increase in Agri Gross Regional Product

It is expected that the reservoir developed in Kalpasar Project will irrigate approximately 10.50 lakh hectare land, benefiting 9 to 10 districts of Gujarat where the present agriculture is dependent solely on monsoon. With an increase in water supply for irrigation due to the development of dyke, the Agricultural output of the state would likely increase, thus, increasing the Agri Gross Regional Product.

As per the DPR (June 2022 Section 2.7.20), the gross value of crops proposed to be grown under irrigation at current prices works out at Rs.10,366.9 Crore as against the present realisation of Rs, 2,110.7 Crore, thereby implying an additional gross value of Rs.8,256.2 Crore per year. Among the proposed crops/crop groups, groundnut turns out to be the main crop with a share of 23% of irrigated area and providing highest return of additional production worth Rs.2,338.2 Crore. Though wheat accounts for 30.8% and cotton 6.4% of irrigated area, the return from wheat is just 50% of that from cotton. The highest return after groundnut is from onion and wheat. These two cash crops taken together constitute the major source of income to the farming community of Saurashtra region. An increase of 8.38 million tonnes is envisaged in the overall production of crops due to the proposed Kalpasar Project.

From available information, it seems that due to dependency on monsoon mostly single crops are roped. With creation of irrigation facilities, the farmers will be able to harvest two to three crops in a year. The availability of water will help in reclamation of degraded soils due to which more land will be converted from barren to fertile. This will bring prosperity to rural households depending mainly on agriculture. The farmers of the area need to be guided to adopt integrated farming through which they can generate more income even from small holdings. With respect to hydrological properties, majority of the soils in the Kalpasar Command Area have high available water capacity suggesting that crops like cotton, sugarcane and paddy, can be safely grown.

Insofar as the fisheries sector is concerned, the proposed Kalpasar Project may not bring in any appreciable loss of fisheries yield (DPR Section 2.7.19). On the contrary, the proposed Kalpasar reservoir would add at least 2,000 tonnes of reservoir fish, valued about Rs.15 Crore through its 2,000 km² reservoir. Thus, the creation of fresh-water reservoir is likely to result in excess reservoir fish yield. Apart from value realisation from the fish yield, the working population ratio is also expected to increase significantly with a substantial number getting involved in pisciculture.

The fishing in the Ghogha area of the Bhavnagar district may profit from the rise in water level. Additionally, prospects for aquaculture near the villages of Ghogha and Kuda may arise due to the rising sea level. Many Ghogha families rely on marine fishing for their livelihood. The years-long decline in fish catches was one of the main complaints. The increase in saltwater could help the local fishing industry.

Families from the SC and ST communities in the Bharuch district, particularly in the Dahej area, have historically relied heavily on fishing as a source of income. But the extensive industrialisation in the Dahej region has had a negative impact on the quality of the seawater, which has decreased the availability of fish and other aquatic life.

The projected Kalpasar dyke is expected to raise the water level, which should help to flush away or diluted the level of pollutants in the sea water in this area. This would have a favourable effect since it would make it easier for fish and other aquatic animals to move about, which would be extremely beneficial for households in the underprivileged groups of society in the villages of Dahej, Luvara, Ambetha, Koliyad, Vengni, Suva, and Mahegam.

With the rise in water level, fishing—another important occupation for the locals in the Hansot-Ankleswar region might benefit. The majority of the households from the Rathore and Vasava villages depend on fishing and day labour in agricultural areas for a living. According to preliminary findings, these communities' way of life will remain mostly

untouched or enhanced. Due to the scarcity of Narmada water following the Sardar Sarovar Dam and the incursion of tidal saline water deep into the river, the yield of hilsa fish has decreased in the Bharbhut region near Bharuch. Freshwater fishing may flourish close to Bharbhut while seawater fishing may flourish in the villages of Katpor and Vamleswar further downstream as a result of the construction of the dyke.

g. Improvement in Groundwater

Due to availability of fresh water from canal system around 10 Lakh ha of area would be under irrigation. With the availability of 4500 MCM/year for irrigation, pressure on groundwater will reduce. Considering infiltration rate of 30 to 35% there would be additional ground water recharge between 1400-1600 MCM/year. This will improve the ground water condition both in terms of increase in water table and reduction in salinity. There are plans to promote drip and sprinkler irrigation to reduce overuse of water in the region, with arid conditions and prevent sodicity of soils. The canals will also firm up existing reservoir in the command area and in turn benefit in prevention of salinity ingress along the sea coast of Saurashtra region. Amreli, Jamnagar, Junagadh, Bhavnagar and Porbandar districts would benefit from the salinity projects already in operation from the Kalpasar canals. This in turn would benefit the ground water resources of the region.

h. Reduction in siltation along coastal shipping route

The region towards the east of the Gulf of Khambhat around Dahej is exposed to siltation due to the discharge of water from Sardar Sarovar Dam which brings a huge volume of silt, impacting the ferry route in the region. With the development of the Kalpasar Dyke the siltation would likely reduce, thus, reviving the ferry route and reducing the cost of dredging along the route.

i. Reduction in Air Pollution and Consequent Carbon Credits

Emission estimates depending on vehicle types are provided in Table 5 (TAS). Reduction in emissions due to distance savings via the Kalpasar Project road will result in Carbon Credits accruing due to the project. Trading of Carbon Credits is therefore, another benefit that is likely to accrue due to the project.

A carbon credit is a generic term for any tradable certificate or permits representing the right to emit one tonne of carbon dioxide or carbon dioxide equivalent. Carbon Credit is maintained in the form of an Electronic Certificate, similar to that of a De-Materialised (Demat) Share Certificate. One carbon credit is equal to one ton of carbon dioxide, or in some markets, carbon dioxide equivalent gases. Emission trading (also known as cap and trade) is a market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants.

32.7.6 Estimation of Various Benefits

This section explains various direct and indirect benefits to be considered for the assessment.

a) Estimation of Direct Benefits

i. Reduction in passenger transport and freight haulage cost

Estimates of traffic volumes and traffic composition for different vehicle movements in the project influence area (heavy and light commercial vehicles, passenger cars, auto rickshaws etc.,) are similar to those provided in the L&T Report submitted in November 2022. These estimates of cost and time (road user benefits) are categorised as Savings in Vehicle Operation Costs (VOC) and Savings in Value of Passenger Time (VOT) and are provided in Table 5-6 (TAS). Initial assumptions and estimates are provided in section 32.8 (d & e)

Sources for Calculation: Conceptual Report for Road, Rail, and Bridge Designs, L&T Infra Engineering, June 2022; L&T Report of November, 2022; Stakeholders' consultations

ii. Generation of Sustainable Energy

As per the Narmada, Water Resources, Water Supply, and Kalpasar Department, the Kalpasar Dyke is proposed to generate 1,470 MW of Wind Energy and 1,000 MW of Solar Energy.

A 25 MW Solar Grid-connected power plant at Sardar Sarovar Dam generated ~183.8 Million units of electricity in May 2022. GT shall estimate the economic benefit due to sustainable energy generation based on benchmarking of unit cost/MW of energy generated in similar projects.

While it may not directly be related to the present project, the benefit of increased consumption resulting from a generation project will also depend on the presence of transmission and distribution surplus capacity. Additional investment in transmission and distribution will be needed if there is insufficient capacity to support increased usage. When this occurs, a system approach should be used to combine the transmission and distribution components with the generation project such that their investment and operation costs are added to the project cost to derive net gain.

Sources for Calculation: Benchmarking from similar projects/studies

iii. Land Reclamation and Development

A maximum water level (MWL) of about 5.0 m in the reservoir will result in recovery of land between 5.0 m to 8.0 m surrounding the reservoir. As per the DPR and the CEPT University reports, it is expected that approximately 1 lakh hectare of land will be reclaimed upon implementation of the project.

GT has estimated the additional revenue generated from the reclaimed land as per the method stipulated in Section under the sub heading "32.6.1 Land Reclamation and Development"

Sources for Calculation: Jantri estimates provided by authorities for land value appreciation in Dholera SIR are employed to compute the escalation factor. These estimates are applied on the proposed reclaimable land jantri rates provided by the authorities. IN addition, benchmarking from prevalent land rates in the areas surrounding the project area

iv. Increase in availability of Industrial and Drinking water

Total water available for storage in Kalpasar reservoir is 10,000 MCM at 50% dependability, of which 6568 MCM water is proposed to be allocated for irrigation in the Saurashtra region covering 39 talukas in six coastal districts viz. Bhavnagar (7 talukas), Amreli (3 talukas), Junagadh (12 talukas), Porbandar (3 talukas), Jamnagar (10 talukas) and Rajkot (4 talukas). Details of net-water availability (after accounting for losses) for these three major causes (industry, agriculture, and domestic) are provided in the reports. GT shall estimate the economic benefit generated due to the provision of water for domestic and industrial purposes based on benchmarking of unit cost/MCM of water supply in similar projects. Initial assumptions and estimates provided in section 32.8 (b).

Sources for Calculation: Data provided by the authorities and conceptual structural plan report (CEPT University). Benchmarking from similar projects/studies

v. Increase in revenue due to tourism and recreation

Estimation of revenue generation from tourism and recreation is based on assessment of and benchmarking against similar development work in Gujarat (Statue of Unity etc.) and elsewhere.

The computation of employment generation potential would require an estimate of full capacity employment at steady state and annual incremental phasing of the same. Assuming three categories of employment, skilled ($wage = w_1$), semi-skilled ($wage = w_2$), and daily wage earners ($wage = w_3$). Moreover, these comprise $x_1\%$, $x_2\%$, $x_3\%$ of the overall employment generation. Here, $w = w_1 * x_1 + w_2 * x_2 + w_3 * x_3$. If 'N' jobs are created in a phase-wise manner over 'n' years, and after that steady state is achieved. Also, the increase in average wage rate to be 'y%' per year. Again the risk of tourism related employment generation can be take as the risk of the project (discount rate of 'r%'). The value created in terms of tourism employment generation can be obtained as follows.

$$PV_{tourism} = N * w \left[\frac{1}{n} * \frac{(1+y)}{1+r} + \frac{2}{n} * \frac{(1+y)^2}{(1+r)^2} + \dots + \frac{(1+y)^n}{(1+r)^n} + \frac{(1+y)^n}{(1+r)^n * (r-y)} \right]$$

The above method is developed based on the inputs from CEPT report (Sec 5).

Any other source of job creation (e.g., industrial and urban development or proposed special investment region) can be suitably considered as per the respective development plans. The discounted cash flow valuation method can be suitably adopted thereafter.

Alternatively, a top-down approach can be followed by examining the new tourists' potential and average spending of these tourists. This can be achieved by benchmarking with other tourism related projects. Inputs from Kalpasar authorities, in-house consultants, and secondary public information for similar project/studies are also being pursued. For example, a cost-benefit analysis for tourism campaigns run by the government may provide a reasonably comparable benchmark.

Because of its interdependence with other sectors of the economy, it is difficult to analyse and plan for tourism. The lack of reliable statistical data hampers the identification of the mechanisms by which tourism generates growth, as well as its potential for development.

However, in an attempt to quantify the tourism benefits that are likely to be created with the development of the Kalpasar dam, especially the recreational avenues along the waterfront, a study of a similar tourism project – the State of Unity has been done to

identify potential economic benefits to the economy. Initial assumptions and estimates provided in section 32.8 (i).

Sources for Calculation: Data provided by the authorities and conceptual structural plan report (CEPT University). Benchmarking from similar projects/studies, inputs from Kalpasar authorities, in-house experts with the consultant

Developments at the Statue of Unity

The Statue of Unity, the tallest statue in the world, was built to accelerate tourism within the region and the surrounding 2,200-acre preserve along the Narmada River, where it is located. In addition to the Statue, which stands on an island in the river, there is an exhibit hall and memorial garden at the base. The project includes a canopied bridge to the island, a visitor's center, a hotel with a conference center, a transit center, and a 3.5 km road from the nearby town of Kevadia.

It was envisaged that the building of the iconic structure, shall become a catalyst for accelerated development in the project area benefitting a large number of the local tribal population. It was anticipated that development will be based on several stimuli such as tourism infrastructure, entertainment, and educational infrastructure, research activity in facets of biotechnology, clean energy, water resources, environmental management, and tribal development. The overall area surrounding the project site was expected to grow and support all of the above activities and more.

Post-Development Impact of Statue of Unity

As per the information received from Gujarat State Government, recreational places have been developed around the Statue of Unity to increase employment and tourism in the surrounding area. Moreover, local people were employed during the construction of different projects undertaken by various Departments including the Tourism Department of the State Government, Sardar Sarovar Narmada Nigam, Sardar Vallabhbhai Patel Rashtriya Ekta Trust, etc. At present approximately 3000 persons have been employed as tourist guides, security guards, animal keepers, operations, maintenance & repair staff, drivers, photographers, etc.

The table below shows the increase in the no. of tourists with the development of the Statue of Unity.

Table 32.8 : Details of Tourists before and after the Statue of Unity

Status	Year	Total no. of tourists visited	Monthly Average
Before the Statue of Unity	2018 (from January to October 2018)	5,81,255	58,125
After the Statue of Unity	November 2018 to February 2020	42,58,060	2,66,129

Source: Rajya Sabha Discussion; Ministry of Tourism, GOI

In terms of revenue generation, as per tourism details shared by Gujarat Tourism Department, a tourist footfall of 2.6 million at the Statue of Unity generated an earning of RS. 570 million through selling tickets and RS. 1160 million including tickets and parking between 1st November 2018 to 12th September 2019.

The Statue of Unity is spread over an area of 0.02 sqkm project area, i.e the revenue generated per sqm of the project area land in a year was RS. 58,000.

Using the same benchmark, the economic benefits of the tourism sector shall be evaluated for the Kalpasar Dam Project. However, due consideration shall also be given to the change in the annual footfall of the facility with time which has an impact on the revenue collection at the facility as well as the application of shadow factor for economic revenue estimates.

b. Estimation of Indirect Benefits

The approach for estimating the indirect benefits is highlighted below.

Increase in Agri Gross Regional Product (including Fisheries)-

The Agri Gross Regional Product would be estimated by benchmarking the unit yield per Hectare in the state and the nation. As per the Social Economic Review of Gujarat 2019-20, the average yield of food grains in 2019-20 was ~2.2 tonnes/hectare.

Depending on information obtained on the current yield, variance from mean yield mentioned above and other necessary limiting factors, the same yield with suitable variations are being used to estimate the output of the single-yield Agricultural activities.

Output from multi crop yield would be based on available market estimates of the proposed (less water intensive) crops to be introduced, adjusted for local conditions. In case market estimates are not available, GT's agri expert is in the process of identifying the likely crops that can be introduced through proactive Government Action. To that effect, the increase in Agri GRP is contingent upon GoG's efforts as suggested in the Agri Action Plan.

Sources for Calculation: Social Economic Review of Gujarat 2021-22; Socio-Economic Survey Report of India 2021-22

The following assumptions are required to value the incremental cash flow benefits from fishing activity.

The creation of fresh-water reservoir may result in excess reservoir fish yield. (a) The max-yield full development scenario and the number of years in which this full capacity scenario is obtained. (b) Yearly incremental phasing of increase in reservoir fish. For example, assume total reservoir fish capacity to be 'C' tonnes.

This is to be achieved in 'n' years with C/n incremental phasing. After n year onwards the capacity will achieve its steady state value C. (c) Assume per tone reservoir value of fish to be 'R' and a steady growth of g_R year on year in this rate. Again the risk of reservoir fishing can be taken as the risk of the dyke project. Then the present value (PV) of reservoir fish at the end of the year can be computed as

$$PV_{fish} = \frac{C}{n} * \frac{R*(1+g_R)}{1+r} + \frac{2C}{n} * \frac{R*(1+g_R)^2}{(1+r)^2} + \dots + \frac{C}{1} * \frac{R*(1+g_R)^n}{(1+r)^n} + \frac{C}{1} * \frac{R*(1+g_R)^n}{(1+r)^n * (R-G)} ; \text{ or}$$

$$PV_{fish} = C * R \left(\frac{1}{n} * \frac{(1+g_R)}{1+r} + \frac{2}{n} * \frac{(1+g_R)^2}{(1+r)^2} + \dots + \frac{(1+g_R)^n}{(1+r)^n} + \frac{(1+g_R)^n}{(1+r)^n * (R-G)} \right)$$

Initial assumptions and estimates provided in section 32.8 (h).

Sources for Calculation: Data provided by the authorities and conceptual structural plan report (CEPT University). Benchmarking from similar projects/studies

Reduction in siltation along coastal shipping route

As per the approved rates by Superintendent Engineer, Port and Inland Water Department, vide letter dated 01/08/2019, the rate for dredging all types of soils, pebbles, soft rocks, etc. is RS. 234 per cum. The same would be considered for the estimation of saving in dredging cost. While the reduction in siltation for coastal shipping routes is indeed a benefit, the cost of desilting the reservoir will be included in the operating costs for the project.

Sources for Calculation: Approved rates by Superintendent Engineer, Port, and Inland Water Department, vide letter dated 01/08/2019 (S. No. 4)

Reduction in air pollution and Consequent Carbon Credit

Emissions from the transport sector depend mainly on type of transport and fuel apart from type of combustion engine, emission mitigation techniques, maintenance procedures, and vehicle age. The major pollutants emitted from transport are Carbon dioxide (CO₂), Methane (CH₄), Carbon monoxide (CO), Nitrogen oxides (NO_x), Nitrous oxide (N₂O), Sulphur dioxide (SO₂), Non-methane volatile organic compounds (NMVOC), Particulate matter (PM) and Hydrocarbon (HC). Diesel is used in public passenger and cargo vehicles, while private two-wheelers, light motor vehicles (passenger), cars, and jeeps use gasoline. Emission estimates depending on vehicle types are provided in Table 5 (TAS). Reduction in emissions due to distance savings via the Kalpasar Project road are quantified based on the number of vehicles and distance saved in a year per different vehicle type, as follows

$$E_i = 365 * \left(\sum_{j=1}^J Veh_{j,without\ GKDP} - \sum_{j=1}^J Veh_{j,with\ GKDP} \right) * E_{ijkm}$$

Here, E_i = emission of GHG (i) in tons;

E_{ijkm} = emission of GHG(i) in tons from vehicle type (j) per driven kilometer.

Estimates for the project are provided in Table 5-5 (TAS).

As per the research paper on Freight Transportation and Value Chains by Rodrigue J. in 2020, a conventional truck carrying 35 tonnes emits ~0.1 kg/tonne-km of CO₂. The average cost of CO₂ per tonne-km is ~RS. 6.7/kg. The same may be used to estimate the reduction in CO₂ emissions in the region.

Sources for Calculation: Rodrigue, J. P., & Slack, B. (n.d.). Freight Transportation and Value Chains. Retrieved January 2021, from The Geography of Transport Systems

Improved navigation for coastal shipping

The development of the Kalpasar Dyke would likely provide efficient navigational lights and sound signals for Ro-PAX movements between Ghogha and Hazira during the night. This would lead to increased revenue due to a longer navigation period. The consultant would review the available information to understand the possibility of night navigation for the Ro-PAX movement between Ghogha and Hazira and estimate the additional revenue generated due to the extended service time of the ferries. Quantification of the benefit is possible once the proposed investment (CAPEX and OPEX) and mode (including frequency) of operations are known and it would be limited to the likely impact of incremental coastal shipping due to the proposed development. In case no such information can be made available and no similar projects can be identified, this will have to be classified as a Non Quantifiable Externalities.

Sources for Calculation: Review of available information

Negative Impact on Fauna

The development of the Kalpasar Dyke would likely change the composition of the water and negatively transform the ecosystem. According to the National Oceanic and Atmospheric Administration, rising temperatures in dammed waters limit the ability of species of cold-water fish to inhabit them.

In a similar case, in Columbia, the construction of the Grand Coulee Dam eliminated a fishery worth USD 0.25 million annually. Almost 30-50% of the anadromous fish habitat in the Columbia basin has submerged due to reservoirs and blocked by dams.

Report from GUIDE is proposed to be used as the basis for such calculations. As on date, the latest estimates have not been received yet.

Sources for Calculation: Secondary Research

c. Shadow Price Approach: Indicative Methodology pertinent to the Kalpasar Project

The key concept is the use of shadow prices to reflect the social opportunity cost of goods and services, instead of prices observed in the market, which may be distorted. Sources of market distortions are manifold.

Non-efficient markets where the public sector and/or operators exercise their power (e.g., subsidies for energy generation from renewable sources, prices including a mark-up over the marginal cost in the case of monopoly, etc.).

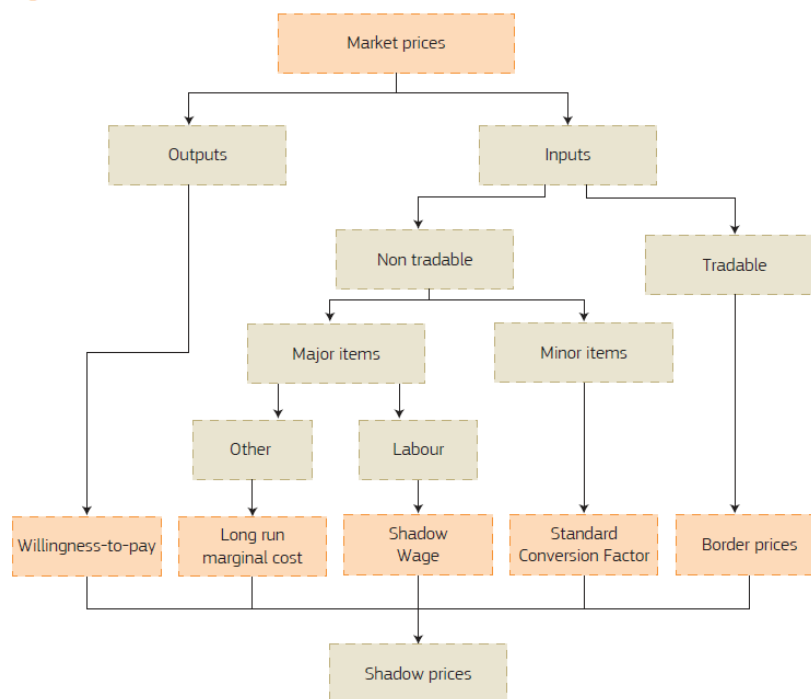
Administered tariffs for utilities may fail to reflect the opportunity cost of inputs due to affordability and equity reasons.

Some prices include fiscal requirements (e.g. duties on import, excises, VAT and other indirect taxes, income taxation on wages, etc.).

For some effects, no market (and prices) are available (e.g. reduction of air pollution, time savings).

In such cases, the standard approach to economic analysis is the conversion from market prices to shadow prices. A simplified operational approach for the estimation of the shadow prices is presented in the schematic below:

Figure 32.3: Estimation of Shadow Prices



Source: Guide to Cost-Benefit Analysis of Investment Projects (Economic appraisal tool for Cohesion Policy 2014-2020; adapted from Saerback (1990).

The approach can be adapted in the Kalpasar project as discussed in the subsequent section.

Shadow Cost Factor Estimation

In order to estimate the economic benefits of the Kalpasar Dyke, the actual financial value of construction and operational costs would be estimated including the Shadow Cost Factor. The Shadow Prices are adjusted financial prices, which discount the effects of government taxation and subsidies, the opportunity cost of resources, environmental externalities, and market distortions.

The Shadow Exchange Rate Factor determines the domestic currency value converted at the official exchange rate, and as per the Asian Development Bank’s (ADB) guidelines, it is determined as per the formula below.

$$\text{SERF} = \text{RER} / \text{OER} * (1 + T - S)$$

Where, SERF = Shadow Cost Factor

RER = Long-run Real Exchange Rate for the economy

OER = Original Exchange Rate (Actual) of the economy

T = Average rate of tax on infrastructure investment, and

S = Average rate of subsidy on infrastructure investment

Shadow Wage Rate Factor (SWRF) determines the opportunity cost of labour. For skilled labour, SWRF is considered equal to 1, whereas, for unskilled labour, SWRF varies between 0-0.75 implying a loss of output.

The relevant shadow factors for the economic assessment of Kalpasar Dyke would be derived using the ADB or similar Guidelines.

32.7.7 Methodology for Identifying Non-Quantifiable Externalities

Large infrastructure projects generally have numerous benefits, both direct and indirect. That apart, some of these direct / indirect projects can be quantified and others cannot, or, are not quantified.

Generally, quantifiable benefits are those where:

- Investments are required to be made to reap the eventual benefits
- The benefits, so identified, can be quantified in terms of market estimates, or close economic approximations and the net of benefits less the required investments are considered for economic analysis.

For the other benefits, it might be challenging to quantify the financial value. These are considered as externalities that can create both positive benefits as well as have negative consequences. Cost-effectiveness analysis should be used in these situations. It is also likely that some benefits, especially external consequences, may not be measurable outside of the social sectors. Where such effects are significant but impossible to quantify, they should be noted and a qualitative explanation offered.

In so far as the Kalpasar Project is concerned, preliminary analysis outlines the following as externalities that are unlikely to be quantified:

a) Projects under the Conceptual Structure Planning of Kalpasar Project

A Conceptual Structure Plan For Gulf of Khambhat Development Project has been submitted by the CEPT University in 2019.

- The proposed Structure Plan for Kalpasar Region has the following objectives
- (1) To delineate the area under the influence of Kalpasar Project for the purpose of the comprehensive development
 - (2) About 122386 ha (public land between 5-6 and 6-7 contour intervals) of area is likely to be created through the Kalpasar Project, by stabilizing the difference between high and low tide. Suitable utilisation of these new/reclaimed/created lands is crucial.
 - (3) To induce optimum development for the improvement of regional economy as well as environmental protection
 - (4) Region as a Global Hub of Eco Centric development
 - (5) To create balanced physical and social infrastructure for sustainable development
 - (6) Capitalise on the proposed investments in the study area, through the development of suitable forward and backward linkages
 - (7) To enhance the infrastructure facilities for better connectivity of the region in order to achieve faster growth of the study area
 - (8) Propose for an institutional structure and legal backing for the Structure Plan
 - (9) The concept development bases on structuring growth, linking the growth centres, economic development and environmental protection. A detailed analysis of existing trends of growth, infrastructure levels, development hotspots, environmental hotspots were used to understand and design the future growth trends in the region.
 - (10) Lakefront zone detailing
 - (11) Health city
 - (12) Waterfront real estate
 - (13) Logistic hub
 - (14) Education city
 - (15) Green energy research and development center
 - (16) Riverfront and tourism development
 - (17) Ghogha port redevelopment

We understand that, while these are part of the overall development plans, these projects would entail CAPEX for each of the sub components mentioned above. Therefore, considering economic benefits accruing due to these projects would not be a true and fair representation of quantifiable benefits. Much of the benefits may eventually have to be classified as non-quantifiable externalities.

b) Impact on Social & Cultural Practices

It's possible that social and cultural behaviours in some of the villages in the Bhavnagar district won't alter significantly. However, due to changes in road connectivity and future industrialisation, a significant influx of migrant workers may occur in the villages. Barwada Mosque, Jain Derasars in Ghogha, and Nishkalank Mahadev in Koliyad, among others, could be impacted. A significant part in the social and cultural lives of the villagers is represented by the numerous temples and ashrams found in some villages of the Bhavnagar district. These religious sites are not anticipated to be negatively impacted by the project.

The Barwada Mosque, a mosque built in the seventh century, is in poor shape. The Mosque may need protection measures in the unlikely event of seawater intrusion to preserve this important historical relic. Similar to this, the neighbouring villagers have religious significance for the Nishkalank Mahadev temple, which is submerged in the water near Koliyad beach. To prevent full submersion, the place that is submerged during high tide may need protection.

Similar to this, there are numerous ashrams and temples situated along the Narmada River in the villages on the Bharuch side. The majority of these temples and ashrams are part of the Narmada Parikrama, an annual pilgrimage that includes Ambetha, Jageswar, Luvara, and Vamleswar. The Narmada River's diversion may have an impact on Narmada Parikrama. Religious and cultural customs may shift in the nearby villages of Ambetha and Vamleswar, which are strongly linked to the Parikrama. Depending on how much of an impact these proposed changes would have on religious monuments and cultural customs, alternative alternatives might be taken into consideration.

c) Impact on Water Bodies

From the initial analysis, it is expected that there would be certain unquantifiable externalities arising out of the following:

- (1) River Boundaries will change, presently rivers in catchment area are not perennial rivers.
- (2) High Tide Lines and Low Tide Lines (HTL & LTL) will change, the demarcation of CRZ Boundaries and permissible activities under various CRZ Zones requires to be confirmed by GCZMA.
- (3) Red and Blue Line demarcation of Rivers in catchment area required to be redefined.
- (4) Total Water disposal through rivers in catchment area (including monthly pattern thereof) is required to be estimated.
- (5) Total Sewage Generation in Catchment area, Quantity of Treated Sewage (with quality of Treated Sewage) and Quantity of untreated Sewage disposal in catchment area is required to be compiled. Presently all treated and untreated Sewage leading to Bay of Khambhat/Cambay get diluted through Esturine / Marine Disposal system, after the project becomes operational the treated/untreated sewage will get dissipated in the reservoir.
- (6) Total Trade Effluent (Industrial Wastewater) Generation in Catchment area, Quantity of Treated Effluent (with quality of Treated Effluent) and Quantity of untreated Effluent, if any and its disposal in the catchment area is required to be compiled.
- (7) This aspect is also required to be looked into in the context of Final Orders passed by Hon'ble NGT in the case of 673/2018 (AKA Polluted Rivers of India).

d) Impact on Institutions & Sociology

- (1) **CSMCRI:** A CSIR Institute having excellent infrastructure, research capabilities and Naval Vessels might become irrelevant on implementation of the proposed project. Its relocation is required to be looked into. Details on similar institutions working on marine and other research and the impact of the proposed project is required to be assessed.
- (2) **Businesses:** Dahej and Vadodara, two of the biggest Industrial hubs of Gujarat thrives on Chlor-Alkali Production by Industries such as GACL (GoG PSU), Reliance, Nirma etc. are dependent on Salt production from the coastal region spread from north of Dahej to Bhavnagar. The industries producing Chlor-Alkali Products, which are essential for Chemicals and other industries, might face short supplies and find challenges to continue their industrial production activities (contributing substantially to GDP).

Note:

- There are no wildlife sanctuaries or national parks in 15 km radius as listed in wildlife protection act (WPA) of India. Blackbuck National Park is located at 37.7 km from the dyke alignment. Also, the proposed project site does not involve any forest land.
- Mangroves are falling within the dyke corridor. Exact no. of trees and girth details are currently not available; it is expected that details would be available in the EIA study.
- The project falls in CRZ area, CRZ map will be prepared by one of the authorised agencies and details will be furnished in EIA report.

32.8 Project Related Assumptions

32.8.1 Dyke Project related Assumptions

Table 32.9 : Dyke Project Capex Phasing Related Assumptions

Year	2023	2024	2025	2026	2027	2028	Total
% Phasing	17.60%	25.40%	23.23%	15.11%	10.12%	8.53%	100.00%
Annual Phasing (Rs Crore)	13,976	20,170	18,448	12,000	8,036	6,775	79,405
Scenario 1 (5% cost escalation)	14,675	21,178	19,370	12,600	8,438	7,114	83,375
Scenario 2 (10% cost escalation)	15,408	22,237	20,339	13,231	8,860	7,469	87,544

The Dyke project cost (including Dyke and Floor regulator) phasing is provided over a period of 6-years (2023-2028). In addition to the base case scenario, two scenarios have been considered: (a) Scenario-1 with 5% cost escalation and (b) Scenario-2 with 10% cost escalation. Cost phasing remains the same as provided by the authorities.

Table 32.10: Dyke Project Financing Related Assumptions

Financing Assumptions	Value	Unit
Debt to Equity	70 : 30	%
Repayment Period		
Door-to-Door tenor	20	Years
Moratorium Period	5	Years
All-in-cost	4	%

The project is considered to be 70:30 Debt to Equity Financed, which is aligned to comparable large infrastructure projects (details provided Separately in Annexure A). Customarily such projects are funded at D:E ratio of 70:30 to 80:20. The debt funding is proposed to be availed for a door-to-door tenor of 20 years comprising 5 years of moratorium with a mix of loans from multilaterals, scheduled commercial banks, and other infrastructure financiers at an all in cost of 4.00%.

Table 32.11: Other Capex Costs

Year	2022	2023	2024	Total
One-time Rehabilitation and Resettlement costs (%)			5%	5%
One-time Preliminary and Pre-operative expenses (Rs crore)	246	63	41	350

These assumptions are taken from comparable Dam projects in India (Daudhan Dam) and other countries (e.g Niger from Africa and Lesotho from South Africa)

Due to the development of project, mangroves will no longer exist near freshwater reservoir. MoEFCC at their discretion, may impose condition in Environment Clearance for compensatory mangrove plantation in the tune of 200% to 500% of present mangrove area. The cost of new mangrove plantation and maintenance for 8 to 10 years requires to be considered.

Usually, MoEFCC mandates project proponents to allocate 2% of Project Cost towards Environment Preservation etc over the span of the project. Depending on the impacts, MoEFCC may impose conditions for additional Environmental Compensation Cost in Environment Clearance. The exact financial implications of all such cost can become clear once the EC is obtained from MoEFCC.

MoEFCC, in CRZ Clearance, may impose additional conditions impacting on various components of project. Such costs are also required to be considered for overall cost benefit

analysis. Exact conditions related to such standard and extra-ordinary costs can become clear only after receiving CRZ Clearance.

There will be collateral cost to GoG for developing / upgrading infrastructure of Industrial wastewater treatment and disposal and Sewage Treatment and disposal in the catchment area of reservoir. Since a lot of Nagarpalikas, Villages etc are yet to have STPs, and also present infrastructure might require substantial upgradation, this substantial cost had also required to be considered, since the water quality in reservoir requires to be maintained as “irrigation water”. This cost will not be borne by the project / project proponent, but it will become a major and substantial cost head for GoG.

Table 32.12: Dyke Project Opex Related Assumptions

Opex Assumption								
Percentage of Capex: 1.00%								
Escalation Rate (Per annum): 5.00%								
Year (Rs crore)	2029	2030	2031	---	---	2057	2058	2059
Annual Phasing	794	834	875	---	---	3,113	3,268	3,432
Scenario 1 (5% cost escalation)	834	875	919	---	---	3,268	3,432	3,603
Scenario 2 (10% cost escalation)	875	919	965	---	---	3,432	3,603	3,784

The opex related assumptions are taken from comparable DAM projects in India (Daudhan DAM) and other countries (e.g., Niger from Africa and Lesotho from South Africa). The projections consider 1.00% annual Opex (of total Capex) and escalation of 5% per annum. Two scenarios are considered in annual projections: (a) Scenario-1 with 5% cost escalation and (b) Scenario-2 with 10% cost escalation.

32.8.2 Fresh Water Availability For Various Applications

Table 32.13: Availability of Fresh Water

Application	Rate	Unit	Consum.	Sc-1	Sc-2	Unit	Esc.
Seasonal irrigation	330.93	Rs/Ha	4487490	4986100	5484710	Ha	2.5%
Perennial irrigation	620.49	Rs/Ha	84770	96880	108990	Ha	2.5%
Drinking water	5.05	Rs/1000Ltr	750	800	850	MM^3*10^6	10%
Industrial use	41.77	Rs/1000Ltr	75	80	85	MM^3*10^6	10%

Assumptions related to availability of fresh water are provided by the authorities. These include the type of applications, rate of water, consumption in the respective applications and annual escalation rates for the price in each application. Three scenarios are employed: (a) Base case scenario with 4.5 times seasonal irrigation, 3.5 times perennial irrigation, and 750 MM^3*10^6 drinking water and 75 MM^3*10^6 industrial use water. (b) Base case scenario with 5.0 times seasonal irrigation, 4.0 times perennial irrigation, and 800 MM^3*10^6 drinking water and 80 MM^3*10^6 industrial use water. (c) Base case scenario with 5.5 times seasonal irrigation, 4.5 times perennial irrigation, and 850 MM^3*10^6 drinking water and 85 MM^3*10^6 industrial use water. Based on these assumptions, the following revenue profile is obtained from fresh water availability (as shown in Table 32.16).

Table 32.14: Revenue Profile from Fresh Water Availability

Year (Rs Crore)	2028	2029	2030	2025	-----	2057	2058	2059
Scenario 1					-----			
Seasonal irrigation	148.50	152.22	156.02	159.92	-----	303.90	311.50	319.29
Perennial irrigation	5.26	5.39	5.53	5.66	-----	10.76	11.03	11.31
Drinking water	378.75	416.63	458.29	504.12	-----	6008.15	6608.96	7269.86
Industrial use	313.28	344.60	379.06	416.97	-----	4969.51	5466.46	6013.11
Total	845.79				-----			
Scenario 2					-----			
Seasonal irrigation	165.01	169.13	173.36	177.69	-----	337.67	346.11	354.76
Perennial irrigation	6.01	6.16	6.32	6.47	-----	12.30	12.61	12.92
Drinking water	404.00	444.40	488.84	537.72	-----	6408.69	7049.56	7754.51
Industrial use	334.16	367.58	404.33	444.77	-----	5300.81	5830.89	6413.98
Total	909.18				-----			
Scenario 3					-----			
Seasonal irrigation	181.51	186.04	190.69	195.46	-----	371.43	380.72	390.24
Perennial irrigation	6.76	6.93	7.11	7.28	-----	13.84	14.19	14.54
Drinking water	429.25	472.18	519.39	571.33	-----	6809.23	7490.16	8239.17
Industrial use	355.05	390.55	429.60	472.56	-----	5632.11	6195.32	6814.86
Total	972.56				-----			

32.8.3 Land Reclamation and Development

Table 32.15: Appreciation of Land Rates at Dholera SIR (Residential, Commercial, and Industrial Land)

Land Sale Rate in Dholera SIR (Rs per Sq. Meter)								
	Pre-Development		Post-Development			Escalation Factor		
			Base	Avg.	Max.	Base	Avg.	Max.
Residential	350		4125	4641	5156	10.8	12.3	13.7
Commercial	550		5500	7288	9625	9.0	12.3	16.5
Industrial	480		2750	2979	3163	4.7	5.2	5.6

For computation of escalation factor due to Kalpasar project, historical appreciation in land values are considered from the Dholera SIR region (as provided in the jantri rates). We compute the base (minimum), average, and maximum appreciation and corresponding escalation factors for all the three land types (i.e., Residential, Commercial, and Industrial).

Table 32.16: Reclaimable Land (Pre-Development Jantri Rates)

District	Area Sq. Meters (Lakh)	Average Rate Rs per Sq. Meter	Current Valuation (Rs Crore)
Bhavnagar	3528.2	128.0	4516
Ahmedabad	2033.8	49.0	997
Anand	922.8	213.7	1972
Vadodara	0.6	65.0	0
Bharuch	3349.9	201.3	6742
Total	9835	144.6	14227

The table provides the details regarding reclaimable land with its pre-development jantri rates. In the absence of segment-wise break-up (Industrial, Residential, and Commercial), the following assumptions (Table 32.17) are employed and subsequently these rates are converted into post development rates using escalation factors computed in Table 32.15.

Table 32.17: Reclaimable Land (Conversion to Post-Development Rates)

Type	Respective Shares	Pre-Development Rate	Post Development		
	%	Rs per Sq. Meter	Base	Average	Maximum
Residential	20%	2845	30689	34881	39071
Commercial	40%	5691	51216	69712	93897
Industrial	40%	5691	26912	29631	31809
Total	100%	14227	108818	134225	164776

Using these land rates, along with the assumptions related to land escalation and monetisation, the following cash inflows are projected from land reclamation (Table 32.18). For brevity only base case values (Rs Crore) are provided.

Table 32.18: Value add from land monetisation (Base case)

Year	2028	2029	2030	2031	2057	2058	2059
Value of Land (Rs crore)	108818	104411	100182	96125	77316	77699	78084
Land Value Escalation (1% each year)		1%	1%	1%	1%	1%	1%
Land Monetisation Phasing		5%	5%	5%	0.5%	0.5%	0.5%
Cumulative Phasing		5%	10%	15%	62.0%	62.5%	63.0%
Cash Inflow (Rs crore)		5331	5115	4908	386	388	389
Cumulative Inflow Over Project Life	54875						

32.8.4 Development of Roadways Project

Table 32.19: Assumptions/Estimates for Roadways Project

S. No.	Assumptions/Estimates major head	Assumption/Estimate (Figures in Rs. Unless mentioned otherwise)	Referred source
1	Related to cost structure	Highway Civil Cost 56,60,24,00,121	With reference to cost estimates provided in the Excel file "Inputs for Financial Analysis" (Sheet 1, capital cost summary)
		Road Structural Cost 35,48,78,08,218	
		Intelligent Transport System (ITS) Cost 75,73,60,040	
		Environmental Charges due to Road @ 1% of civil cost - 56,60,24,001	
		Sub-Total - Road 93,41,35,92,380	
		Maintenance cost for Road 28,62,15,91,004	
2	Related to Operation and maintenance cost	Periodic maintenance cost @ 5% every five years	With reference to the construction period provided in the input sheet (Sheet 3, Capex and Opex year-wise)
		Routine maintenance cost @ 1% Yearly	
3	Related to loan repayment and moratorium period	The total door-to-door period (including three years of moratorium period) = 40 years Moratorium period = 8 years	We assume a moratorium period of 8 years from 2024 till the construction period ends.
4	Related to the construction period	Construction period = 6 years	With reference to the construction period provided in the input sheet (Sheet 3, Capex and Opex year-wise)
5	Related to funding pattern	Debt - 60%, Equity - 40%	
6	Related to interest rate	5%	ADB (Annual LIBOR Rate) +
7	Related to toll revenue	Traffic forecast- Given	With reference to the traffic forecast provided in the Excel file "Inputs for Financial Analysis" (Sheet 4, traffic forecast)
		Toll rates - Given	With reference to the toll rates provided in the Excel file "Inputs for Financial Analysis" (Sheet 6, toll rates)
8	Related to depreciation	Economic life - 30 years	With reference to economic life provided in the Excel file "Inputs for Financial Analysis" (Sheet 2, Economic life)
		Dep rate = $100/30 = 3.33\%$	

9	Related to NPV (discount rates)	12%, 10%, 8%	As provided in the "Traffic Assessment Study" by L&T RAMBOL CONSULTING Page no. 114 (Economic Viability Analysis page 5-4)
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Based on these assumptions, the projections are made. For brevity, only toll revenues and O&M cost figures are shown. Three scenarios are considered for projections. **(a) Average Scenario:** Annual O and M cost remains 1% of the total cost of the project, and • Periodic O & M cost remains 5% of the total cost of the project (as provided in the input for financial analysis excel sheet). **(b) Adverse Scenario:** Annual O and M cost increased to 1.5% of the total cost, Periodic O & M cost increased to 6.5% of the total cost. **(c) Favourable Scenario:** Annual O and M cost decreased to 0.5% of the total cost. Periodic O & M cost decreased to 3.5% of the total cost. In addition to this, O&M costs are escalated at 3% on annual basis for all the three scenarios

Table 32.20: Projections for Road Project

Year	2029	2030	2031	.....	2057	2058	2059
Average Scenario (Rs Crore)							
Toll Revenue	2089.2	2305.6	2538.5	.....	17856.2	18975.1	19939.1
Operation and maintenance cost	108.4	111.6	115.0	.....	247.9	1276.8	263.0
Adverse Scenario (Rs Crore)							
Toll Revenue	2089.2	2305.6	2538.5	.....	17856.2	18975.1	19939.1
Operation and maintenance cost	162.5	167.4	172.4	.....	371.9	1659.8	394.5
Favorable Scenario (Rs Crore)							
Toll Revenue	2089.2	2305.6	2538.5	.....	17856.2	18975.1	19939.1
Operation and maintenance cost	54.2	55.8	57.5	.....	124.0	893.7	131.5

32.8.5 Development of Railways Project

Table 32.21: Assumptions/Estimates for Railways Project

S.No.	Assumptions major head	Assumption/Estimate (Figures in Rs. Lakh unless mentioned otherwise)	Referred source
1	Related to cost structure	Railway Civil Cost = 4,424.84 Railway Signaling, telecommunication and Electrification Cost = 1221.68 Railway Mechanical Cost = 1.16 Railway Structural Cost = 1754.87 Environmental Charges due to Rail @ 1% of Civil cost = 44.25	With reference to cost estimates provided in input sheet (Sheet 1, capital cost summary)
2	Related to Financing pattern	Debt - 60%, Equity - 40%	
3	Related to interest rate	Interest Rate = 1.40%	With reference to Bangalore suburban rail project (Page no. 82)
4	Related to loan repayment and moratorium period	Total door to door period (including 10years of moratorium period) = 40 Moratorium period = 10	With reference to Bangalore suburban rail project (Page no. 82)
5	Related to construction period	Construction period = 6 years	With reference to construction period provided in input sheet (sheet 3, capex and opex year wise)
6	Related to Operation and maintenance cost	Opex rate as percentage of total project cost = 2.03% in 2027	With reference to DPR of Silverline project report
		escalation rate for operation and maintenance = 5.5%	With reference to DPR of Silverline project report (page no. 177)
7	Related to passenger trains	Distance = 97.5 km	With reference to concept plan report by L and T infrastructural engineering (page no 87)
		fare per passenger = 2.75	With reference to Silverline project DPR (page no 183)
		Escalation rate on fare = 6%	With reference to Silverline project DPR(page no 183)
		Passenger train per day given	With reference to concept plan report by L and T infrastructural engineering (page no 87)
		Number of increase in train each year	Own assumption
		No of daily passengers per train per day = 1128	With reference to vande bharat semi high speed train circular (page no 2)
		Passenger train capacity	With reference to concept plan report by L and T infrastructural engineering (page no 20)
8	Related to freight trains	Distance = 97.5 km	With reference to concept

	(overall)		plan report by L and T infrastructural engineering (page no 87)
		Freight trains per day	With reference to concept plan report by L and T infrastructural engineering (page no 87)
		Proportion of freight with RORO service to Freight without RORO service 5:5	Own assumption
		Freight trains capacity	With reference to concept plan report by L and T infrastructural engineering (page no 20)
9	Related to FREIGHT TRAINS with RORO	Wagons per train = 60	With reference to concept plan report by L and T infrastructural engineering (page no 20)
		Rate per wagon (Assuming loaded vehicles with rigid body) = 7855	With reference to report RORO charges per wagon from rate circular on RORO operations (page no 5)
10	Related to FREIGHT TRAINS without RORO	Wagons per train = 60	With reference to concept plan report by L and T infrastructural engineering (page no 20)
		Ton capacity per wagon	With reference to Indian railways report on carrying capacity of different types of wagons
		Rate per wagon (per tonn) = 150	With reference to rate circular for different class of commodity, rate is taken as average of high and low (page 3-14)
11	Related to NPV Rates	Rates = 14%,12%, 10%, 8%	With reference to traffic assessment study by L&T - page no. 114 (economic viability analysis page 5-4)

Based on these assumptions, the projections are made. For brevity, only revenues and O&M cost figures are shown. Three scenarios are considered for projections. **(a) Average Scenario:** Proportion of Freight train with RORO to freight train without RORO service: 0.5:0.5 and Operating maintenance cost: 2.65%. Escalation rate for operation and maintenance: 5% (b) **Adverse Scenario:** Proportion of Freight train with RORO to freight train without RORO service: 0.1:0.9. Operating maintenance cost: 2.80%. Escalation rate for operation and maintenance: 5% (c) **Favourable Scenario:** Proportion of Freight train with RORO to freight train without RORO service: 0.9:0.1. Operating maintenance cost: 2.50%. Escalation rate for operation and maintenance: 4%.

Table 32.22: Projections for Railways Project

Year	2029	2030	2031	.....	2057	2058	2059
Average Scenario (Rs crore)							
Fare revenue from passenger traffic	390.9	424.3	460.3	.....	6866.5	8209.8	8807.9
Freight revenue	140.6	151.0	161.5	.....	1021.1	1242.5	1259.0
Operation and maintenance cost	208.4	219.8	231.9	.....	933.0	984.4	1038.5
Adverse Scenario (Rs crore)							
Fare revenue from passenger traffic	390.9	424.3	460.3	.....	6866.5	8209.8	8807.9
Freight revenue	138.0	148.1	158.6	.....	1002.2	1219.4	1235.1
Operation and maintenance cost	220.2	232.3	245.0	.....	985.9	1040.1	1097.3
Favorable Scenario							
Fare revenue from passenger traffic	390.9	424.3	460.3	.....	6866.5	8209.8	8807.9
Freight revenue	143.3	153.9	164.4	.....	1040.0	1265.6	1282.1
Operation and maintenance cost	196.6	204.4	212.6	.....	589.5	613.0	637.6

32.8.6 Development of Wind Project

Table 32.23: Assumptions/Estimates for Wind Project

S.No.	Assumptions major head	Assumption/Estimate	Referred source
1	Related to project cost	7536 Cr	With reference to Cost estimate for Dyke-Transportation-Renewable Energy file (Page no. 2)
2	Related to Project Life	25 years	With reference to CERC RE Tariff Order for FY 2021-22(Page no. 203)
3	Related to capital cost	CAPEX= 467 Rs. Lakh/MW	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
4	Break-up of CAPEX	WEGs= 0.692	Vaayu India Wind Power Project in Gujarat (page-15)
		Concrete Tower= 0.124	
		Distribution Transformer= 0.052	
		Civil Work= 0.0339	
		Erection, Commissioning, Insurance= 0.0339	
		Land And Transportation= 0.025	
		Transfer Of Development Right Charges= 0.036	
5	Related to Financing pattern	Debt - 70% , Equity - 30%	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
6	Related to interest rate	Interest Rate = 8%	With reference to PLR, also varies between 8-12% across projects and 9% with reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
7	Related to loan repayment and moratorium period	Total door to door period (including 3 years of moratorium period) = 15 Moratorium period = 3	10 is normative for power generation Sector India but varies between 10-15
8	Related to Operation and maintenance cost	OPEX = 25.46 lakh/MW/yr.	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
		Escalation rate for operation and maintenance = 5%	3.84% (With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203) 3.84% (NIWE)
9	Related to Tariff	3.55 kWh	GERC has fixed the tariff for the period of 20yrs (lifetime) for the wind power projects; GERC

			Tariff Order/Draft Order no. 2 of 2009
10	Related to PLF base	25.71%	With reference to report of Center for Wind Energy Testing
11	Related to tax rate	33.22%	Indian IT Act for FY11-12 And the report of CERC RE Tariff Order for FY 2021-22(Page no. 203) recommends tax rate of 35%
12	Related to depreciation rate	5.28%	Indian Companies Act; and National institute of wind energy recommends 4.67% as depreciation rate

Table 32.24: Projections for Wind Project

Year	2029	2030	2031	.....	2057	2058	2059
Average Scenario (Rs crore)							
Revenues	1232.3	1232.3	1232.3	.....	1232.3	1232.3	1232.3
Operation and maintenance cost	383.8	387.6	407.0	.....	878.0	904.3	931.5
Adverse Scenario (Rs crore)							
Revenues	1170.4	1170.4	1170.4	.....	1170.4	1170.4	1170.4
Operation and maintenance cost	402.9	415.0	427.4	.....	921.8	949.4	977.9
Favorable Scenario (Rs crore)							
Revenues	1293.6	1293.6	1293.6	.....	1293.6	1293.6	1293.6
Operation and maintenance cost	366.0	377.0	388.3	.....	837.4	862.5	888.4

32.8.7 Development of Solar Project

Table 32.25: Assumptions/Estimates for Solar Project

S.N o.	Assumption major head	Units/ Sub-head	Assumption/Estimate	Referred Source
1	Related to project capacity	MW	1000	With reference to Cost estimate for Dyke-Transportation-Renewable Energy file (Page no. 2)
2	Related to project cost	Creore	7000.00	With reference to Cost estimate for Dyke-Transportation-Renewable Energy file (Page no. 2)
3	Related to Financing pattern	Ratio	Debt - 70%, Equity - 30%	With reference to following projects:CERC RE Tariff Order for FY 2021-22(Page no. 203); Solar Power project in Rajasthan-UNFCCC(Page no. 16)
4	Related to Project Life	years	25	With reference to following projects:CERC RE Tariff Order for FY 2021-22(Page no. 203); Solar Power project in Rajasthan-UNFCCC(Page no. 16)
5	Related to PLF base	%	18.6	With reference to following projects:Solar Power project in Rajasthan 2012-UNFCCC(Page no. 16); Mithapur Solar Power Project 2012-UNFCCC(Page no. 17)
6	Related to tax rate	%	0.35	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
7	Related to depreciation rate	Depreciation Rate(Power Plant)%	4.67	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203) and With reference to Kalpasar PPT wind solar hybrid NIWE_26th Aug 2022_01 ppt(Slide no 14)
8		Depreciation Rate 16th year onwards(%)	2	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
9	Related to Interest rate	%	9	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203)
10	Related to loan repayment and moratorium period	Related to Moratorium(years)	5	With reference to the project IBRD_INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY LIMITED(Page no. 20)
11		Related to Tenor(years)	15	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203) and With reference to Kalpasar PPT wind solar hybrid NIWE_26th Aug 2022_01 ppt(Slide no 14)
12		Total Door-to-Door(years)	20	Moratorium + Tenor
13	Related to Capital cost	CRORE	4670	With reference to the report of CERC RE Tariff Order for FY

				2021-22(Page no. 203)	
14	Related to Operation and maintenance cost	Escalation(OPE X)%	3.84	With reference to the report of CERC RE Tariff Order for FY 2021-22(Page no. 203) and With reference to Kalpasar PPT wind solar hybrid NIWE_26th Aug 2022_01 ppt(Slide no 14)	
15		Plant In-charge(% of total OPEX)	0.1008	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
16		Electrical Engineers(% of total OPEX)	0.2376	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
17		Electricians(% of total OPEX)	0.084	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
18		House keeping Boys (% of total OPEX)	0.192	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
19		Security Guards(% of total OPEX)	0.192	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
20		Maintenance of Green area(% of total OPEX)	0.072	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
21		Plant transport vehicle(% of total OPEX)	0.072	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
22		Misc Maint expense and other related to maintain the plant(% of total OPEX)	0.06	With reference to 5129 IRR & CER Calculations_5129 Rajasthan UNFCCC PROJECT	
23		Related to Tariff rate	Rs/kWh.	3.63	With reference to Kalpasar PPT wind solar hybrid NIWE_26th Aug 2022_01 ppt(Slide no 14)

Table 32.26: Projections for Solar Project

Year	2029	2030	2031	.....	2057	2058	2059
Average Scenario (Rs Crore)							
Revenues	593.1	593.1	593.1	.....	593.1	593.1	593.1
Operation and maintenance cost	257.2	259.8	262.4	.....	339.9	343.3	346.7
Adverse Scenario (Rs crore)							
Revenues	545.3	545.3	545.3	.....	545.3	545.3	545.3
Operation and maintenance cost	270.1	272.8	275.5	.....	356.9	360.5	364.1
Favorable Scenario (Rs crore)							
Revenues	602.7	602.7	602.7	.....	602.7	602.7	602.7
Operation and maintenance cost	244.4	246.8	249.3	.....	322.9	326.1	329.4

32.8.8 Benefits to Fisheries due to Kalpasar DAM

Table 32.27: Augmentation in Fisheries due to Kalpasar DAM

	Value	Unit	Price	Unit
Base Case	20000	Tonne	75000	Rs /Tonne
Scenario -1	15000	Tonne	60000	Rs /Tonne
Scenario-2	25000	Tonne	90000	Rs /Tonne
Price Escalation	3%	Per Year		

The potential for fisheries due to Kalpasar project is projected using data provided by conceptual structural plan report by CEPT university. & 2) and are considered as provided in Table 32.27. Price escalation of 3% per year is considered which is customary and aligned to the average inflation rates (2%-4% as per the inflation targeting policy of RBI). These assumptions coupled with the phasing of fishery development (as shown in Table 32.28) the following projections are made regarding revenues from Fisheries.

Table 32.28: Revenue projections from Fishery Development

Year	2029	2030	2031	-	2057	2058	2059
Base Case (Rs crore)				-			
Phasing of Fishery Development	15%	20%	20%	-	0%	0%	0%
Cumulative Development	15%	35%	55%	-	100%	100%	100%
Value of Fisheries	23.18	55.70	90.15	-	353.48	364.09	375.01
Scenario-1 (Rs crore)				-			
Phasing of Fishery Development	15%	20%	20%	-	0%	0%	0%
Cumulative Development	15%	35%	55%	-	100%	100%	100%
Value of Fisheries	13.91	33.42	54.09	-	212.09	218.45	225.01
Scenario-2 (Rs crore)				-			
Phasing of Fishery Development	15%	20%	20%	-	0%	0%	0%
Cumulative Development	15%	35%	55%	-	100%	100%	100%
Value of Fisheries	34.76	83.55	135.22	-	530.23	546.13	562.52

32.8.9 Employment Generation from Agricultural, Industrial, Tourism, Special Investment Region (SIR), and Urban development

Table 32.29: Employment potential with agriculture

Agricultural Employment	Value	Unit
Agriculture under agriculture as per CEPT	3066.06	sq.km
Total Workforce Dependent on Agriculture	3.2	Lakh
Dependents Per Job	2	Lakh
Workforce Participation	1.6	Lakh
Man Land Ratio for Direct Jobs (CEPT Report)	1.377	Ha per person
Total Direct Job Opportunities	4.22	Lakh
Incremental Direct Job Opportunities (by 2030)	2.62	Lakh
Indirect Jobs in Agriculture (@30% of Direct Jobs)	0.79	30%
Total Agricultural Jobs	3.41	Lakh
Average daily wage rate (RBI)(250* *20 Days a month*12)	60000	Rs per person per annum
Maximum average daily wage rate (RBI)(300* *20 Days a month*12)	72000	Rs per person per annum
Escalation in wages	1%	Per Annum

Based on the assumption provided in the conceptual structural plan report (by CEPT University), we project the employment potential due to increase in agricultural activity. In addition to these assumptions, we make the assumptions related to phasing of employment generation (provided in Table 32.30) to compute the projections. Two scenarios are considered: (a) Base case scenario with Rs 250 daily wages, and (b) Rs 300 daily wages.

Table 32.30: Revenue projections from Agricultural Employment

Year	2029	2030	2031	2057	2058	2059
Phasing of Jobs	5%	5%	5%	0%	0%	0%
Cumulative phasing	5%	10%	15%	100%	100%	100%
Base Case (Rs crore): Rs 250 Daily wage	103	209	316	2,729	2,757	2,784
Scenario 1 (Rs crore): Rs 300 Daily age	124	250	379	3,275	3,308	3,341

* For economic benefits from increase in Agro GDP accruing due to availability of irrigation water, please refer to estimations as mentioned in the relevant Section

Table 32.31: Employment potential with Industrial activity

Industry Related Job Creation (Urbanisation Zone 3)	Value	Unit
Industrial area to be created as per CEPT	615	sq.km
Jobs per unit area	500	Jobs per Sq. Km
Total Number of Direct Jobs	307500	
Indirect Jobs	61,500	20%
Total Industrial Jobs	3.69	Lakh
Salary (@10000 per month)	120000	Rs per person per annum
Salary (@15000 per month)	180000	Rs per person per annum

Industry Related Job Creation (Urbanisation Zone 3)	Value	Unit
Escalation in Salary	1%	Per Annum

Based on the assumption provided in the conceptual structural plan report (by CEPT University), we project the employment potential due to increase in industrial activity. In addition to these assumptions, we make the assumptions related to phasing of employment generation (provided in Table 32.32) to compute the projections. Two scenarios are considered: (a) Base case scenario with Rs 10000 per month salary, and (b) Rs 15000 per month salary.

Table 32.32: Revenue projections from Industrial Employment

Year	2029	2030	2031	2057	2058	2059
Phasing of Jobs	5%	5%	5%	0%	0%	0%
Cumulative phasing	5%	10%	15%	100%	100%	100%
Base Case (Rs crore): (@ Rs 10000 per month)	224	452	684	5,909	5,968	6,028
Scenario 1 (Rs crore): (@ Rs 15000 per month)	335	678	1,026	8,864	8,952	9,042

Table 32.33: Employment potential with Tourism activity

Tourism Related Job Creation	Value	Unit
Tourism area to be created as per CEPT	235	sq.km
Jobs per unit area	200	Jobs per Sq. Km
Total Number of Direct Jobs	47000	
Indirect Jobs	32,900	70%
Total Jobs	0.80	Lakh
Salary (@5000 per month)	60000	Rs per person per annum
Salary (@10000 per month)	120000	Rs per person per annum
Escalation in Salary	1%	Per Annum

Based on the assumption provided in the conceptual structural plan report (by CEPT University), we project the employment potential due to increase in tourism activity. In addition to these assumptions, we make the assumptions related to phasing of employment generation (provided in Table 32.33) to compute the projections. Two scenarios are considered: (a) Base case scenario with Rs 5000 per month salary, and (b) Rs 10000 per month salary.

Table 32.34: Revenue projections from Tourism Related Employment

Year	2029	2030	2031	2057	2058	2059
Phasing of Jobs	5%	5%	5%	0%	0%	0%
Cumulative phasing	5%	10%	15%	100%	100%	100%
Base Case (Rs crore): (@ Rs 5000 per month)	24	49	74	640	646	653
Scenario 1 (Rs crore): (@ Rs 10000 per month)	48	98	148	1,280	1,292	1,305

* For economic benefits from tourism activity, please refer to comparable and estimations as mentioned in the relevant Section

Table 32.35: Employment potential with Urbanisation

Urbanisation Related Job Creation	Value	Unit
Urban area to be created as per CEPT	690	sq.km
Jobs per unit area	1200	Jobs per Sq. Km
Total Number of Direct Jobs	828000	
Indirect Jobs due to urban agglomeration	99,360	12%
Total Jobs	9.27	Lakh
Salary (@5000 per month)	60000	Rs per person per annum
Salary (@10000 per month)	120000	Rs per person per annum
Escalation in Salary	1%	Per Annum

Based on the assumption provided in the conceptual structural plan report (by CEPT University), we project the employment potential due to urbanisation driven by Kalpasar project development. In addition to these assumptions, we make the assumptions related to phasing of employment generation (provided in Table 32.35) to compute the projections. Two scenarios are considered: (a) Base case scenario with Rs 5000 per month salary, and (b) Rs 10000 per month salary.

Table 32.36: Revenue projections from Urbanisation related Employment

Year	2029	2030	2031	2057	2058	2059
Phasing of Jobs	5%	5%	5%	0%	0%	0%
Cumulative phasing	5%	10%	15%	100%	100%	100%
Base Case (Rs crore): (@ Rs 5000 per month)	281	568	860	7,425	7,500	7,575
Scenario 1 (Rs crore): (@ Rs 10000 per month)	562	1,135	1,720	14,851	14,999	15,149

Table 32.37: Employment potential with SIR (Dholera and Dahej)

SIR Related Job Creation	Value	Unit
Total SIR Jobs	14.35	Lakh
Salary (@5000 per month)	60000	Rs per person per annum
Salary (@10000 per month)	120000	Rs per person per annum
Escalation in Salary	1%	Per Annum

Based on the assumption provided in the conceptual structural plan report (by CEPT University), we project the employment potential due to development of SIRs driven by Kalpasar project development. In addition to these assumptions, we make the assumptions related to phasing of employment generation (provided in Table 32.38) to compute the projections. Two scenarios are considered: (a) Base case scenario with Rs 5000 per month salary, and (b) Rs 10000 per month salary.

Table 32.38: Revenue projections from SIR related Employment

Year	2029	2030	2031	2057	2058	2059
Phasing of Jobs	5%	5%	5%	0%	0%	0%
Cumulative phasing	5%	10%	15%	100%	100%	100%
Base Case (Rs crore): (@ Rs 5000 per month)	435	879	1,331	11,493	11,608	11,724
Scenario 1 (Rs crore): (@ Rs 10000 per month)	870	1,757	2,662	22,986	23,216	23,448

Based on these individual components of employment generation, the overall employment generation potential due to Kalpasar project is provided below (for both the scenarios: (a) Base case and (b) Scenario 1).

Table 32.39: Aggregate Revenue projections from Kalpasar Project related Employment Generation

Year	2029	2030	2031	2057	2058	2059
Base Case	1,067	2,155	3,265	28,197	28,479	28,763
Scenario 1	1,940	3,918	5,936	51,255	51,768	52,286

32.9 Secondary Data Points

Table 32.40: Secondary Data points to be employed for Financial Modelling

Information taken from secondary sources					
1. Roadways					
S. No.	Assumptions major head			Referred sources	
1	Related to funding pattern (Debt-Equity ratio)			ADB report (Tamil Nadu Industrial Connectivity Project) - (Project Number: 51337-001, March 2021)	
2	Related to interest rate			ADB report (Tamil Nadu Industrial Connectivity Project) - (Project Number: 51337-001, March 2021)	
3	Related to loan repayment and moratorium period			Bangalore suburban railway DPR	
2. Railways					
S.No.	Information			Source	
1	Opex rate as a percentage of total project cost, escalation rate for operation and maintenance, fare per passenger, and Escalation rate on fare			Silverline railway DPR	
2	Debt - Equity Ratio, Interest Rate The total door-to-door period, and Moratorium period			Bangalore suburban railway DPR	
3	No of daily passengers per train per day			Vande Bharat semi-high-speed train circular	
4	Rate per wagon (Assuming loaded vehicles with the rigid body)			Report RORO charges per wagon from the rate circular on RORO operations	
5	Ton capacity per wagon for freight trains without RORO			Indian railways report on the carrying capacity of different types of wagons	
6	Rate per wagon (per ton) for freight trains without RORO			Rate circular for different classes of commodity, the rate is taken as the average of high and low	
3. Wind Project					
S.no.	Referred Source	Name of public source	Details	Particulars	

1	CERC RE Tariff Order for FY 2021-22	CERC	Life of the project	25 years
			CPEX	467 lakh/MW
			OPEX	25.46 lakh/MW/yr.
			Escalation OPEX	3.84%
			Financing pattern	Debt - 70%, Equity - 30%
			Interest rate	0.09
2	NIWE(National Institute of Wind Energy)	Kalapsar PPT solar_wind hybrid NIWE	Tariff	3.63 Rs/kWh
			Depreciation rate	4.67%
3	CWET(Center for Wind Energy Testing)	CWET	PLF base	25.71%
4	Indian IT Act for FY11-12	IT act	Tax rate	33.22%

4. Dyke Project

S.no.	Referred Source	Name of public source
1	Cost of capital/WACC	Daudhan dam Appraisal Report
2	Annual O&M Charges	Daudhan dam
3	Escalation cost	Ken Dam
4	Land rehabilitation and resettlement	Gonda Dam

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