Hochschule Flensburg
University of Applied Sciences

Wind Energy Technology Institute

Team 3: Wind Farm Project in Gujarat, India

Wind Farm Project Development, WiSe 2024/25

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Agenda

1 Introduction

2 Legal Framework

3 Wind Farm Development

4 Transportation

5 Environmental Impact and Conflicts

6 Land Leasing

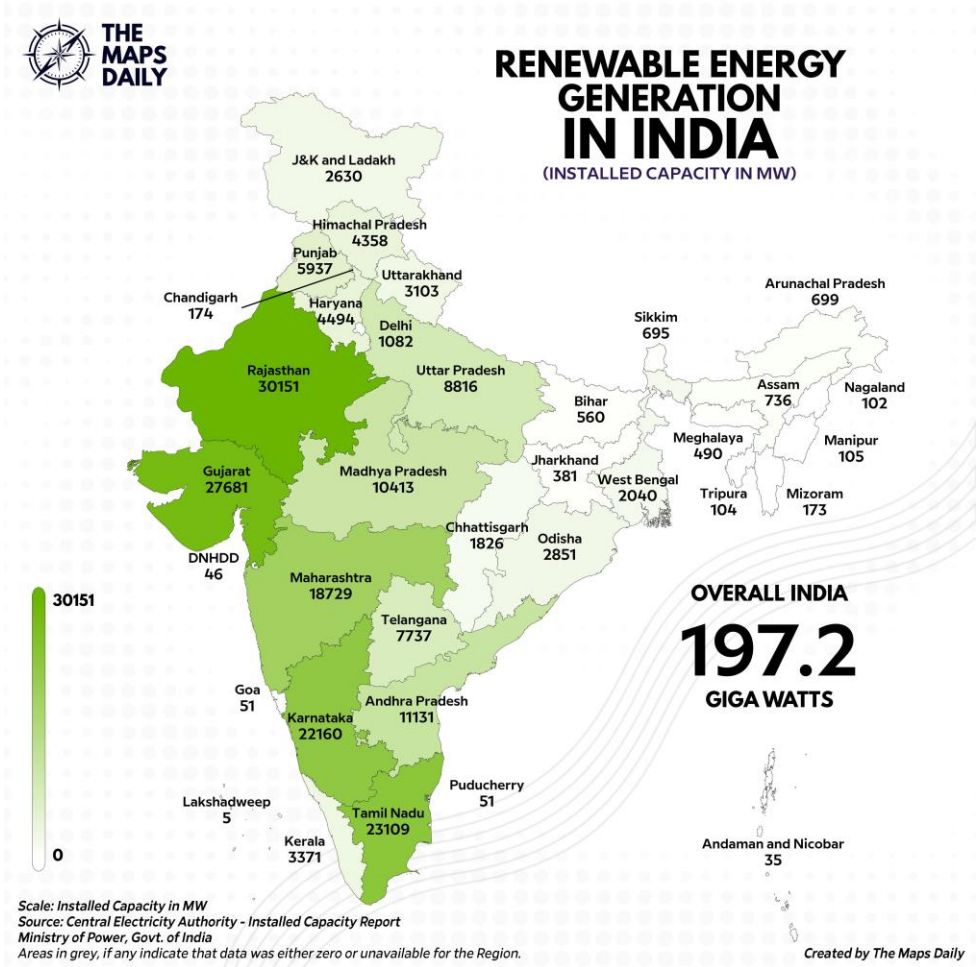
7 Economic Analysis

8 Barrier and Obstacles

9 Project Timeline

10 Future Strategies

1. Introduction



India:

- India ranks **fourth** in terms of installed wind power capacity
- High Wind potential **695 GW** with minimum **32%** CUF(at 130 M HH)
- Ambitious Target(Wind) : **140 GW** by **2030** (**48 GW** Current)
- Energy Security

Figure 1.1: Information of renewable energy generation in India [38]

1. Introduction

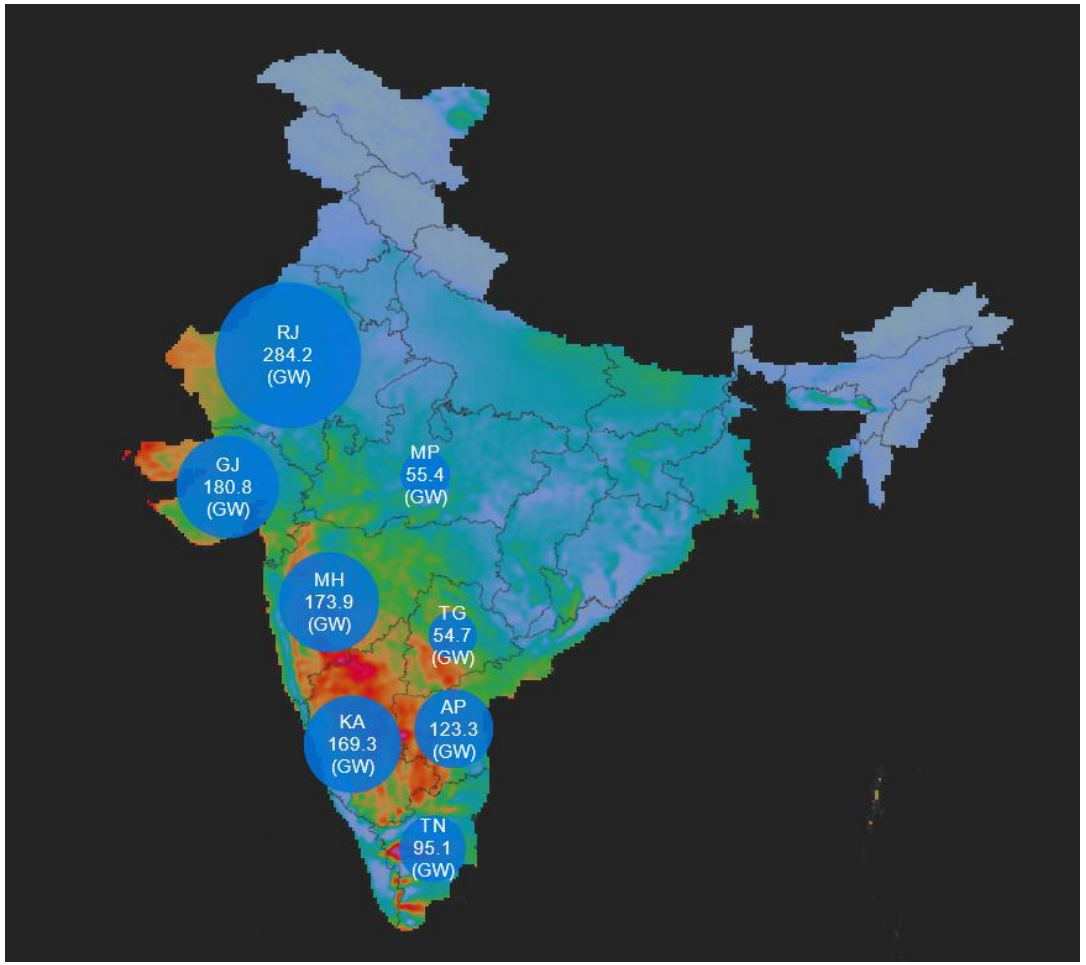


Figure 1.2: Information of capacity wind potential in India [39]

Gujarat:

- As **May 2024**, makes it the **leading state in India** for wind energy.
- **12.2 GW** installed wind power capacity (**26%** Of total capacity)
- Second rank, Tamil Nadu **11 GW**

Why?

- Geographic advantages
- Government supports
- Land policy
- Tax benefits(First **10 Years** no taxes)

2. Legal Framework

Gov. Body

- Ministry of New and Renewables (MNRE)

Central Agencies

- National Institute of Wind Energy(NIWE)
- Ministry for Environment, forest and Climate change(MoEFCC)
- Ministry of Defence (MoD)
- Directorate General of Civil Aviation

State Agencies

- Gujarat Energy Development Agency(GEDA)
- Gujarat Power Corporation Limited (GPCL)
- Gujarat Pollution Control Board(GPCB)
- Revenue Department and Local Panchayat

2. Legal Framework

1. Consent to Establish from GSPCB
2. NOC from State Electricity board
3. Land Allotment letter
4. NOC from DLIR Department
5. Permission for Forest Department
6. NOC from Mining Department
7. NOC from AAI and MoD
8. Power Purchase Agreement
9. NOC from Village Panchayat

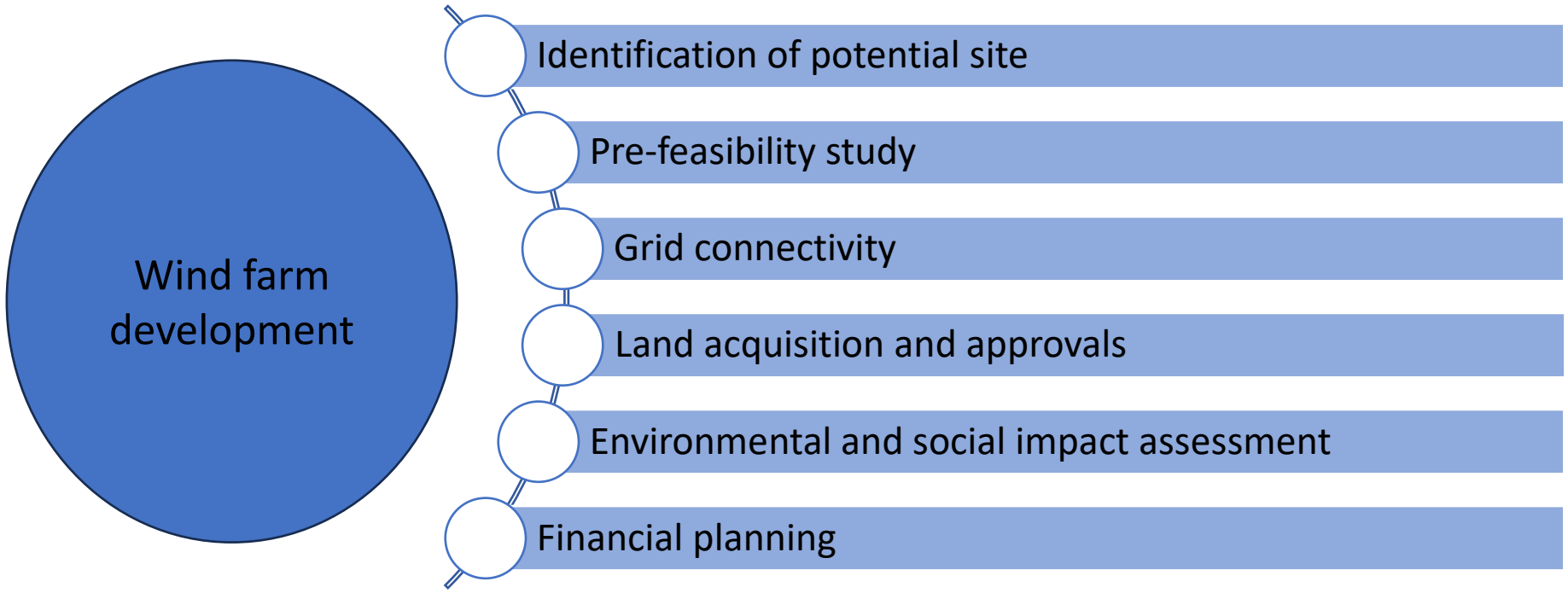
Permits and approvals:

Micro siting guidelines:

Criteria	Buffer Distance
Micro siting within Wind Farm	3D-2D
Public Roads, railway tracks, highways, buildings, public institutions	HH+0.5·RD+5m
Eco-Sensitives Zones	10 KM
Forest	6.6 M from Ground (Power Lines)
Satic Air Defence Radar	10 KM
Airports and Airstrips	20 KM
Rivers	250 M

Table 2.1: Information of micro siting guidelines [7]

3. Wind Farm Development



Identification of Potential Sites (QGIS)

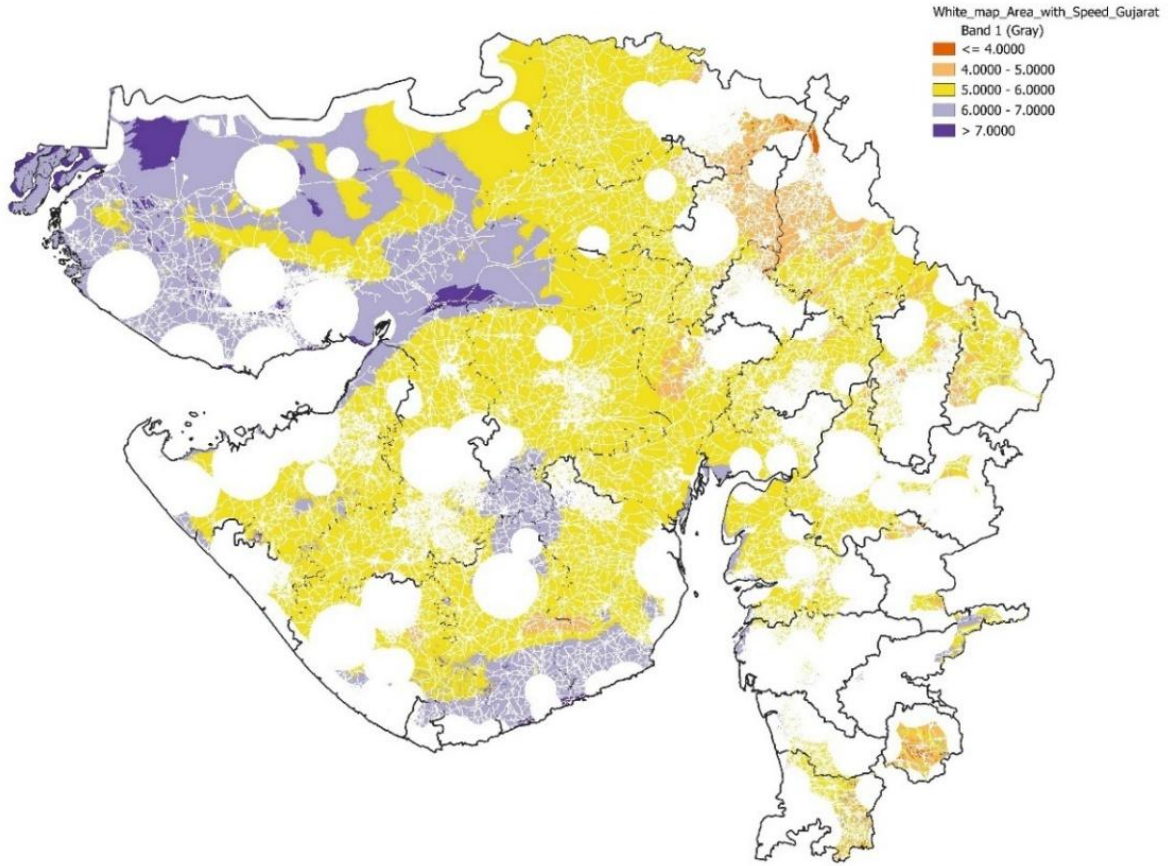


Figure 3.1: White map area **[own]**

Analyse Wind site:

- Wind speed data at **100m height**
- Coordinate Reference System: **WGS 84/ UTM zone 43N**, Authority ID: **EPSG:32643**

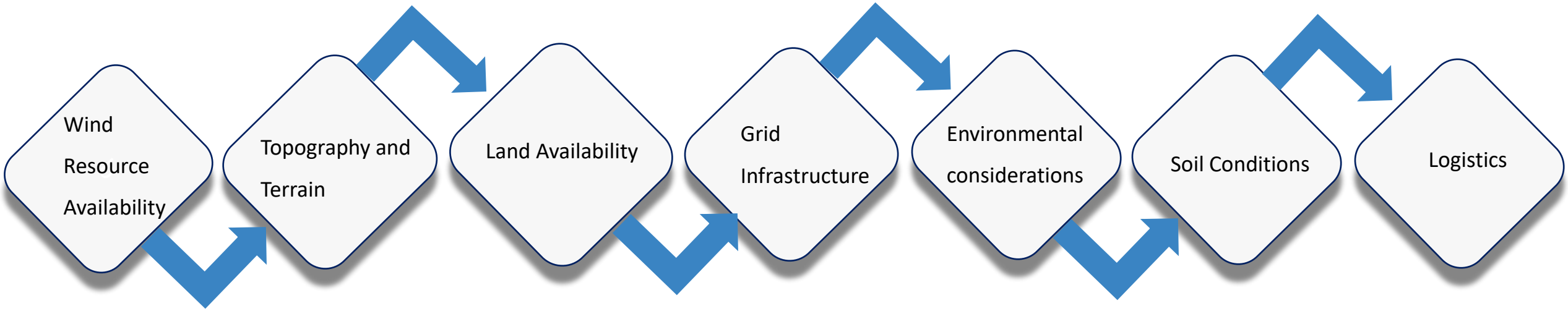
GIS Layers	Distances [m]
Buildings	250
Forests	10,000
Military Areas	10,000
Railways/ Industrial	250
Roads	250
Airports/ Airfields	20,000
Rivers	250

Table 3.1: GIS layers information **[own]**

- **Integrated** wind speed data onto the white map layer [Use the clip Raster by Mask Layer Tool]

Pre-Feasibility study

Criteria For site selection



3. Wind Farm development

Selection of site

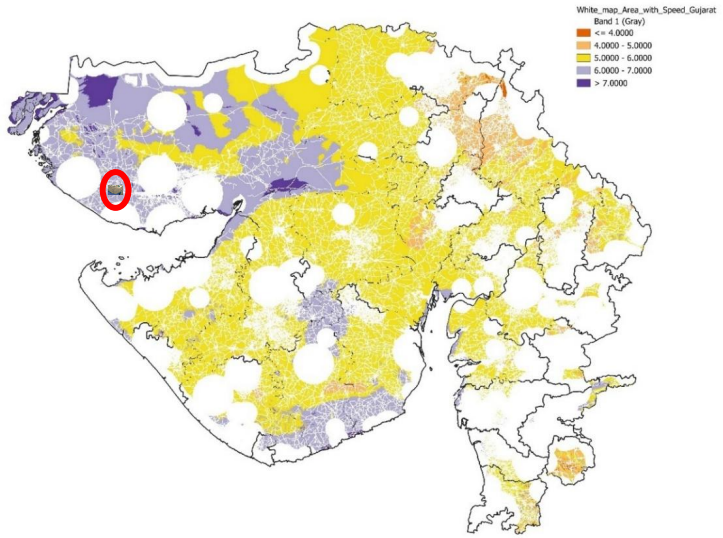


Figure 3.2: White map area **[own]**

Figure 3.3: Wind farm location **[own]**

3. Wind Farm development

Figure 3.3: Wind farm location **[own]**

Selection of site

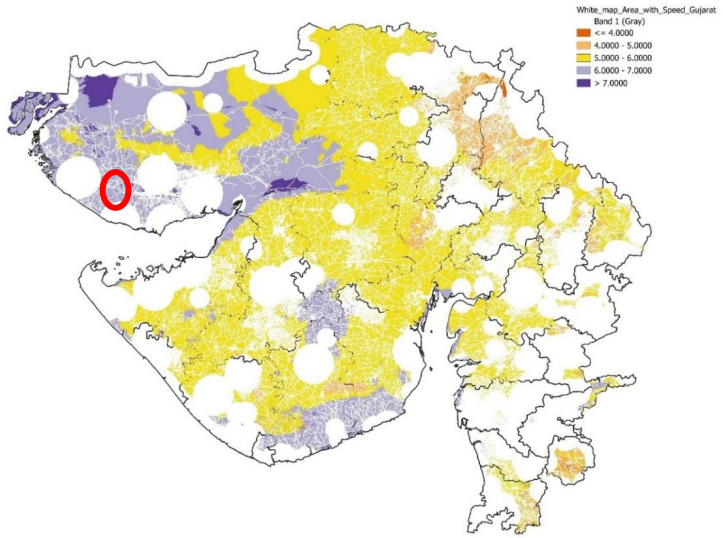


Figure 3.2: White map area **[own]**

3. Wind Farm development

Site selection

- Used Google Earth Pro for a comprehensive site assessment

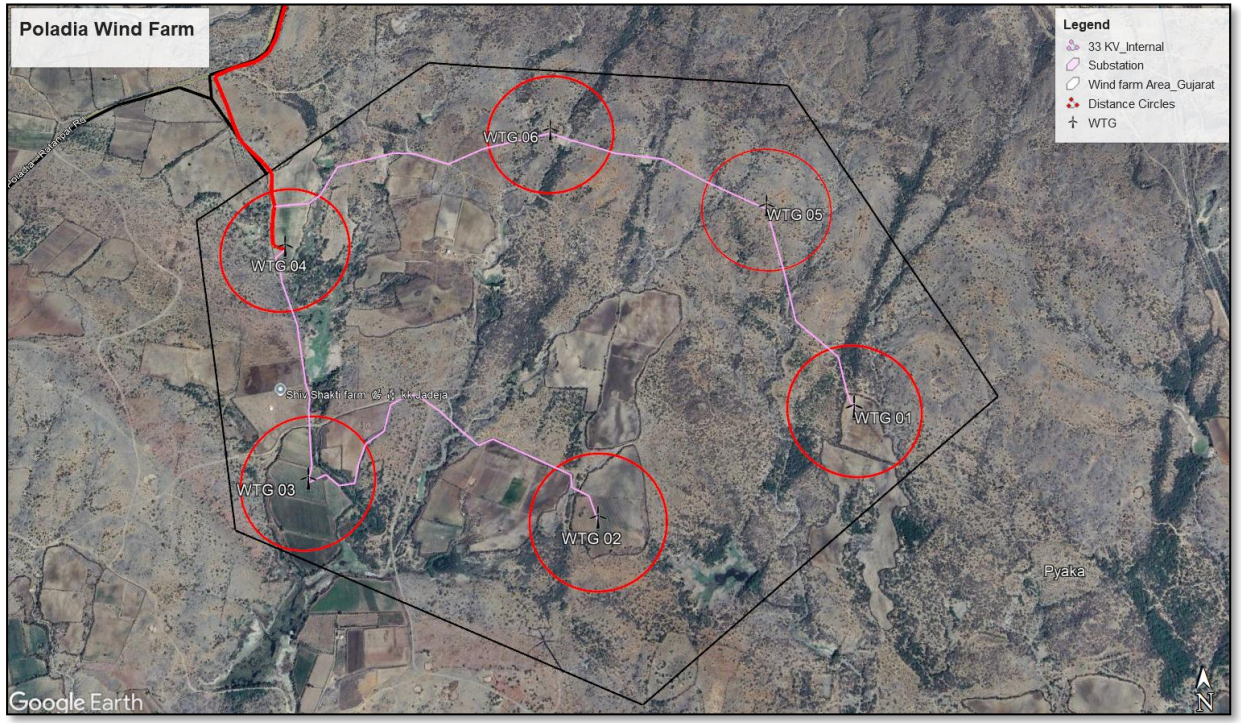


Figure 3.4: Poladia wind farm **[own]**

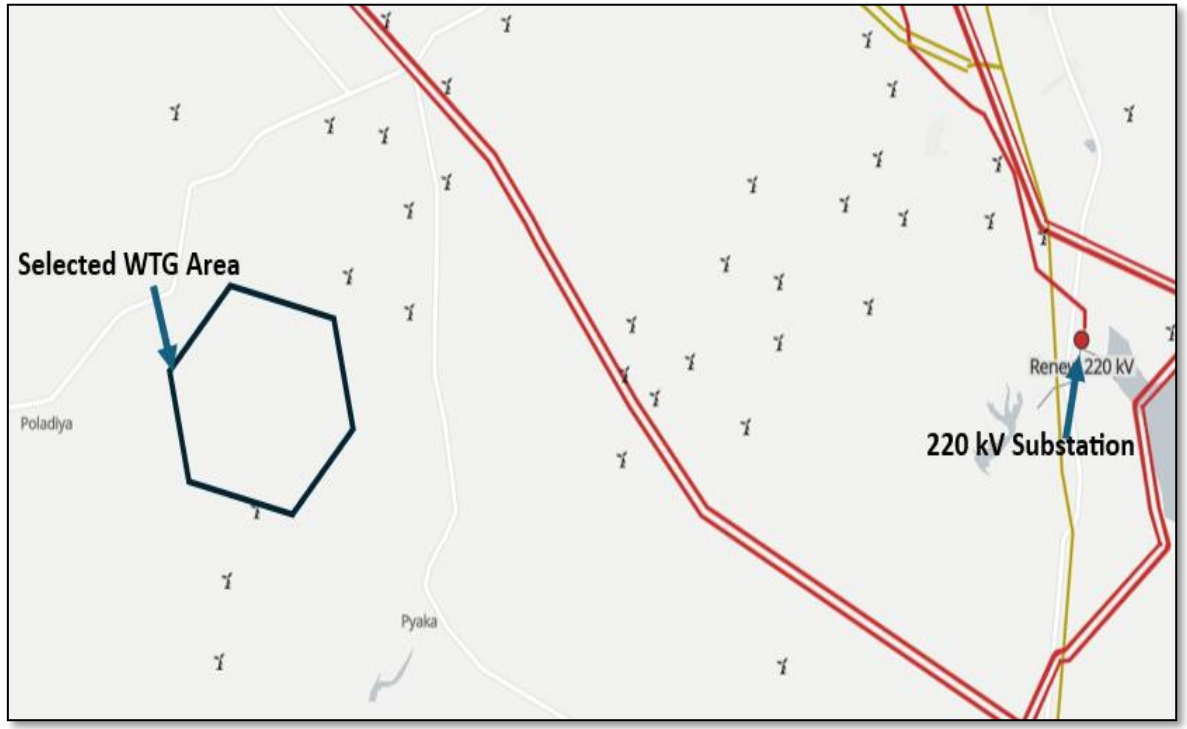


Figure 3.5: Poladia wind farm**[own]**

Site selection

- Type of Land and Soil Condition
- Soil :- Residual soil with reddish brown in color
- Land :- Private farmland (**100 X 100 m**)

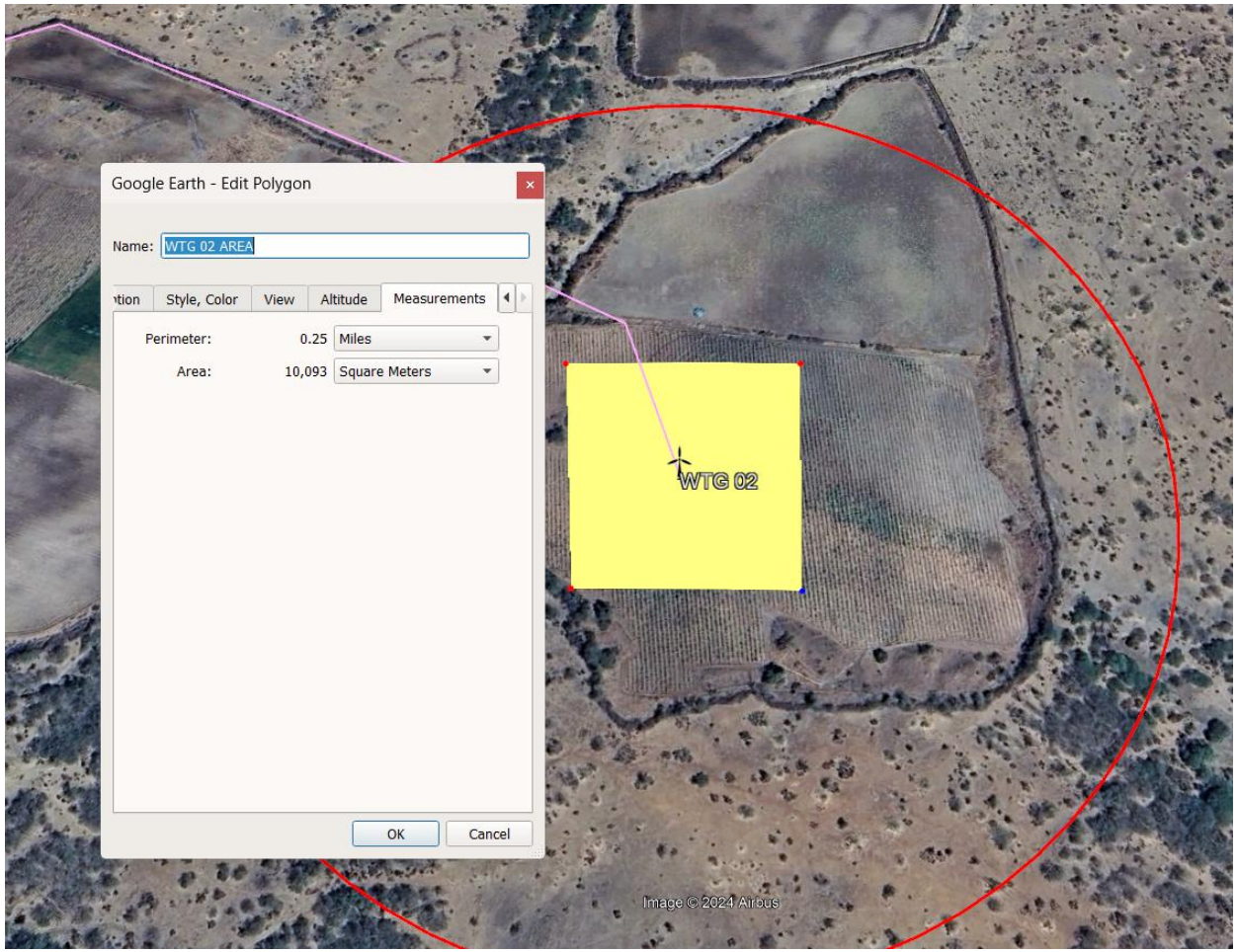


Figure 3.6: Poladia wind farm **[own]**

3. Wind Farm Development

Site selection

Elevation Profile of Site

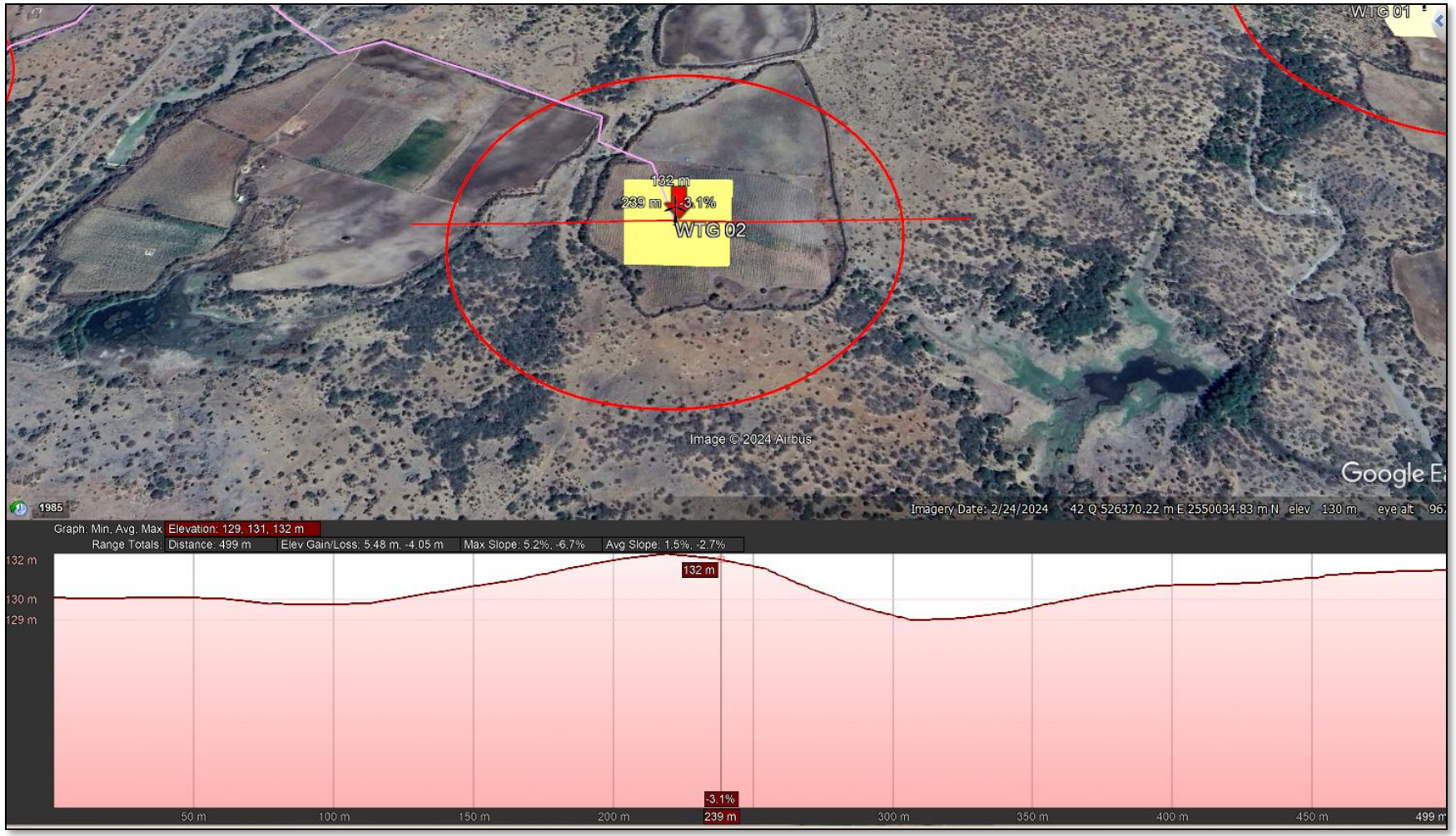


Figure 3.7: Poladia wind farm **[own]**

Predominant Wind direction of Site

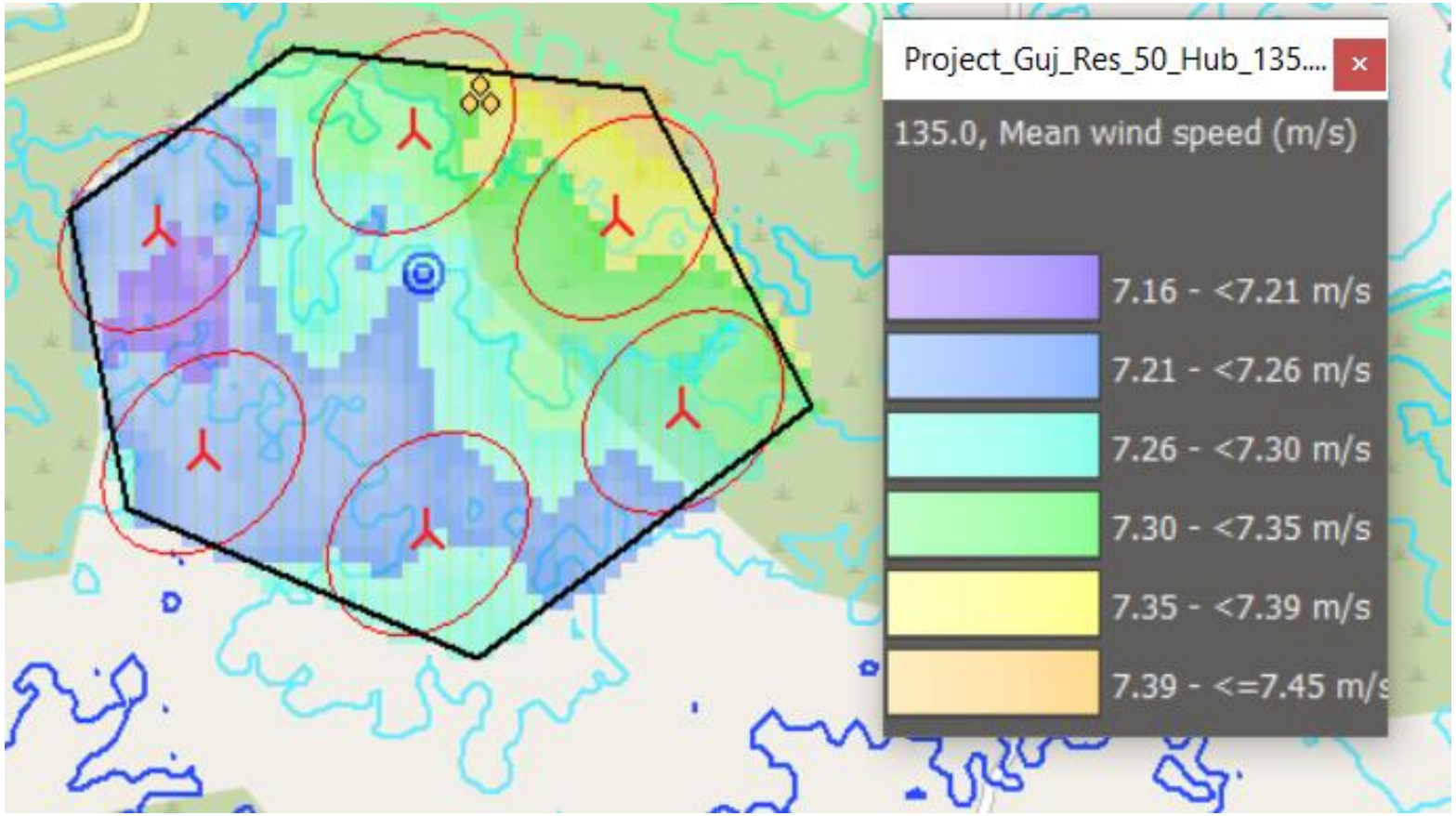


Figure 3.8: Poladia wind farm **[own]**

- Six Suzlon **2.1 MW** wind turbines, strategically positioning them to account for wind direction

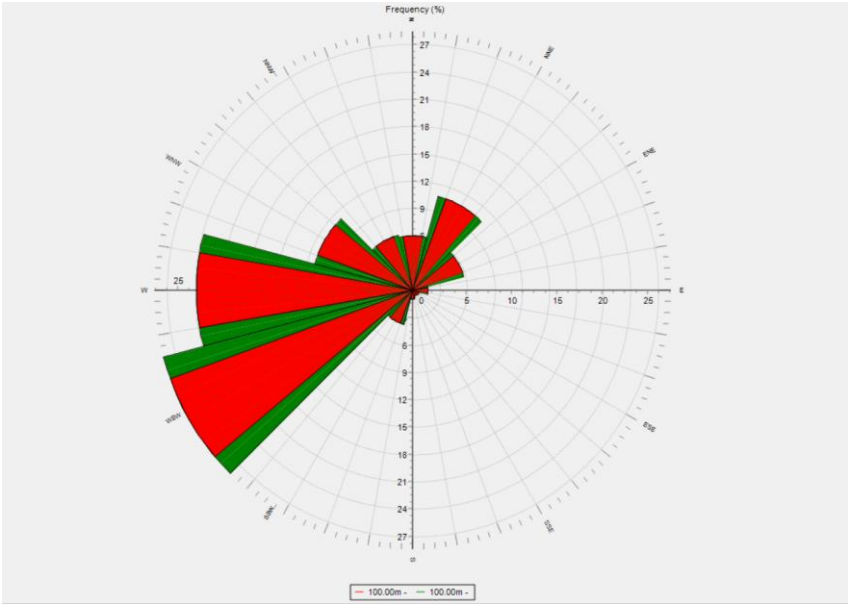


Figure 3.9: Wind rose **[40]**

Selection of WTGs

Figure 3.10: SUZLON wind turbine [41]

Wind Farm Capacity :- **12.6 MW**

Turbine:- **S97*2100(112 m HH)**

Why Suzlon?

- Local Manufacturer
- High-capacity utilization factor (CUF)
- Low Cost Availability
- Logistics

Grid infrastructure and cable routing

- Our wind farm has a capacity of **12.6 MW**, which is relatively below 20 MW. Therefore, we utilized an available substation.
- The substation, named **Renew Wind Energy (AP2) Pvt Ltd**, operates at **33/220 kV**.
- The length of the 33 kV line from the inside wind farm is **4.41 Km** and from wind farm area to the pooling substation is **16 km.**
- Followed existing roads for transmission line in order to avoid conflicts and permissions.

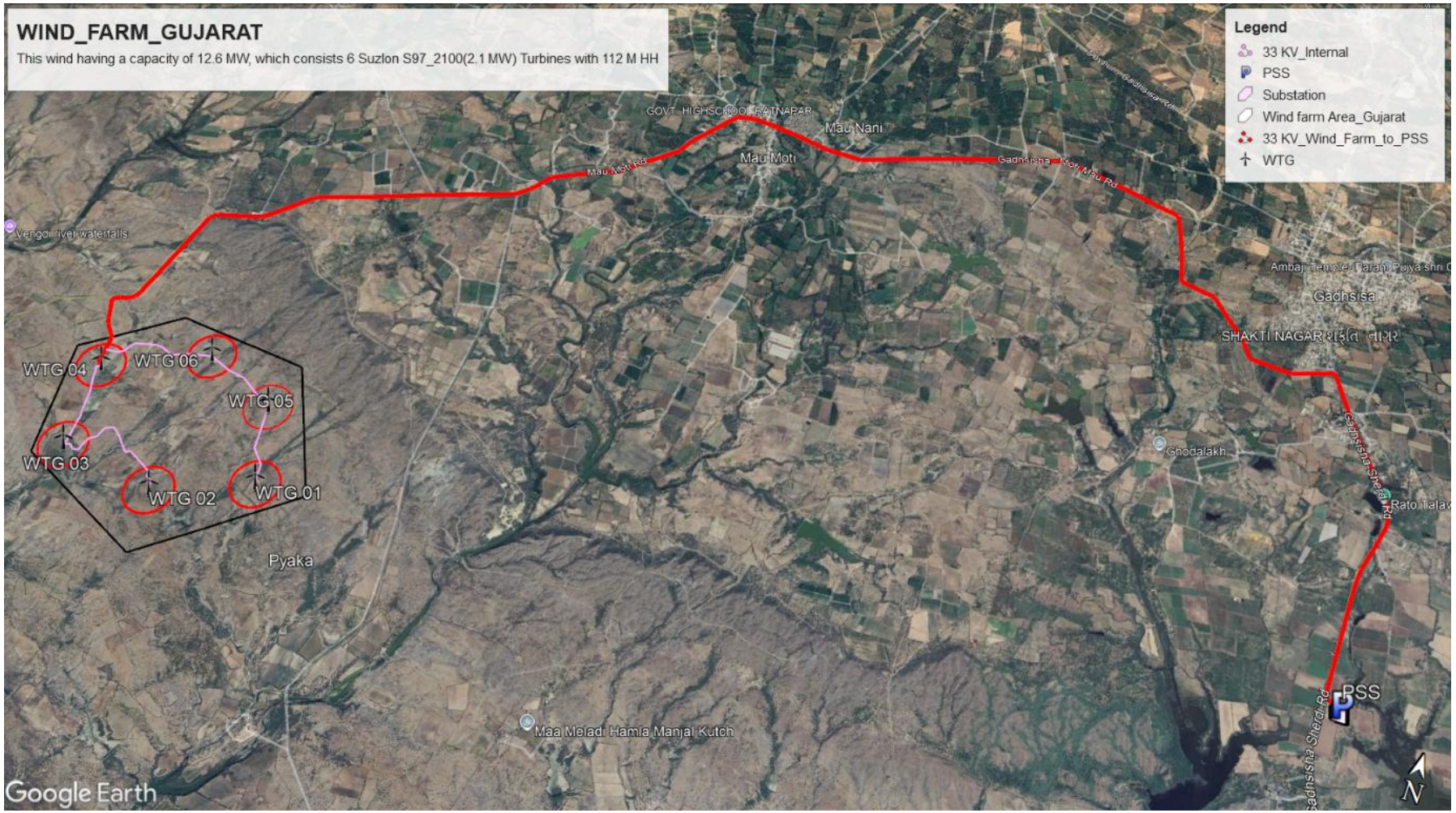


Figure 3.11: Grid infrastructure and cable routing **[own]**

4. Transportation

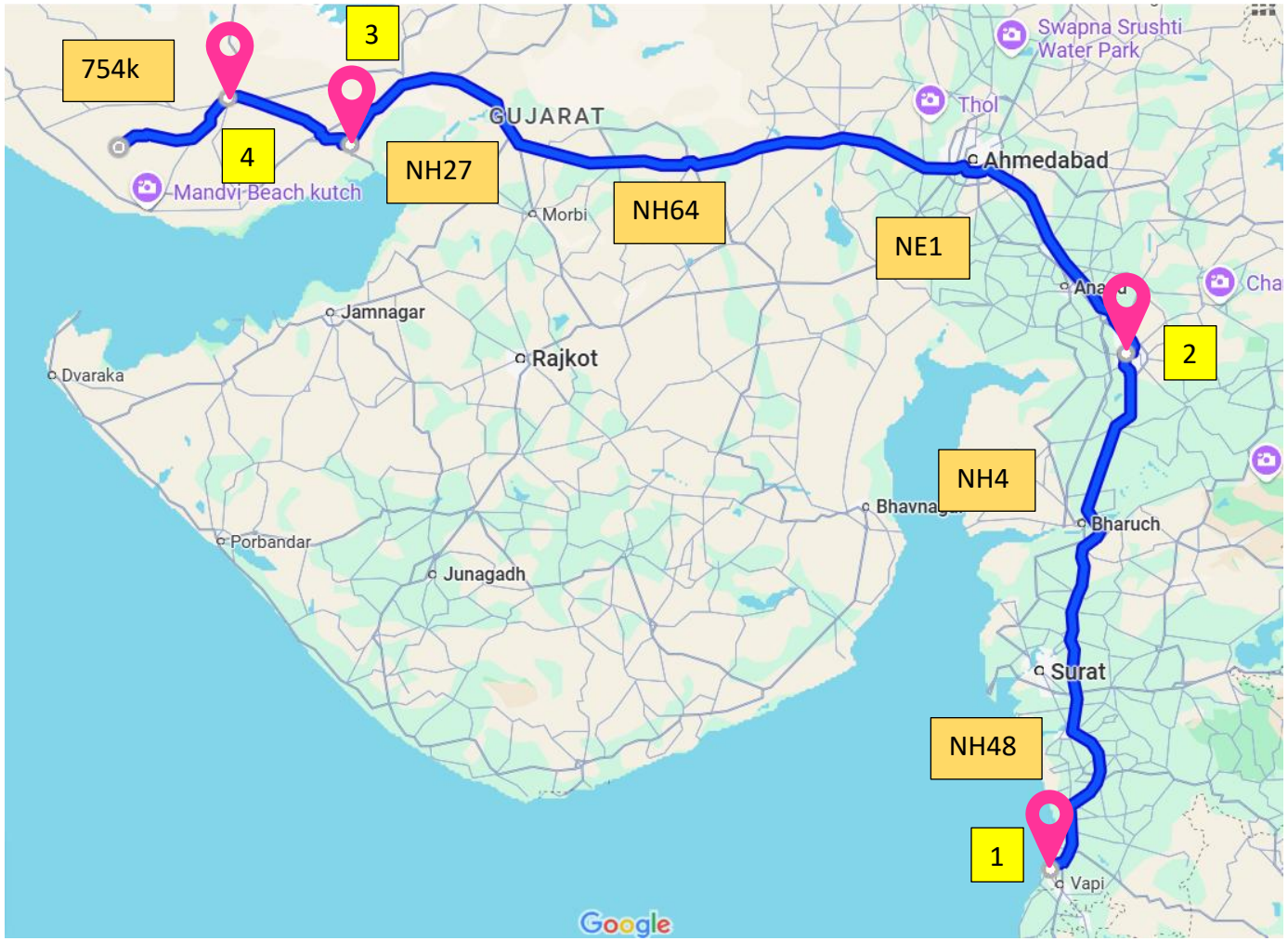


Figure 4.1: Transportation route from manufacturing place to wind farm [18] [45]

Wind farm location:

Poladia, Gujarat, India

Manufacturing Locations	Wind Turbine Manufacturing components	Distance between Manufacturing location to Wind farm [km]
Daman [1]	Nacelle, Nacelle cover, Hub	743
Bhuj [4]	Rotor blades	57
Gandhidham, [3]	Tower	136
Vadodara [2]	Electrical	544

Table 4.1: Wind manufacturing components of SUZLON company [18]

Maximum Permissible Dimensions for Transportation:

- **Height:** Up to **4.75 meters** for indivisible loads (e.g., nacelles, blades).
- **Width: 3.0 meters**
- **Length:** Extendable mechanical trailers: Up to **50 meters** for goods of exceptional length (e.g., wind turbine blades).

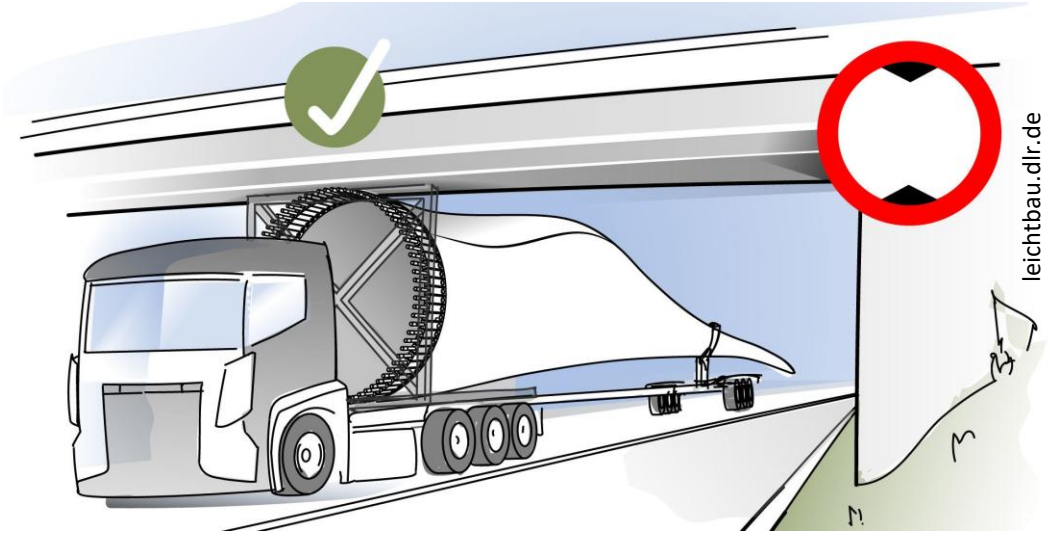


Figure 4.2 [46]

Route & Permits:

- Special goods require **special route permissions**.

25 km

Distance Between State highway to our Wind Farm:

Environmental Conflicts in Wind Energy Projects

Biodiversity Impact:

Top 5 migratory birds in Gujarat

Pied Avocet, Eurasian Teal, Northern Pintail, Bar-headed Geese, Ruddy Shelduck

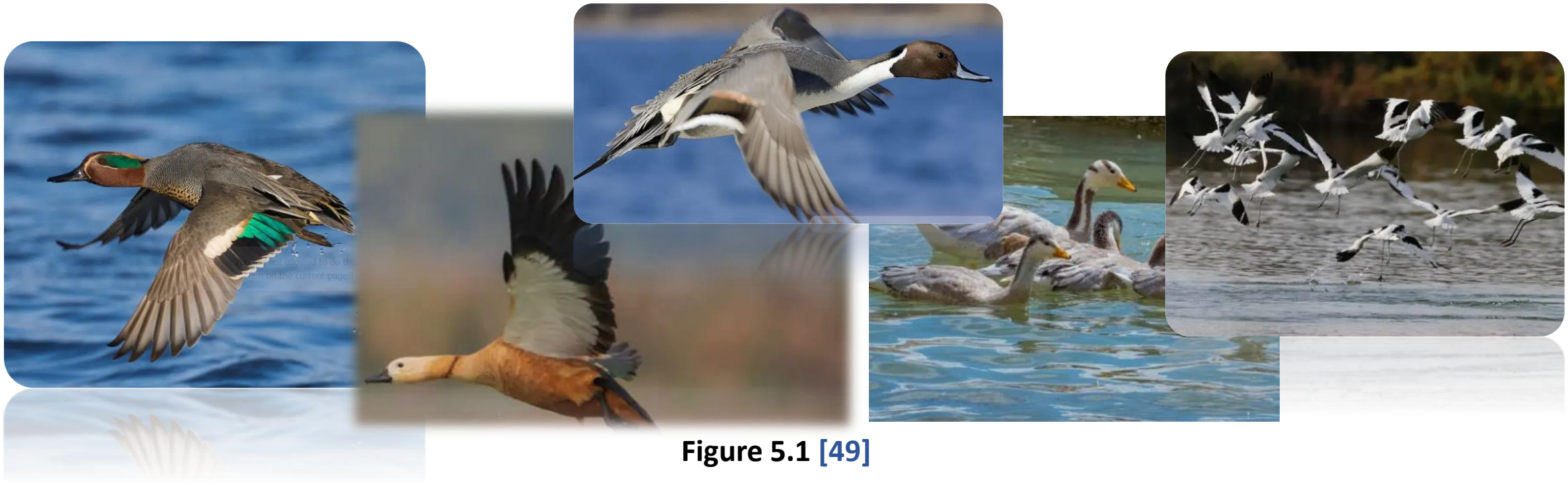


Figure 5.1 [49]

Environmental Conflicts in Wind Energy Projects

Gujarat has important habitats of critically-endangered White-backed and Long-billed Vultures. About half the world population of the endangered Lesser Florican breeds at the grasslands of (source: fatbirder.com)

Figure 5.2: Distance to flight corridor **[own]**

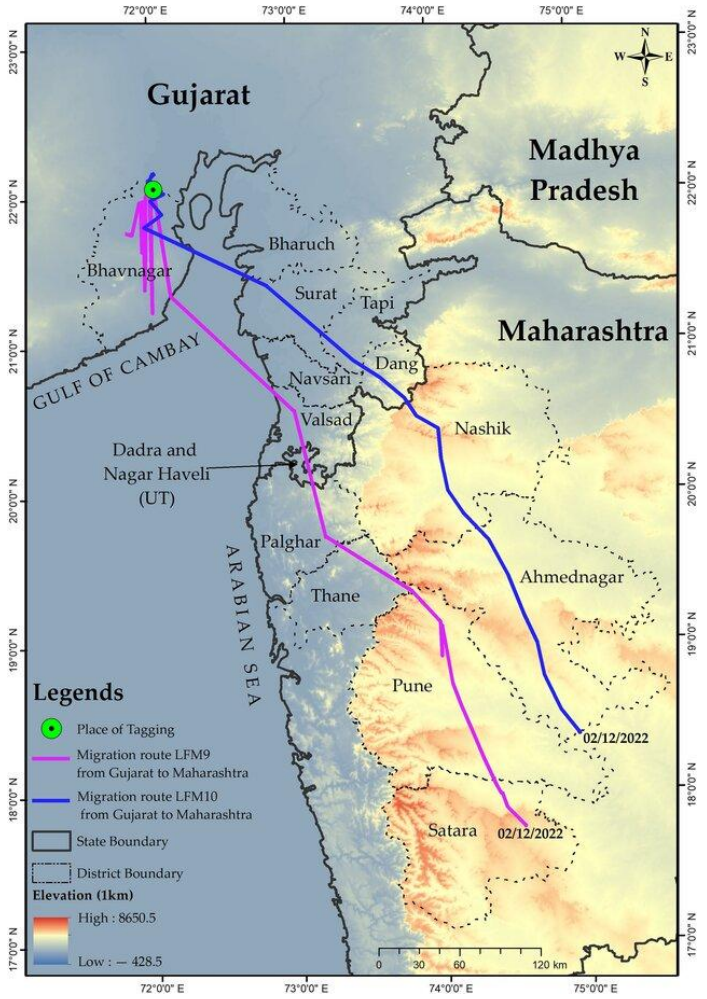


Figure 5.3: Birds flight corridor Gujarat-India **[50]**

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Duration and Terms:

- **Lease Period:** 40 years
- **Annual Rent:** ₹15,000 (€150–€170) per 10,000 m² area
- Rent increase: 15% every 3 years
- **Advance Payment:** Annual rent and taxes must be paid in advance (12% simple interest after 90 days for late payments).
- **Security Deposit:** Equal to one year's rent + 1% service charge + stamp duty.

Eligibility and Allocation:

- **Financial Stability:** Minimum net worth ₹1200 crore (€130.44 million).
- **Renewable Energy Experience:** Minimum 500 MW capacity.
- **Land Allocation Limit:** Only sufficient land for producing 30 lakh metric tones of green hydrogen per year.[15]

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Application and Approval Process:

Pre-Feasibility Report:

- Applicants must demonstrate capability to produce green hydrogen.

Review Committees:

- Applications evaluated by a Committee of Experts.
- High-Power Committee makes final recommendations.

Tripartite Agreement:

- Signed between the Collector, Gujarat Power Corporation Limited (GPCL), and the Applicant.

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Usage and Compliance:

Dedicated Use: Leased land must be exclusively used for green hydrogen production.

Development Timeline: Projects must develop infrastructure and achieve 50% capacity within 3 years and full capacity within 8 years.

No Subleasing: The leased land cannot be subleased to third parties.

Figure 6.1 [47]

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Governance and Oversight:

Nodal Agency (GPCL): Periodic project monitoring to ensure milestones.

High Power Committee (HPC): production standards

Revenue Department: Ensures land allocation aligns with state requirements

Figure 6.2 [48]

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Private land Approval Process:

Step 1: Title Clearance

- Checking all historical ownership records.
- Ensuring there are no legal issues associated with the land.

Step 2: Conversion to Old Tenure Land

- Land in Gujarat is often classified as "new tenure" (with restrictions on sale or use).
- Developers must convert it to "old tenure" to remove restrictions.

Step 3 :Obtaining 89A Permission from revenue department

- this permission is required to formally register the land transaction.

Land Leasing Overview:

Accordig to Gujurat goverment leasing policy 2023

Private land Approval Process:

Step 4: Leasing agreement

- formal agreement with the landowner, documenting the
- agreed price, terms of payment, and timelines for the transaction.

Step 5: Obtain 65 Kh Permission

- Land classified as agricultural must be converted to non-agricultural (NA) for setting
- up infrastructure like wind turbines.[16]

Land Leasing strategy

Fixed amount + Flexible amount + Agricultural losses compensation

$$\text{Flexible amount} = 0.5\% \cdot Annual\ income\ (Euro)$$

Number of owner	Area (m^2)	Financial by rule (1/year)	Bonus (1/year)	Total (per year)
1 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
2 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
3 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
4 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
5 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
6 (WTG)	100 x 100	€ 2050	€ 921	€ 2971
7 (transmission line)	20 x 1000	€ 4100	€ 921	€ 2971

Table 5.1: Land leasing own strategy [own]

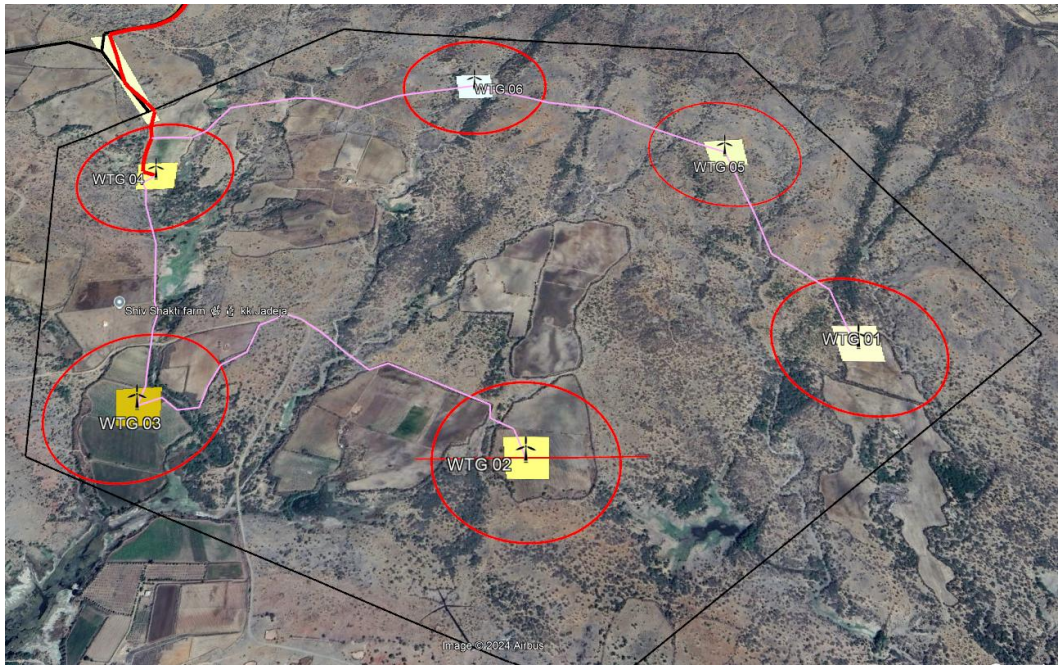


Figure 5.5: Information of landowner [own]

Input Parameters of Annual Energy For Wind Farm:

Calculated Annual Energy for Wind Farm

WTG combination	Result PARK [MWh/y]	GROSS (no loss) Free WTGs [MWh/y]	Wake loss [%]	Specific results¤) Capacity factor [%]	Mean WTG result [MWh/y]	Full load hours [Hours/year]	Mean wind speed @hub height [m/s]
Wind farm	39,026.7	39,924.5	2.2	35.3	6,504.5	3,097	6.9

¤) Based on wake reduced results and any curtailments.

Calculated Annual Energy for each of 6 new WTGs with total 12.6 MW rated power

	WTG type						Power curve		Annual Energy		
Links	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Creator	Name	Result [MWh/y]	Wake loss [%]	Free mean wind speed [m/s]
1 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,420.5	3.7	6.88
2 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,519.8	2.2	6.88
3 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,441.5	1.4	6.82
4 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,472.3	0.4	6.81
5 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,598.3	3.2	6.95
6 A	Yes	Suzlon	S97-2,100	2,100	97.0	112.0	EMD	Level 0 - Calculated - SB47 S97 - 03-2013	6,574.2	2.5	6.92

Figure 7.1: Wind pro report [own]

- One of the most aspect for optimization
- Improving efficiency and effectiveness

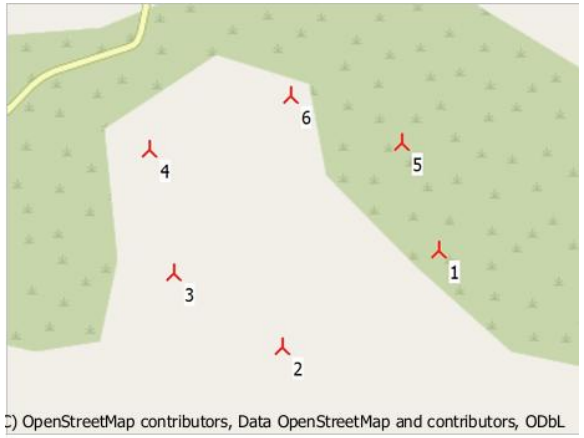


Figure 7.2: Wind pro report [own]

7. Economic Analysis

Input Parameters to calculate Profit analysis calculation:

Calculated by use of WindPro

INR **3 per kwh**

Capital costs:
1 MW = INR **70 million** (Euro **0.791 million**)

Operating costs:
1 MW = INR **0.75 million/year** = (Euro **0.105** million)

Last **10 years** average

Parameter	Economics	Unit
Number of WT	6	-
Installation output	2100	KW
Total output	12600	kW
Gross Energy Yield	39924500	KWh/a
Total losses	2.20	%
Net Energy Yield	399,046,161	kWh
Site Quality	71.04	%
Feed in Tariff	0.033	Euro/kWh
Total Investment Costs (CAPEX)	98,07,253	Euro
Total Operating Costs (OPEX)	1,05,000	Euro
Constant Payment Loan Type (Debt ratio)	72.73	%
Equity	26,74,327	Euro
Term	17	Years
Interest rate of Bank	9.0	%
Debt Capital	71,32,926	Euro
Inflation rate	5.16	%

Table 7.1: Input parameters for calculating profit analysis **[own]**

Income vs Years:

$$Income = Net\ energy\ yield\ (kwh)\ \cdot Feed\ in\ tariff\ \left(\frac{Euro}{kWh}\right)$$

- **Income: 1.29** Million Euro/ year
- **operation period: 20** years

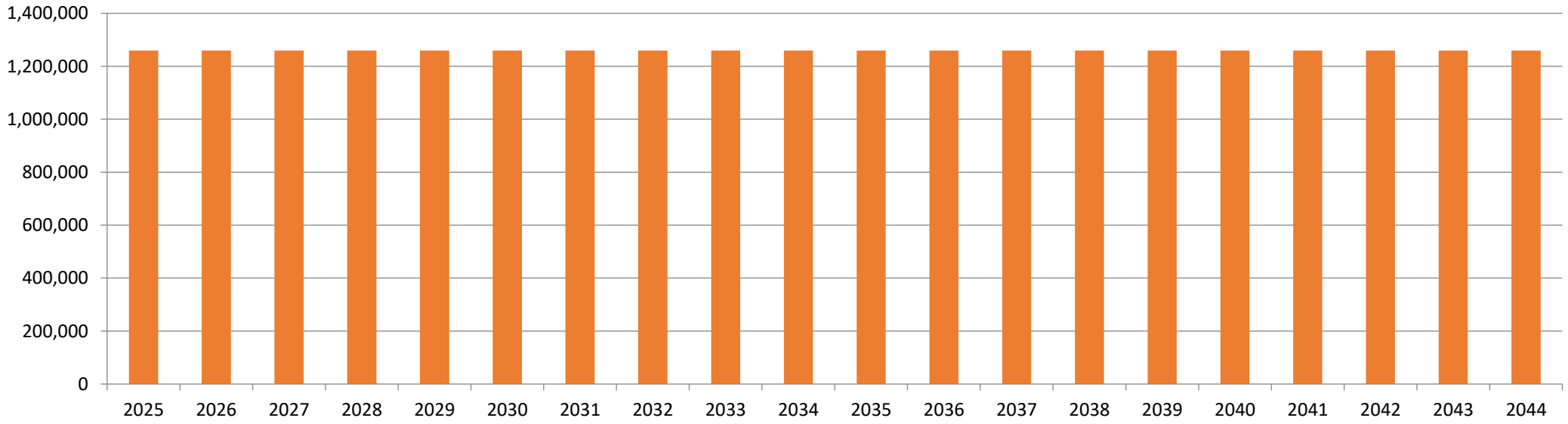


Figure 7.3: Income Vs Years **[own]**

Operating costs (OPEX) vs Years:

$$Oprating\ costs = Total\ operating\ costs\ (Euro) \cdot last\ year\ infation\ \cdot (1 + inflation)$$

- **Operating costs: 0.25** Million staring year
- **operation period: 20** years

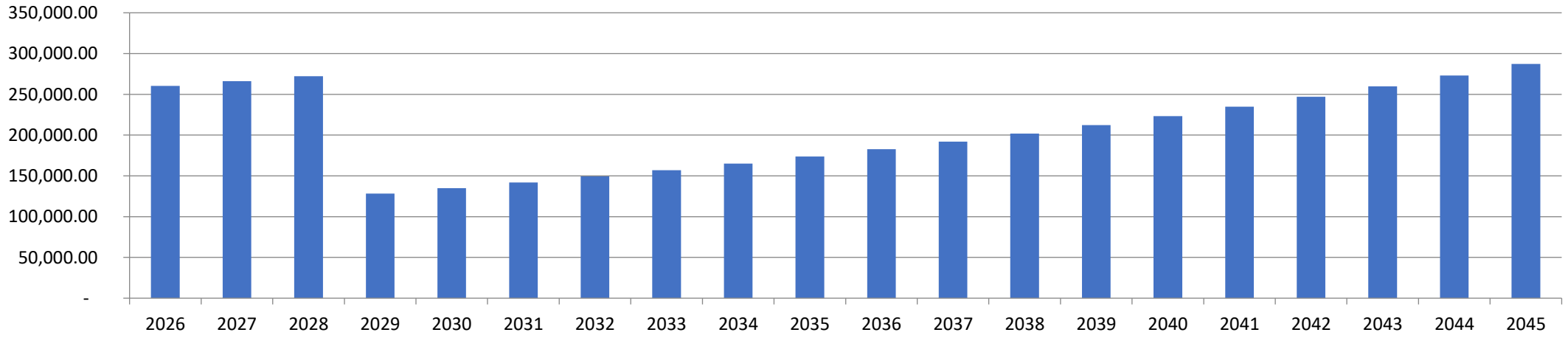


Figure 7.4: Operating cost Vs Years **[own]**

Debt service Vs Years:

- Repayment: **0.4** million euro/year
- Bank interest rate: **9 %**
- Duration of repayment: **17** years

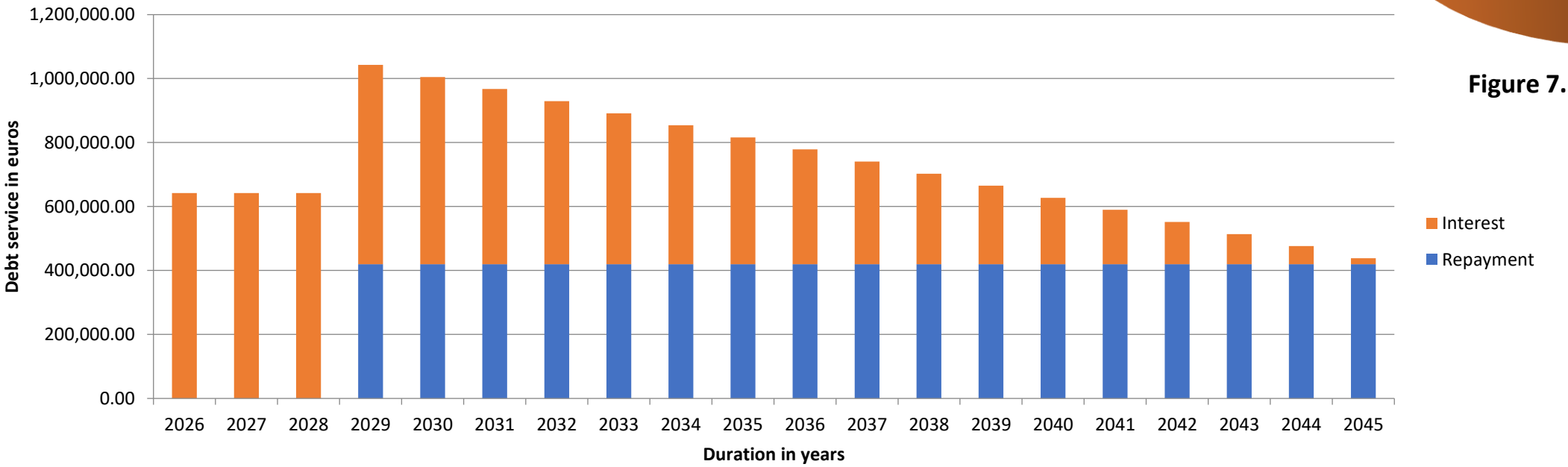


Figure 7.6: Debt service Vs years [own]

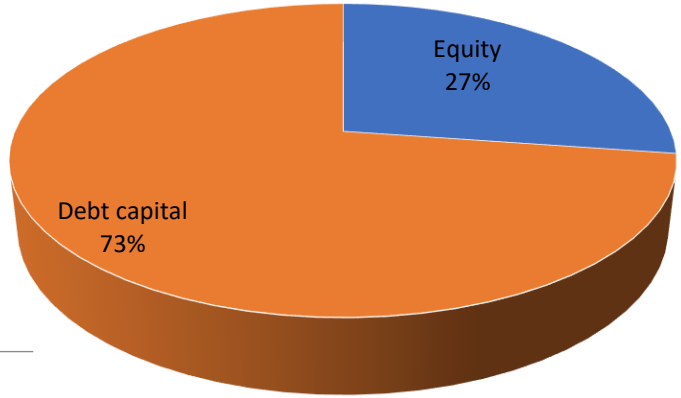


Figure 7.5: Investment **[own]**

Taxes Vs Years:

- **Taxes Free:** First **10** years
- **After 10 years: 30%**

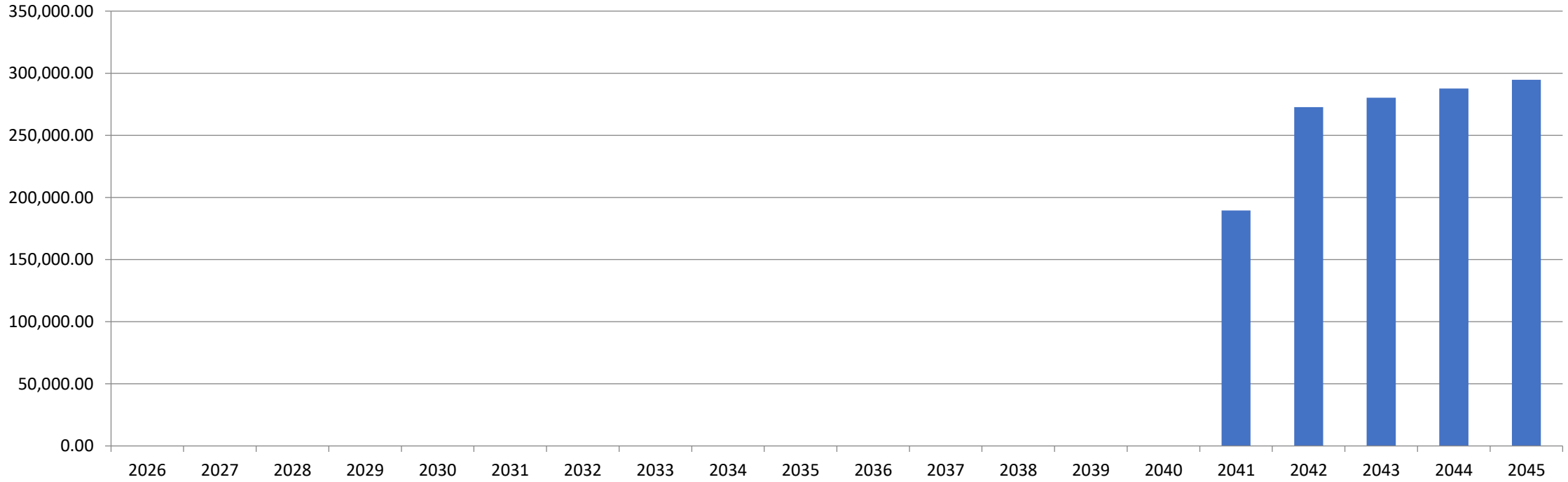


Figure 7.7: Taxes Vs years [own]

7. Economic Analysis

	Value	Unit
NPV	**303,893 (0.3 Million)**	**EUR**
IRR	**8.730**	**%**
LEC	0.0179	EUR
Min. DSCR	1.11	
ADSCR	1.40	

NPV = Net Present Value, **IRR** = Internal Rate of Return, **LEC** = Levelized Cost of Energy, Min. **DSCR** = Minimum Debt Service Coverage Ratio, **ADSCR** = Average Debt Service Coverage Ratio

Table 7.2: Financial result of wind farm [own]

$$NPV = -I_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} \geq 0$$

$$IRR = -I_0 + \sum_{t=1}^{T} C_t \geq 0$$

- Positive NPV
- Impressive IRR
- Project promises cost efficiency and financial stability
- Profitable project

8. Barriers and Obstacles

Land Use Conflicts

Maintenance Issues

Grid Integration

Limited Awareness

Preference for Solar Energy

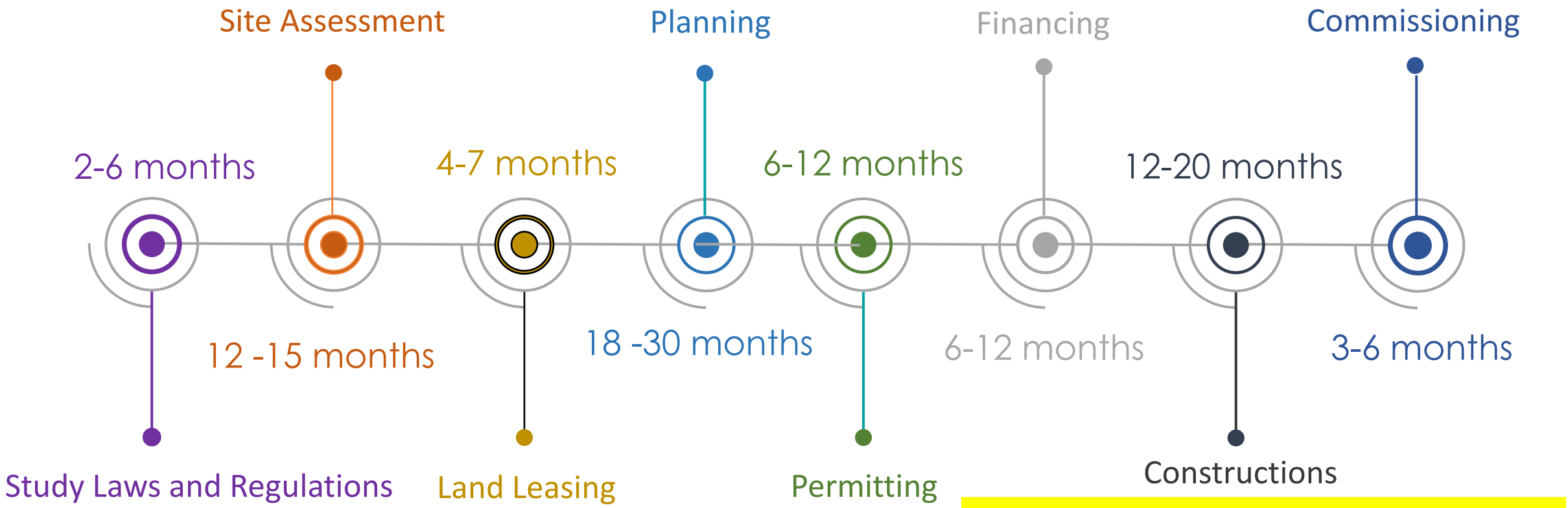
Low energy price

High bank tax rate

9. Project Development Timeline

From Greenfield to Operation:

Total timeline: 5 years – 9 years



Optimizing timeline: 3.5 years - 5 years

Vision for 2030

Vision of India:

- To achieve **500 GW** renewable energy capacity
- **140 GW (28%)** will be Wind energy production

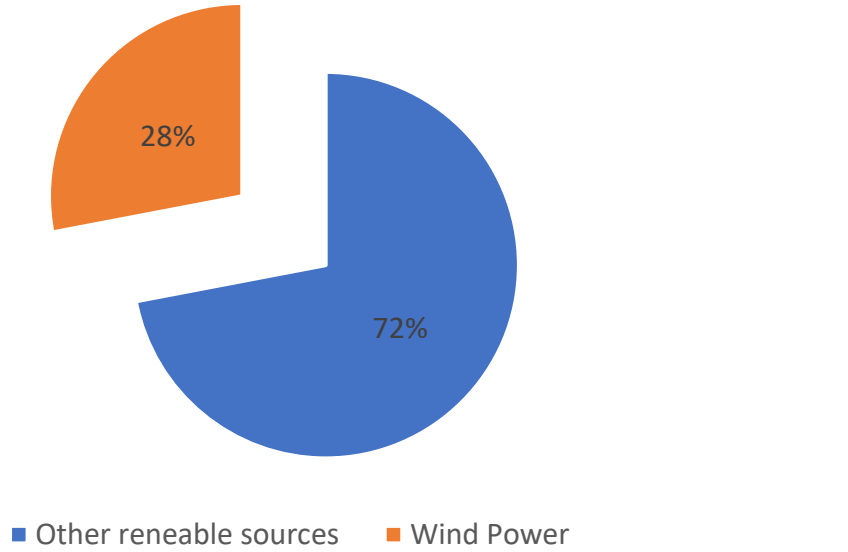


Figure 10.1: Vision of India renewable energy production for 2030 **[own]**

Figure 10.2: Vision of Gujarat renewable energy production for 2030 **[own]**

Vision of Gujarat:

- To achieve **128.6 GW** renewable energy capacity
- Increase the share of wind energy to **24%**
- Launch the first phase of offshore wind projects.

Vision for 2050

Figure 10.3: Onshore wind turbine [44]

- Establish Gujarat as a global leader in wind energy.
- Fully integrate smart grid solutions for efficient energy distribution.
- Achieve a **50%** reduction in carbon emissions from energy production.

10. Future Strategy

1. Integrating smart grid
2. Improve Policy support
3. Energy storage system
4. Upgrade infrastructure
5. Advanced turbine technologies
6. Encouraging community engagement
7. Spend more money in research and development of wind turbine

11. Short video: India's Wind Energy Potential

[https://www.youtube.com/watch?v=F_jBS1S-9oE&t=6s]

12. References

[1] “MINISTRY OF NEW AND RENEWABLE ENERGY,” 01 2024. [Online]. Available: https://mnre.gov.in/wind-overview. [Accessed 2024 10 02].

[2] “A Deep Dive into Wind Energy Farms in India: Tapping into the Power of the Breeze,” Green Energy, 23 01 2024. [Online]. Available: https://powerefficiency.com/wind-energy-farms-in-india/. [Accessed 02 10 2024].

[3] “gujarat-bags-award-for-highest-wind-power-installed-capacity,” thehindubusinessline, 15 06 2024. [Online]. Available: https://www.thehindubusinessline.com. [Accessed 2 10 2024].

[4] A. P. Z. P. C. Draxl, “Wind Resource Assessment,” NREL National Renewable Energy Laboratory, July, 2014.

[5] M. Gupta, “Scaling Challenges In Gujarat: Adani’s 300 MW Wind Farm Project And Its Journey Through Regulatory And Logistical Hurdles,” WINDINSIDER EMPOWERING THE WIND SECTOR, 13 05 2024. [Online]. Available: https://windinsider.com. [Accessed 10 10 2024].

[6] Suzlon Group, “Suzlon secures a repeat order of 193.2 MW from The KP Group in Gujarat,” 21 December 2023. [Online]. Available: https://www.suzlon.com. [Accessed 13 10 2024].

[7] MINISTRY OF NEW AND RENEWABLE ENERGY, “Clarification to the ‘Guidelines for Development of Onshore Wind Power Projects’ and amendments,” Government of India, 18 12 2024. [Online]. Available: https://mnre.gov.in/en/document/clarification-to-the-guidelines-for-development-of-onshore-wind-power-projects-and-amendments/. [Accessed 15 11 2024].

[8] thc.nic.in, “THE HAZARDOUS WASTES (MANAGEHANDLING AND TRANSBOUNDARY MOVEMENT) RULES, 2008,” Official Gazeette, MARCH, 2010.

[9] Forest Clearance, “Forest Conservation Rules,” 2003. [Online]. Available: https://forestsclearance.nic.in. [Accessed 17.11.2024].

[10] National Board for Wildlife, Ministry of Environment and Forest, India, “Guidelines for linear infrastructure intrusions in natural areas: roads and powerlines,” 10 Octomber 2011. [Online]. Available: https://moef.gov.in. [Accessed 25 11 2024].

[11] India Air Force, “GUIDELINES FOR ISSUE OF NOC FOR CONSTRUCTIONS AROUND INDIAN AIR FORCE AERODROMES,” 12 2021. [Online]. Available: https://indianairforce.nic.in. [Accessed 11 11 2024].

[12] DTU, “GLOBAL WIND ATLAS,” DTU, ESMAP, WORLD BANK GROUP, VORTEX, [Online]. Available: https://globalwindatlas.info. [Accessed 24 11 2024].

12. References

[13] GEOFABRIK, “OpenStreetMap Data Extracts,” [Online]. Available: https://download.geofabrik.de/. [Accessed 25 11 2024].

[14] Openinframap, [Online]. Available: openinframap.org. [Accessed 26 12 2024].

[15] Government of Gujarat, “Policy-2023 for leasing the government fallow land for green hydrogen production using non-conventional energy sources such as solar, wind, wind solar hybrid energy.,” 08 May 2023. [Online]. Available: https://www.eqmagpro.com. [Accessed 13 10 2024].

[16] ARCADIS India Pvt. Ltd., “ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT: 250 MW Wind Power Project in Kutch district, Gujarat,” ARCADIS, Kutch, 2017.

[17] Gujarat Goverment , “policy_files,” 2016. [Online]. Available: https://geda.gujarat.gov.in. [Accessed 28 11 2024].

[18] suzlon, “supply-chain-management-and-manufacturing,” 2024. [Online]. Available: https://www.suzlon.com. [Accessed 12 12 2024].

[19] A. Joshi, “Gujarat Sets ₹2.84/kWh Tariff for wind projects below 10 MW comnnissioned by 2027,” MERCOM Clean Energy Insights, 04 09 2024. [Online]. Available: https://www.mercomindia.com. [Accessed 25 12 2024].

[20] Macrotrends, “India Inflation Rate 1960-2024,” Macrotrends LLC, [Online]. Available: https://www.macrotrends.net. [Accessed 25 12 2024].

[21] U. Ehlers, Project financing in the wind power sector (Lecture Note), Flensburg, Germany: Hochschule Flensburg Prof. Marina Blohm, 20.11.2024.

[22] EI News Network, “GERC Updates Regulations for Small Wind Projects,” energetica INDIA, 05 September 2024. [Online]. Available: https://www.energetica-india.net. [Accessed 27 12 2024].

[23] iNDEXTb/GM(Project&Tech.), “Wind Farm - An Opportunity for Investment in Gujarat,” Goverment of Gujarat, Gandhinagar.

[24] M. B. Arshi Banu P S, “Wind energy feasibility and wind turbine selection studies for the city Surat, India,” Clean Energy, vol. 8, no. 3, pp. 166-173, 2024.

[25] L. C. a. A. B. Vaisakh Suresh Kumar, “Scaling up small wind turbines in India (Barriers and options for the way forward),” WRI-INDIA.ORG and CLEAN , Delhi, 2024.

[26] A. P. a. Z. P. . Draxl, “Wind Resource Assessment,” National Renewable Energy Laboratory (NREL), 2014.

[27] R. m. https://www.mercomindia.com/gujarat-land-policy-solar-wind-projects, “Gujarat's New Land Policy for Solar, Wind Projects to Make Developers More Accountable,” MERCOM, Clean Energy Insights, 17 September 2020. [Online]. Available: https://www.mercomindia.com/gujarat-land-policy-solar-wind-projects. [Accessed 05 10 2024].

12. References

[28] D. M. Blohm, Lecture Notes on Wind Farm Development, Flensburg, 2024.

[29] EU-INDIA CLEAN ENERGY & CLIMATE PARTNERSHIP, “About the partnership,” European Union , 30 March 2016. [Online]. Available: https://www.cecp-eu.in. [Accessed 13 10 2024].

[30] Nature India, “Is the drive for clean energy throwing environmental caution to the wind?,” NEWS FEATURE, 16 June 2019.

[31] P. C. Abhishek Gawande, “Environmental and social impacts of wind energy: a view point with reference to India,” Indian Institute of Forest Management, Bhopa, 2019.

[32] Gujarat Urja Vikas Nigam Ltd, “REQUEST FOR SELECTION (RfS),” 10 07 2023. [Online]. Available: https://jmkresearch.com. [Accessed 20 10 2024].

[33] V. Shah, “India Sets Sail on 1 GW Offshore Wind Energy Projects in Gujarat, Tamil Nadu,” goodreturns, 19 June 2024. [Online]. Available: https://www.goodreturns.in. [Accessed 22 10 2024].

[34] Editorial Team, “Gujarat: Pioneering Sustainable Wind Power Generation in India,” SSMB.IN, 19 September 2024. [Online]. Available: https://ssmb.in/2024/09/19/gujarat-pioneering-sustainable-wind-power-generation-in-india/. [Accessed 22 10 2024].

[35] GE VERNOVA, “GE acquires 49% stake in Continuum onshore wind farm in support of the energy transition in India,” GE, [Online]. Available: https://www.gevernova.com. [Accessed 22 10 2024].

[36] Gujarat Energy Development Agency, Gujarat Government, [Online]. Available: https://geda.gujarat.gov.in. [Accessed 22 10 2024].

[37] Wind farm BoP, “Wind farm testing and commissioning,” 2017, [Online]. Available: https://www.windfarmbop.com/. [Accessed 22 10 2024].

[38] India Renewable energy race :- https://www.downtoearth.org.in/renewable-energy/india-s-renewable-energy-race-mp-up-will-take-more-than-50-years-to-meet-2022-target-at-current-pace-85195, 10/01/2025

[39] India Wind Potential, https://www.tandfonline.com/doi/full/10.1080/15435075.2021.1978447, 10/01/2025.

[40] https://www.indianclimate.com/show-data.php?request=CRBLWINFEW

[41] https://www.netsolwater.com/what-is-major-environmental-conflicts-in-india-with-example.php?blog=130

[42] https://www.sciencedirect.com/science/article/pii/S2214629621004357

12. References

[43] the world's biggest blackout, 31th July 2012 [source:nbcnews]

[44] https://sl.bing.net/hVlnu47HBZs

[45] https://www.google.com/maps

[46] Ministry of Road Transport & Highways (MoRTH), India – Notification GSR No. 414(E), June 2020

[47] https://www.crematrix.com/blog/what-are-the-different-types-of-commercial-leases-in-india

[48] enercon.de

[49] indiabirdwatching.com

[50] M. Ram, D. Gadhavi, A. Sahu, and D. Devaliya, "Unravelling the secrets of lesser florican: a study of their home range and habitat use in Gujarat, India," *Scientific Reports*, vol. 13, no. 1, Nov. 2023, doi: 10.1038/s41598-023-46563-5.

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