II. PROJECT DESCRIPTION

II.1 PROJECT GENERAL INFORMATION

The Project of Tres Mesas Wind Farm (hereinafter PETM or Project) consists of the construction and operation of a wind generation farm, intended to be developed in the region of Tres Mesas (Mesa La Paz, Mesa Las Chinas, and Mesa La Sandía), in the municipality of Llera de Canales, and a small portion in the Municipality of Casas, in the State of Tamaulipas.

In order to determine the exact number of wind turbines, their characteristics, and capacities, as well as the precise location, it is necessary to have accurate data on the climatic conditions and wind conditions of the zone for a given time. Therefore, there are presently meteorological towers in the zone equipped with measurement instruments as anemometers, barometers, thermometers, and wind vanes measuring the characteristics of each of these variables storing the information. The data generated in the meteorological towers are collected, filtered, and analyzed with the purpose of having a representative data record of the climatic conditions and wind conditions in the zone, with the purpose of drafting a detail design of the farm, selecting the turbines to be used, and the distances between them, as well as foreseen the energy production.

The PTEM is intended to be developed in five stages, and it is foreseen that once all stages are concluded, 500 to 700 MW of electric energy is generated. In total, it is foreseen that 152 to 436 wind turbines of 1.6 to 3.3 MW of capacity could be installed, distributed in Mesas de La Paz and La Sandía. The petitioner already has a preliminary arrangement of the wind farm, within which, corridors to install the wind turbines are already defined, and only the precise location is to be defined.

The stages will be the following:

- Stage I: 19 to 39 wind turbines
- Stage II: 28 to 58 wind turbines
- Stage III: 22 to 74 wind turbines
- Stage IV 42 to 134 wind turbines
- Stage V: 41 to 131 wind turbines

The Project has the objective of providing clean power and renewable electric energy to the internal market of the region with the purpose of satisfying the needs of individuals and/or companies. The energy generated during the first and second stage will be destined to the national industry market.

II.1.1 Project Nature

As provided above, the Project consists of the generation of electric energy from harnessing wind, which is achieved through the usage of wind turbines.

The wind turbine is composed of three basic parts: the tower, the nacelle (containing the main turbine components, including the generator and the electrical controls) and the rotor (composed by the hub, nosecone, and blades).

The electric energy is generated when the rotor of a wind turbine, generally composed of three fiberglass layers blades, rotates with the action of wind. The rotor energy is transmitted to a synchronic generator that produces low-voltage electric energy. This energy is sent a transformer located on the tower base, where the energy is taken to 34,5 kV. The energy generated by each turbine is transported through electric lines to the transformers and collection sub-stations, where voltage is raised to be sent to the final destination or main sub-station.

The total height of each wind turbine, including tower and blades, is estimated to be maximum 117 meters, but it may vary depending finally on the wind turbine capacity, the blades length (which in turn depends on the wind characteristics at the exact location of the turbine), and the height of the towers selected.

As part of the farm, we have included the installation of permanent meteorological towers defined spots to monitor the site meteorological conditions.

On the other hand, the Project requires the construction of new access roads as well as the rehabilitation and extension of the existing roads network.

For the construction and operation of the wind farm, it should be necessary to have the following permanent and provisional infrastructure:

- From 152 to 436 wind turbines of 1.6 to 3.3 MW of capacity, distributed in Mesas de La Paz and La Sandía. It is important to mention that in Mesa Las Chinas, we have not planned to install any wind turbine.
- Two operation and maintenance buildings, one in Mesa de la Sandía and another in Mesa La Paz.
- Underground Collection System
- Electric Power Collection Air System (SARE).
- Electric Power Conduction Line (LCE) towards the Main Sub-station
- Collection Sub-stations
- Main Sub-stations
- Access Roads
- Permanent meteorological towers (TMP)

- Two helipads (to be used in case of emergency), one in Mesa la Sandía and another in Mesa La Paz.
- Two concrete mixture plants with ice manufacturing, one in Mesa la Sandía and another in Mesa La Paz
- Crushers and screens for the material product of the demolition, which are located to the side of the concrete mixture plants.
- Construction offices, warehouses, and temporal parking lots

Said components are described in detail in section II.2.3

As part of the design and engineering process, different site conditions are been analyzed, such as: wind speed, soils mechanics, geological formations, soils types, seismic data, etc. The wind farm design will comply with the applicable legislation in Mexico, including those provided by SEMARNAT, STPS, CRE, and all the competent local authorities. In case of absence of any Mexican code or standard, the design standards, codes, regulations, and guidelines internationally recognized will be used.

It is important to mention that the Project will not be located within any protected natural area. The following table shows the distances different protected natural areas of the zone are located.

Table II.1 Distance of the Project to Protected Natural Areas

ANP	Approximate distance to the Project (meters)
Laguna Madre and Río Bravo Delta	95,000
Altas Cumbres	22,000
Bernal de Horcasitas or Cerro de Bernal	57,000
El Cielo	9,000
Parras de la Fuente	45,000
La Vega Escondida	143,000

As it can be observed in the above table, the Protected Natural Area closest to the Project polygon is the Biosphere Reserve "El Cielo", located to its south-east. A small portion of this reserve area is within the analyzed SAR limits, however, it is important to point out that considering the project nature and the mitigation measurements and/or compensation to be carried out, we consider said Reserve will not be affected.

On the other hand, specifically within the Project polygon, there is no information of possible archeological remains, such as provided in chapter III herein.

II.1.2 Site Selection

The wind energy, besides the environmental benefits it provides, under some conditions, results economically competitive for the case of conventional fuels.

Some of the advantages the wind-electricity conversion process has are:

- It does not release greenhouse effect gases.
- It does not release atmospheric pollutants.
- It does not use water.
- It does not generate hazardous waste.

On the other hand, the energy source (the wind), has the following advantages:

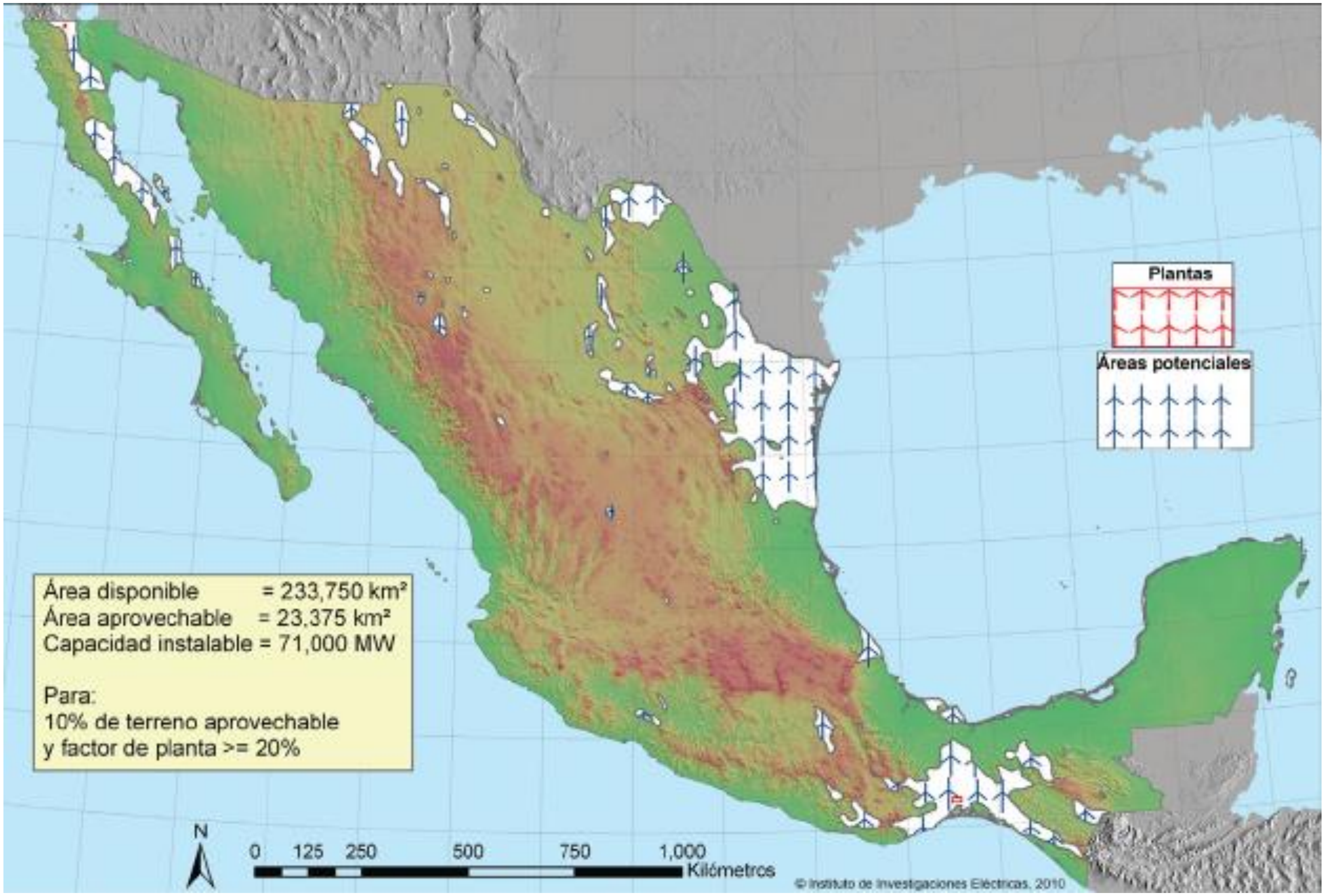
- It is inexhaustible, since it arises from perennial atmospheric processes.
- It is on the surface and, therefore, it does not require extraction processes.
- Its management and possible accidents in its exploitation have no high-impact environmental risks, such as transportation spillage, explosions, fires, etc.

In general, the wind-electric generation environmental advantages are:

- Creation of new employments.
- Encouraging regional development.
- Attraction of private investment.
- Contribution to reactivate the productive plant.
- Creation of small and medium-sized companies.
- Supplying electric energy using energy local sources.
- Saving fossil fuels.
- Reducing risks related to energetic supply.
- Energetic independence.

As regards the national context, the evolution in the generation of electric energy in the country is observed when the national demand increases in view of modernizing and increasing the existing structure, diversifying the generation options when adopting and installing plants with new technology.

In the region of Itsmo de Tehuantepec, in the State of Oaxaca, there exists one of the highest potential spots for wind energy generation in the world, however, there are some other spots within the Mexican Republic with wind potential, such is the case of Baja California, Sonora, Coahuila, Nuevo León, Tamaulipas, among others. The following figure shows the highest wind potential zones in Mexico, highlighting the State of Tamaulipas, located to the northeast of the country, and Istmo de Tehuantepec, to the southeast of the country.



Source: Energy Department, Potential harnessing zones for wind-energy generation, Mexico, Address
URL: http://sener.gob.mx/webSener/res/1803/Eolico.pdf

Figure II.1 Zones with highest wind potential in Mexico

The Project has the objective of providing clean power and renewable electric energy to the internal market of the region with the purpose of satisfying the needs of individuals and/or companies. The sale of power generated by the wind farm has not agreed with any entity or company, therefore, the destination of this electric energy is not completely defined yet.

For the site selection, technical-economic criteria were considered, as well as legal and environmental basis in accordance with the "Best Practices Guideline" prepared by Dr Herman Snel in April 2006, within the framework of the activities performed in the Project "Action Plan to Remove the Barriers for the Wind-Energy Generation Development in Mexico"[1], described in the following table:

Table II.2 Technical-economic, legal and environmental criteria for the site selection

Criteria	Project Situation
Technical-economic aspects	
1. The site should have a good wind resource, that mainly reflects in the average value of the annual wind speed. The wind resource classifications arise from different sources such as the case of those obtained from the International Electro technical Commission (IEC). The local resource quantification is only acquired from the wind speed measurements in the site. An annual average speed of 5m/s (measured at 10 m height from the floor) may be considered as enough; however, it is better if it is higher. From 7.5 m/s, it may be considered as very appropriate and around 10 m/s is rated as excellent.	Analyzing the wind speed data in the study zone, it may be observed that the wind turbines are to be installed in the zones where the wind speed exceeds 8 m/s, recording averages of 7.57 m/s. In the zone, there are already 5 meteorological towers and they are installing another 9 meteorological towers, with the purpose of having representative data on the climatic conditions and wind in the zone. These data are essential for: • The wind farm design where the wind mid and extreme conditions are considered. • The selection of turbines to be used and their locations • Distance between turbines • The foresight of the energetic production, considering mid wind values, daily, seasonal, directional distributions, etc. • The operation and regulation of the wind farm to plan its real-time working, operation strategy (starting, stopping, orientation between other details) and, lastly, factors that affect the maintenance or lifespan (blasting, turbulence, extreme speeds, ice, or others)

[1]This Project is funded by the Global Environment Facility (GEF), implemented by the United Nations Development Programme (UNDP), and executed by Instituto de Investigaciones Eléctricas (IIE).

Criteria	Project Situation
2. The site should have access to the electric network to a short distance. The electric energy generated should be introduced to the distribution network through an electric sub-station. A considerable distance between the generation site and the network delivery requires an expensive conduction with losses. The network should have enough capacity to absorb and transmit the electric energy generated to a consumption center.	To the eastern limit of the project area, over the road 83 towards the north of the town San Francisco, there is a transmission line of 400 kV that connects two substations of the CFE, with enough capacity to receive the energy coming from the farm.
3. The site should have the proper road access. The wind-electric plant building requires big and heavy components transportation cranes. It also should consider the access for the turbine maintenance equipment.	The Project area polygon is limited to the west by the federal road 85 (Mexico - Nuevo Laredo) and to the east by road 83. The project entails the access road construction, although it is important to point out that the area already uses a rural roads network that communicates the different lands part of the project polygon, which are used, therefore, adaptation and rehabilitation will be necessary.
4. The land should have enough extension to install the proper voltage. In a more or less square site, approximately 12 MW per km^2 may be installed, independently from the turbine size.	The zones where wind turbines will be installed are extremely extensive. For this Project, wind turbines will be placed with a minimum distance of 200 m (central axe to central axe). Considering that the blades have a maximum diameter of 120 meters, the turbines will have a distance of approximately 80 m from blade tip to blade tip between them.
5. In general a simple, flat or slightly undulating land, with low buildings without major crops, is more appropriate than a complex (very hilly), or high field crops or buildings. Apart from access to the site, it is necessary to build within the land a path to the turbines, which is difficult in a complex land. Moreover, in general the intensity of turbulence will be higher in a complex land, increasing the fatigue loads on the turbine.	The lines of wind turbines will be located close to the shores of plateaus, on almost flat and rocky land, with low-rise scrub where there are no buildings. It is also important to consider that in the Project polygon already exists a network of rural roads that will be rehabilitated to meet the specifications for this type of project.
6. In general, it is best to locate a wind farm on land of low elevation. The low air density with the height also proportionately affects the power of the wind. For example, at 2,000 meters above sea level, the low wind density by 20%. An increase in the wind speed of 6 to 7% is needed to compensate this loss.	Wind turbines of this project will be installed in extremely low region: La Mesa La Sandía, which has an altitude of 445 meters, and Mesa La Paz, which has an altitude of 418 meters.

Criteria	Project Situation
Legal aspects	
7. The chosen site must have the possibility of obtaining the proper permissions. At the same time, the established land uses must not conflict with the development of a wind-electric Project. If the land is used for agriculture or farming, you can usually combine seamlessly with a wind advantage, while there are legal permits. In general, we must have proper permission to use land, a building permit, (both issued by the municipal government), permits generation issued by the Energy Regulatory Commission (CRE), an interconnection agreement (issued by CFE) and the environmental permit that is granted by the Environment and Natural Resources Department (SEMARNAT).	The site where the project will be developed is located on ejido lands and some private properties. The properties are mostly without a specific use, and in some cases are used as rangeland, so their use can be perfectly combined with the wind advantage.
8. It is important that the landowner is willing to sell or lease all or part of their land for the use of a electric-wind plant.	Frontera Renovable already has contracts with all the owners, as well as all the necessary legal documentation.
Environmental Aspects	
9. To select the appropriate site and perform detailed studies necessary to minimize the possible effect of any electric-wind plant in the flora and fauna, in general, are assessed, as well as on the routes of migratory birds, if any. Although the effect of an electric-wind plant on birds is insignificant according to several studies performed, measuring the potential impact it could have on them, in addition to all preventive and corrective actions, will minimize the possibility of impacts to birds.	Chapter IV studies that have been conducted on flora and fauna are described, especially on migratory birds and bats, in order to determine the possible impact that could have on them. Furthermore, in Chapter VI all mitigation measures in this regard, as well as plans and programs related to this issue will be described, and which will also be described in more detail in Chapter VII.
10. Another important thing to take care is the archaeological, which can intervene in obtaining building permits, and in some cases during the construction process may be archaeological remains, which could lead to setbacks in implementing the project.	Specifically within the study area, there is no information of possible archeological remains, such as provided in chapter III herein.

II.1.3 Physical location of the project and location blueprints

The PETM is located within the premises known as "Tres Mesas" located to the north-east of the head municipality of the municipality of Llera de Canales, in the State of Tamaulipas, at a distance of 24.4 km towards the south of the Airport of Ciudad Victoria. The closest location to the site is the City of Llera Canales (Head Municipality), located to the south-east of the project area, and the small town of General Pedro José Méndez, located to the south of it. Likewise, there is a small town in the border of the project polygon, called San Francisco and found in the border of Carretera Federal 85, approximately 47 km and 44 km from Ciudad Victoria and Ciudad Mante, respectively.

The farm is located within a polygon of 30,113 hectares, entailing Mesas de La Sandía. La Paz and Las Chinas. It is important to mention that within Mesa Las Chinas, no wind turbine will be placed.

The land is located where the PETM are mainly private and ejido properties, which has the corresponding leases. The topographic map showing the polygon of the property where the project will be located, where you can see all the properties that are included within the polygon, is presented in Appendix II.I.

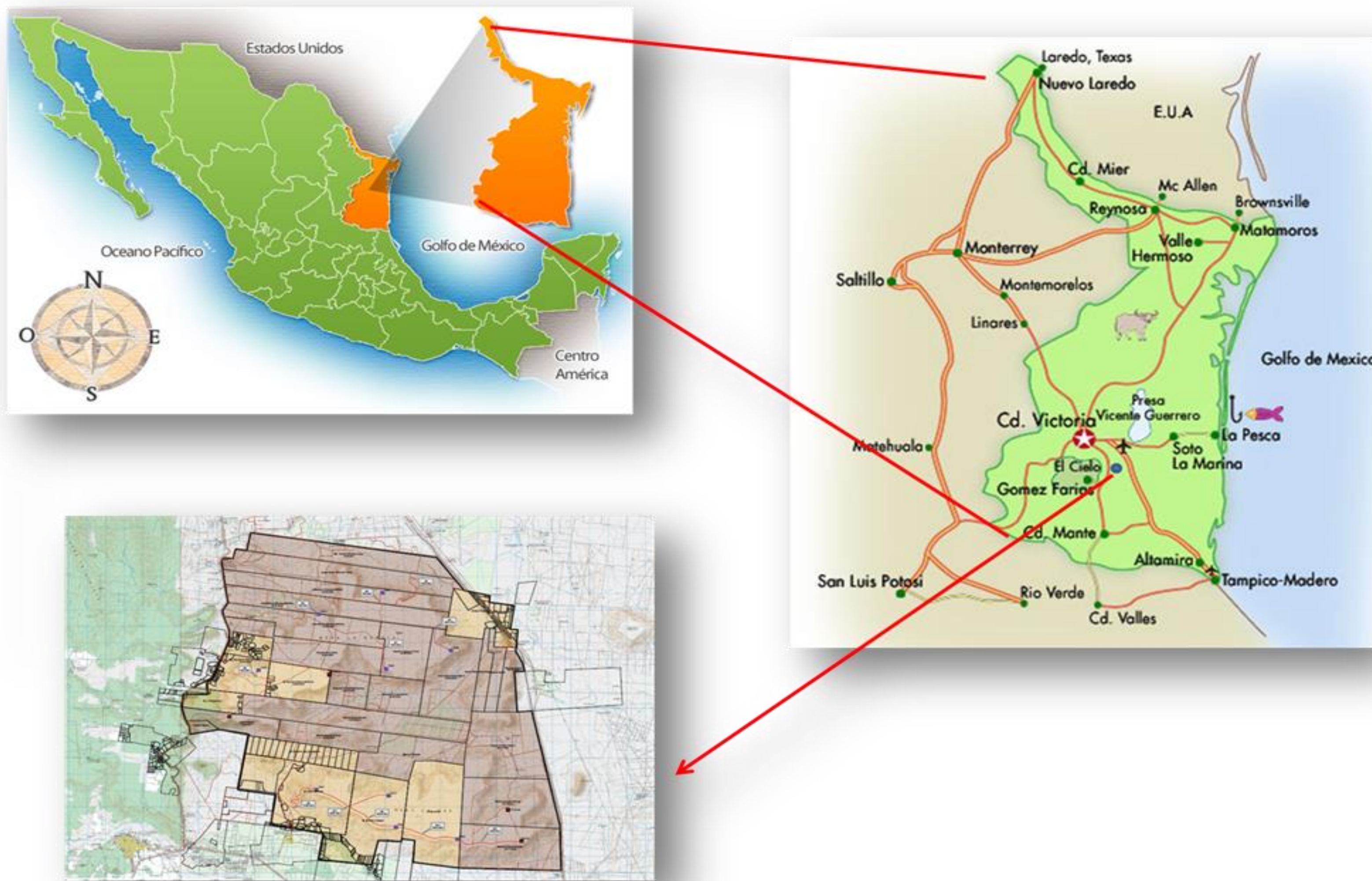


Figure II.2 Location of the Project site

The coordinates of the land polygon where the Project will be located are shown in the following table:

Table II. 3. Coordinates of the land polygon

Vertical	Coordinates (UTM)		Vertical	Coordinates (UTM)	
	X	Y		X	Y
1	503806.33	2597689.641	34	510290.707	2577505.866
2	509355.332	2596900.683	35	507433.609	2577855.511
3	509355.332	2597742.238	36	507693.345	2579383.958
4	512905.641	2597742.238	37	505615.456	2579813.522
5	513142.328	2597821.133	38	505315.760	2576956.424
6	513352.717	2597584.446	39	504196.897	2577895.470
7	513142.328	2597374.057	40	503317.790	2578095.267
8	517218.609	2592035.444	41	503647.455	2580153.177
9	517402.699	2592140.639	42	504856.227	2579963.369
10	517586.789	2591851.354	43	505145.933	2581741.563
11	517455.297	2591772.458	44	503098.013	2582071.228
12	517803.076	2591251.903	45	503667.435	2585447.798
13	517952.924	2590762.400	46	502089.038	2585727.514
14	518022.853	2590742.420	47	500510.641	2585457.788
15	518012.863	2590672.491	48	500480.672	2585907.332
16	517972.903	2590672.491	49	500440.712	2585897.342
17	518372.497	2589783.394	50	500320.834	2586117.119
18	518502.365	2589273.912	51	500101.057	2586976.246
19	517962.913	2589243.942	52	500160.996	2587875.333
20	518112.761	2586806.418	53	501449.687	2587875.333
21	518891.970	2586856.368	54	501459.677	2588634.561
22	519721.127	2583030.254	55	501719.413	2588784.409
23	519970.874	2583020.264	56	502618.500	2591062.096
24	519960.884	2582820.467	57	502628.490	2591751.395
25	519761.087	25822820.467	58	502318.804	2592590.543
26	520380.458	2579943.390	59	502268.855	2592960.168
27	520460.377	2577136.241	60	502568.551	2593459.660
28	514935.988	2577296.079	61	502208.916	2595967.113
29	512508.454	2577665.703	62	502388.733	2596166.910
30	512598.363	2578974.374	63	502818.297	2596146.930
31	511899.073	2579074.273	64	502978.135	2596726.342
32	511879.093	2578904.445	65	503567.536	2596626.443
33	510640.352	2578964.384			

II.1.4 Required Investment

The amount of investment required in local currency is approximately US$ 900,000,000 for all stages. The costs arising from the implementation of the mitigation measures in this project are already considered and included in the amount of investment.

Maintenance costs are generally very low when turbines are completely new, but it is estimated that as they are worn down components increase at an estimated range of 1.5 to 2 percent per year of the initial investment of the wind turbine.

II.1.5. Project Dimensions

The Tres Mesas wind farm is located within a polygon of about 30,113 ha. As mentioned above, the project involves the construction and operation of a wind farm consisting of the following permanent and temporary elements:

Permanent works:

- From 152 to 436 wind turbines of 1.6 to 3.3 MW of capacity, distributed in Mesas de La Paz and La Sandía. It is important to mention that in Mesa Las Chinas, we have not planned to install any wind turbine.
- Two operation and maintenance buildings, one in Mesa de la Sandía and another in Mesa La Paz.
- Electric Power Collection Air System (SARE).
- Electric Power Conduction Line (LCE) towards the Main Sub-station
- Collection Sub-stations
- Main Sub-stations
- Access Roads
- Permanent meteorological towers (TMP)
- Two helipads, one in Mesa la Sandía and another in Mesa La Paz.

Provisional works

- Two concrete mixture plants with ice manufacturing, one in Mesa la Sandía and another in Mesa La Paz
- Crushers and screens for the material product of the demolition, which are located to the side of the concrete mixture plants.
- Construction offices, warehouses, and temporary parking lots

It is noteworthy that the exact location of each of these elements is not yet defined, however, there are defined potential areas and corridors where the wind turbines would installed (Appendix II.2.). The areas occupying temporary facilities will be used later to build some permanent works such as building and maintenance operation.

Surfaces of permanent and temporary involvement of the project are presented in the following tables, showing the project will entail 3.01% of the polygon, from which 1.69% are permanent works and 1.32% are temporary works.

Table II.4 Impairment areas

Works	Total permanent impairment area (Ha)	Temporary impairment area	Total
Wind-turbine (436 wind turbines)	34.88	192.71	227.59
Operations and Maintenance Offices (O&M)	2.18	1.28	3.46
Helipads	0.33		0.33
Meteorological towers (10 towers)	7.80		7.80
Access Roads	352.69		352.69
Collecting lines	48.87	109.81	158.68
Transmission lines	47.71	90.99	138.70
Collecting sub-stations	12.55		12.55
Main Sub-station	1.51		1.51
Concrete plants		3.93	3.93
TOTAL	508.51	398.72	907.23
PERCENTAGE	1.69 %	1.32 %	3.01 %

Notes: All figures are approximate.

It is noteworthy that for the assessment of impacts of this statement, the surfaces of maximum involvement were considered, considering the maximum wind turbine in each of the stages, the widths of right of maximum route and options routes for longer transmission lines. Later there will be a more detailed description of the permanent and temporary surfaces of each of the elements of the project areas.

II.1.6. Current land use and water bodies in the project site and its adjacencies.

Within the polygon and its adjacencies there are no permanent water bodies, only small water levees built by farmers and ranchers and some intermittent water flows are recorded. The most important water reservoir but that is outside the limits of the SAR is Vicente Guerrero Dam that is located to the north.

Land uses are shown in the table below within the polygon of the project, being able to observe that 68% is submontane scrub, followed by deciduous lowland forest and agricultural areas.

Table II.5 Land uses and vegetation area

Ecosystem type	Vegetation type	Project polygon	
		(Ha)	(%)
Natural	Submontane scrub	20,756	68.93
	Tropical Mezquital	1,357	4.51
	Deciduous lowland forest	2,351	7.81
	Low thorny deciduous forest	1,010	3.35
	Pine-oak forest		--
	Oak forest		--
	Water body		--
Modified	Pastureland		--
	Irrigation agriculture	965	3.20
	Dryland agriculture	3,672	12.19
Artificial	Urban zones	2	0.01

It is important that in the area have historically made intensive farming activities and the establishment of livestock mainly cattle pastures, which in some areas has led to fragmentation of vegetable coverage.

II.1.7. Urbanization of the area and description of services required.

As mentioned above, within the property there are a number of rural roads, mainly in the east and west side of the polygon. These roads will be rehabilitated and equipped to allow the entry of construction equipment and trucks needed.

The polygon is a totally rural area that does not have potable water, electricity or drainage.

II.1.7.1. Water

During the stage of site preparation and construction, water will be used for road construction, concrete manufacturing, office use and pressure washing equipment for wind turbines after delivery to the site. Furthermore, water is used to moisten the dirt roads as necessary to minimize dust generation.

The water used is preferably treated and will be transported through pipes 20,000 liters to the site. There are plans for the installation of storage tanks in strategic places, where if necessary, it will be transported by gravity to the work sites using surface or pipe by the use of portable tanks.

Where necessary and feasible, the existing water wells will be used in the area, for which the appropriate arrangements will be made for the relevant concession.

For personal consumption, drinking water will be getting from nearby localities and 20-liter jugs will be placed in the workplace.

Currently, the usage or exploitation of national waters is not deemed necessary, however, in case of requiring the delivery of water, the corresponding license will be requested and obtained.

II.1.7.2. Electricity

The works for the site preparation and construction will be carried out normally during the day, therefore, very low power consumption is estimated for this stage. During the construction stage, portable diesel generators of 5 to 100 kV will be used.

II.1.7.3. Fuel

Most of the equipment or machinery to be used during site preparation and construction will use diesel and / or gasoline (loaders, graders, backhoes, excavators, compactors, trenchers, cranes, dump trucks, haul trucks). This fuel will be purchased at nearby service stations and transferred to the site by using pipes. There will be ground tanks for storage in the area of office building and storage area of machinery and equipment. Storage tanks should have dikes and all necessary safety devices.

II.1.7.4. Material Banks

It is important to point out that as regards as material banks, it is estimated that banks near the Project area material will be used, which must be duly authorized. According to Banks Stock Materials, 2009, in proximity to the project, there are three federal banks of gravel and sand materials: La Cañada, José Silva Sánchez, and San Pedro. [2]

II.2 PROJECT SPECIAL CHARACTERISTICS

II.2.1. Wind turbines

Wind turbines consist of three basic parts: a) the tower, which is usually made of steel and / or concrete and has a height ranging from 80-117 meters, b) the nacelle, which is placed in the tower, and it is a structure of reinforced fiberglass containing the main components of the turbine, including the gears, the generator and electrical controls, and finally c) and the rotor connected to the nacelle, which comprises the hub and three blades nose traditionally constructed of fiberglass and steel fittings with a length of 50 to 63 m by the blade, thereby forming a rotor of 100-126 m of diameter.

The petitioner is still assessing the type of wind turbine to be used; however, it is estimated that for stage one and two it will possibly be equipment VESTAS model V112 of 3.0 to 3.3. MW, with a rotor diameter of 112 meters.

The total height of each wind turbine, including tower and blades, is estimated to be maximum 117 meters, but it may vary depending finally on the wind turbine capacity, the blades length (which in turn depends on the wind characteristics at the exact location of the turbine), and the height of the towers selected.

Each wind turbine will carry a circular foundation 10 meters of radius, to a depth of 3-12 meters, depending on soil characteristics in the exact location of the wind turbine installation. The foundation will be concrete made.

Considering the above, it is estimated that the area affected by the foundation will be 400 m2 and 400 m2 will be required for parking and maneuvering area, giving a total area of permanent impairment of 800 m2 per turbine.

[2] http://dgst.sct.gob.mx/fileadmin/Bancos_09/bancos_Tamaulipas.pdf

As mentioned above, it is estimated that the park will consist of 152-436 turbines at most, divided into five stages, therefore considering a permanent impairment area of 800 m2, having the following effects caused per stage:

Table II.6 Permanent impairment area per wind turbines

STAGE	WIND TURBINES NUMBER	PERMANENT IMPAIRMENT AREA (Ha)	
		MINIMUM	MAXIMUM
Stage I:	19 to 39 wind turbines	1.52	3.12
Stage II:	28 to 58 wind turbines	2.24	4.64
Stage III:	22 to 74 wind turbines	1.76	5.92
Stage IV:	42 to 134 wind turbines	3.36	10.72
Stage V:	41 to 131 wind turbines	3.28	10.48
	TOTAL	**12.16**	**34.88**

Appendix II.3. contains a plan with the possible location of each wind turbine indicating which stage each of them correspond to.

For the installation of each wind turbine, temporary use of approximately 4,420 m of ^{2} for each additional wind turbine founding and permanent impairment area (800 m2) will be required. This surface is required for maneuvering the crane and installation of the turbines. Importantly, this surface area is considered temporary impairment, which returns to their original condition after completing the stage of preparing the site and building. The following figure shows an example of the areas of permanent impairment (red zone) and areas of temporary impairment (marked in gray areas).

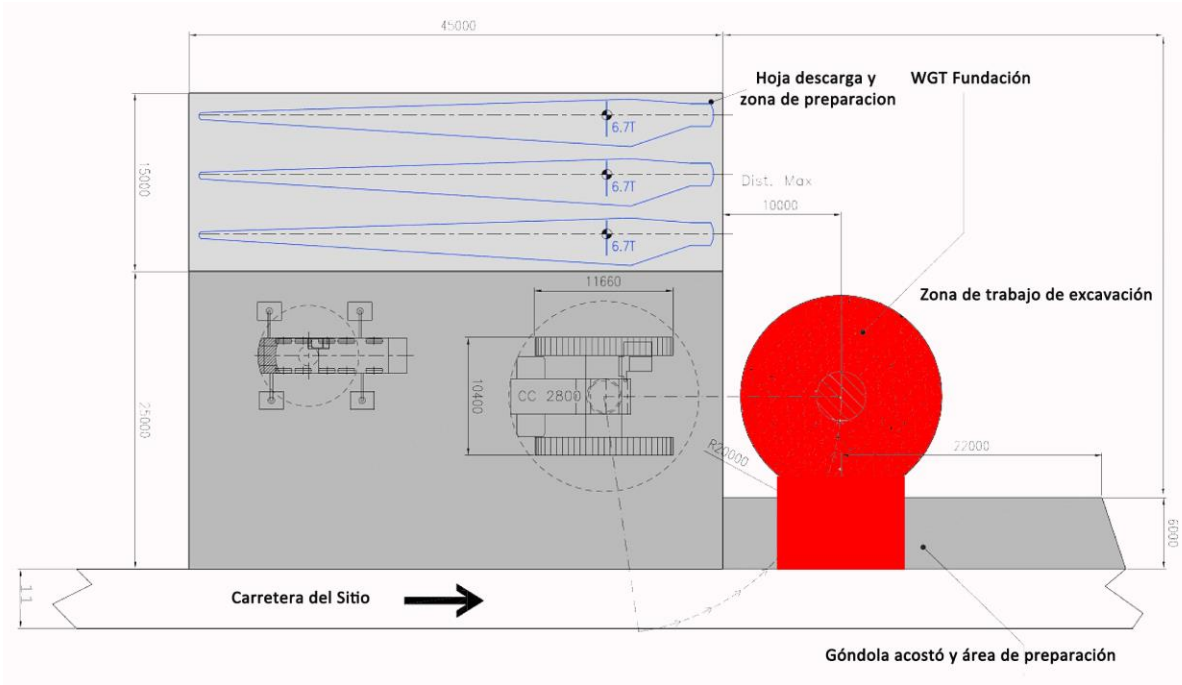


Figure II.3 Comparison of a temporary surface area involvement and permanent involvement in each turbine.

The following table shows surface temporal involvement for each of the stages of the project, considering that the farm will consist of 152-436 maximum wind turbines, divided into five stages.

Table II.7 Temporary impairment area due to maneuvers for the installation of each wind turbine.

STAGE	WIND TURBINES NUMBER	TEMPORARY IMPAIRMENT AREA (Ha)	
		MINIMUM	MAXIMUM
Stage I:	19 to 39 wind turbines	8.398	17.238
Stage II:	28 to 58 wind turbines	12.376	25.636
Stage III:	22 to 71 wind turbines	9.724	32.708
Stage IV:	42 to 134 wind turbines	18.564	59.228
Stage V:	41 to 131 wind turbines	18.122	57.902
	TOTAL	**67.184**	**192.712**

II.2.2. Operations and Maintenance Offices (O&M)

The Project will have two areas for building operations and maintenance, which will be located strategically: one in Mesa la Sandía and another in Mesa La Paz. The area these facilities will occupy is of approximately 10,875 m2 each. Within this area, the building will house operations and maintenance, which occupies an area of approximately 327 m2, a storage area and parking will occupy an estimated area of 739 m2, and the remaining area of 9,809 m2 will be destined to an area intended for storage equipment, both for construction and for the operation.

Considering that two buildings (one in each plateau) will be available, it is estimated that an area of 21,750 m2 (2.175 Ha) of permanent impairment will be taken. It is worth mentioning that are evaluating three potential sites for the location of this building in each land, which are presented in Appendix II.4.

It is important to note that during the construction of the wind farm, the area destined to the offices of operation and maintenance is temporarily used as office building and warehouse materials, in order to take advantage of areas already deforested within the property. Once the construction of the farm is concluded, the offices will be dismantled and the operation and maintenance building will be built, so this area is already considered within the area of permanent impairment. It is important to mention that the offices will be modular and pre-manufactured, in order to dismantle them and use them elsewhere.

Additionally, during the construction stage, it will be necessary to condition an area temporarily for the storage of materials, machinery, equipment and land product of all excavations. This area is located next to the area that will be aimed at building operations and maintenance, and it will occupy an area of 6,400 m2 (1,087 Ha), so considering that there will be two areas for each plateau, it is estimated that an additional area of temporary impairment of 12,800 m2 (1.28 Ha) will be required.

II.2.3. Helipads

The project has provided the construction of two helipads, one in Mesa la Sandia and another in Mesa La Paz, located next to the building operation and maintenance. The helipads will be permanent, occupy an area of 1,633 m2, and may be paved or stay with natural soil, depending on the characteristics of the selected site. Considering the above, it is estimated that the permanent impairment area for helipads be 266 m2 (0.3266 Ha)

II.2.4. Concrete mixture plant

Two floors of mixed concrete or concrete mixing plants, one in Mesa la Sandía and one in Mesa La Paz, located next to the building operation and maintenance will be installed. In these plants, bulk cement, sand, stone aggregates and additives to be mixed as are required and prepare the concrete for the foundation of each turbine will be stored. These plants will have ice factories to be incorporated into the concrete mix when needed.

Near the surface mixing plant, an area will be destined for crushing and screening the material resulting from the excavation. The material, product of the excavation, will be sent to the crushing and screening, where the rocks will be reduced in size to be used as filler or base aggregate for roads.

Each mixing plant will occupy an area of approximately 1,963 Ha, so considering that two plants mixed concrete will be needed, it totals an area of 3.93 ha of temporary impairment. After the construction phase, the facility will be dismantled and removed from the project area.

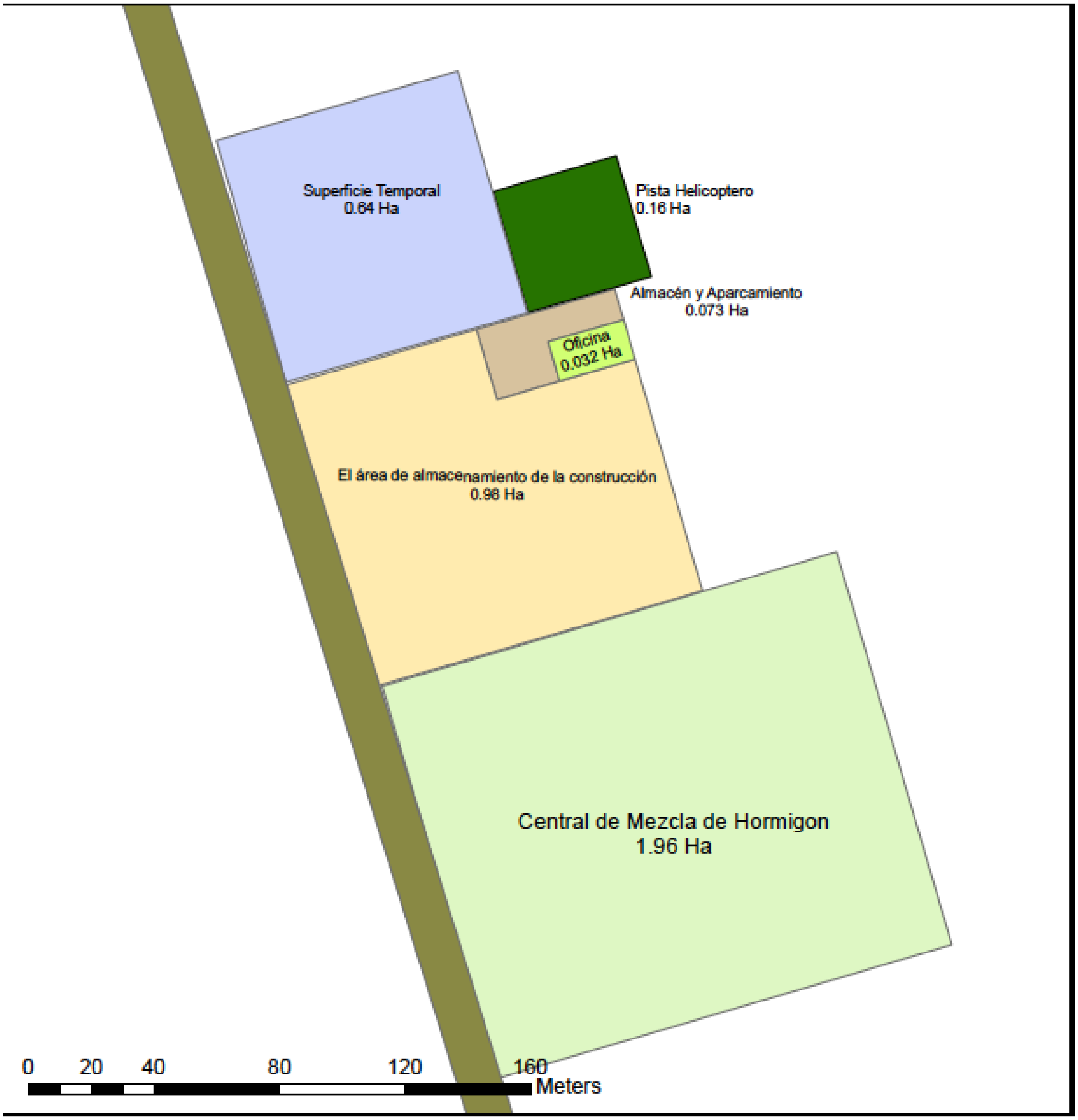


Figure II.4 Proposed distribution for operation and maintenance building, helipad, concrete plant and temporary storage area.

II.2.5 Permanent meteorological towers (TMP)

Meteorological towers commonly used for such projects are framed with metal towers similar to those of wind turbines, anchored to a concrete foundation at the base and sometimes do not require guide wires heights. Currently it exist in the Project area 4 meteorological towers, one located south of Mesa la Sandía (TM Sandía and TM01), and two located in the eastern part of the Mesa La Paz (TM North and TM South). We are in the process of carrying out the construction of 9 more meteorological towers, which may be temporary and will remain in the first year of operation of the wind farm. However, it is estimated that the construction of additional towers for data collection during the operation stage is likely to be necessary, a maximum of 10 permanent towers distributed in the project area is estimated; the possible location is presented in the plan of Appendix II.5.

It is estimated that each meteorological tower occupies an area of 78 hectares, taking into ditch the foundation, the placement area and buffer zone tensioners for maneuvers. Taking the scenario of 10 meteorological towers, it is estimated that the area of permanent impairment will be 7.8 ha.

II.2.6. Access Roads

To access the Project area building, new roads and rehabilitation of the existing rural roads within the Project polygon will be required. In the plateaus, there is already an extensive network of rural roads, mainly in the east and west side of the polygon. These roads will be rehabilitated and equipped to allow the entry of construction equipment and trucks needed.

It is estimated that in general the roads have a width of approximately 14 meters between the internal roads and 60 meters of main access roads. It is important to point out that this amplitude is the maximum impairment scenario, and considers the width of the road, the shoulder, sidewalk and buffer zone. The width (w) and finish (final cover) thereof may vary depending on the service provided within the Project.

It is important to point out that five potions of access roads to the property are being evaluated, all of which are considered in this paper. It is estimated that the roads will occupy a maximum area of permanent impairment of 352.69 Ha, considering the maximum width for all roads and considering all options for access roads.

Next, a table is presented with mileages of roads needed for each phase of the project, indicating the estimated area of permanent impairment. This table shows the internal roads and the different options for access roads to the project

Table II.8 Necessary roads for each of the project stages

STAGE	DISTANCE (km)	WIDTH (m)	Total impairment area (Ha)
Stage 1	17.19	14	24.066
Stage 2	18.73	14	26.222
Stage 3	14.29	14	20.006
Stage 4	20.91	14	29.274
Stage 5	18.63	14	26.082
Access road option 1	9.57	60	57.42
Access road option 2	8.23	60	49.38
Access road option 3	8.64	60	51.84
Access road option 4	5.81	60	34.86
Access road option 5	5.59	60	33.54
TOTAL	127.59		352.69

Appendix II.6. contains a map of the existing roads and new roads.

II.2.7. Transmission system

Energy generated from each turbine will be transmitted to the collection substations and then to substations in the final interconnection point of the CFE. It is important to note that they are still in the process of defining exactly the final line, however, different options are being assessed. The layout of the transmission system is shown in Appendix II.7 with the different options being evaluated, as well as a brief description of each component indicating the estimated impairment areas.

- *Underground line of 34p5kV- that will connect each turbine.*

These lines will be underground and will connect all wind turbines. The line laying will be on the roads that connect each turbine, so it is estimated that there will be additional permanent impairment area. It is noteworthy that the length of this line will depend on the final location of each wind turbine.

- *Collecting lines of 34p5kV, which may be underground or overhead*

These lines are connected to a collecting substation and they may be overhead or underground. For purposes of assessing the impacts of this event, the worst-case scenario was taken into consideration, which considers overhead line.

The overhead line poles of *34p5kV* will occupy an area of 15 meters by 15 meters, ie 225 m2, which will go into the right track and will be considered as a permanent impairment area. It is estimated that approximately 11 poles per kilometer will be placed.

The width of right of way for these overhead collecting lines should not exceed 25 meters, within which poles and rustic way of 5 meters wide will be installed. Because of this, it is considered that within the 25-meter wide right of way, there will be a permanent impairment of approximately 0.77 Ha per kilometer. The remaining area will only be pruned so that does not pose a risk, however this is considered a temporary impairment area.

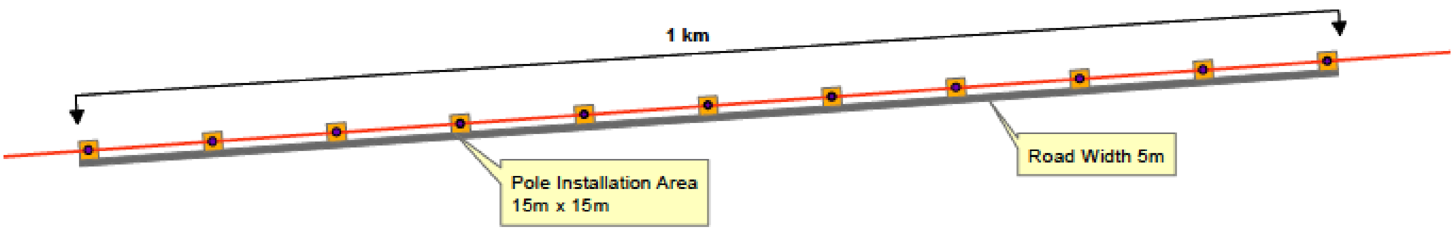


Figure II.5 Sketch of the overhead collecting line of 34p5kV

The following table shows the temporary and permanent impairment area (poles and road width of 5 meters, equivalent to 0.77 Ha per kilometer).

Table II. 9. Approximate distance and areas of impairment for collecting lines

STAGE	Length (m)	Right of way width (m)	Total area[1]	Permanent area[2]	Temporary area[3]
Stage 1	6,972.39	25	17.43	5.37	12.06
Stage 2	12,913.97	25	32.28	9.94	22.34
Stage 3	14,684.85	25	36.71	11.31	25.40
Stage 4	13,333.07	25	33.33	10.27	23.07
Stage 5	15,568.41	25	38.92	11.99	26.93
TOTAL	**63,472.70**		**158.68**	**48.87**	**109.81**

[1] Length width right of way
[2] Lenght of 0.77 Ha. of permanent impairment per kilometer
[3] Total area minus permanent area

- *Overhead line of 69/115 kV,*

This transmission line will be overhead and it will carry the electricity to the final interconnection point of the CFE. .

The overhead line poles of *69/115 kV* will occupy an area of 33 meters by 33 meters, ie 1,089 m2, which will go into the right track and will be considered as a permanent impairment area. It is estimated that approximately 11 poles per kilometer will be placed.

The width of right of way for these overhead collecting lines should not exceed 50 meters, within which poles and rustic way of 5 meters wide will be installed. Because of this, it is considered that within the 50-meter wide right of way, there will be a permanent impairment of approximately 1.72 Ha per kilometer. The remaining area will only be pruned so that does not pose a risk, however this is considered a temporary impairment area.

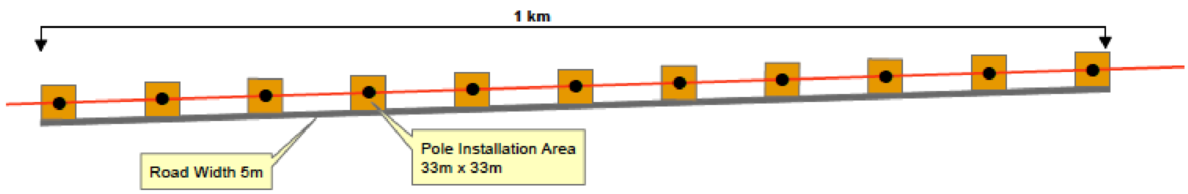


Figure II.6 Sketch of the overhead collecting line of 69/115 kV

Currently, we are still assessing in detail two options for stroke, however, we already have estimation and lengths of each option, and for purposes of this demonstration, we are considering the option with the longest length, as it is considered as the worst-case scenario.

The different options of lines are presented in the following figure, while in the same plane Appendix II.7 presents a more readable scale.

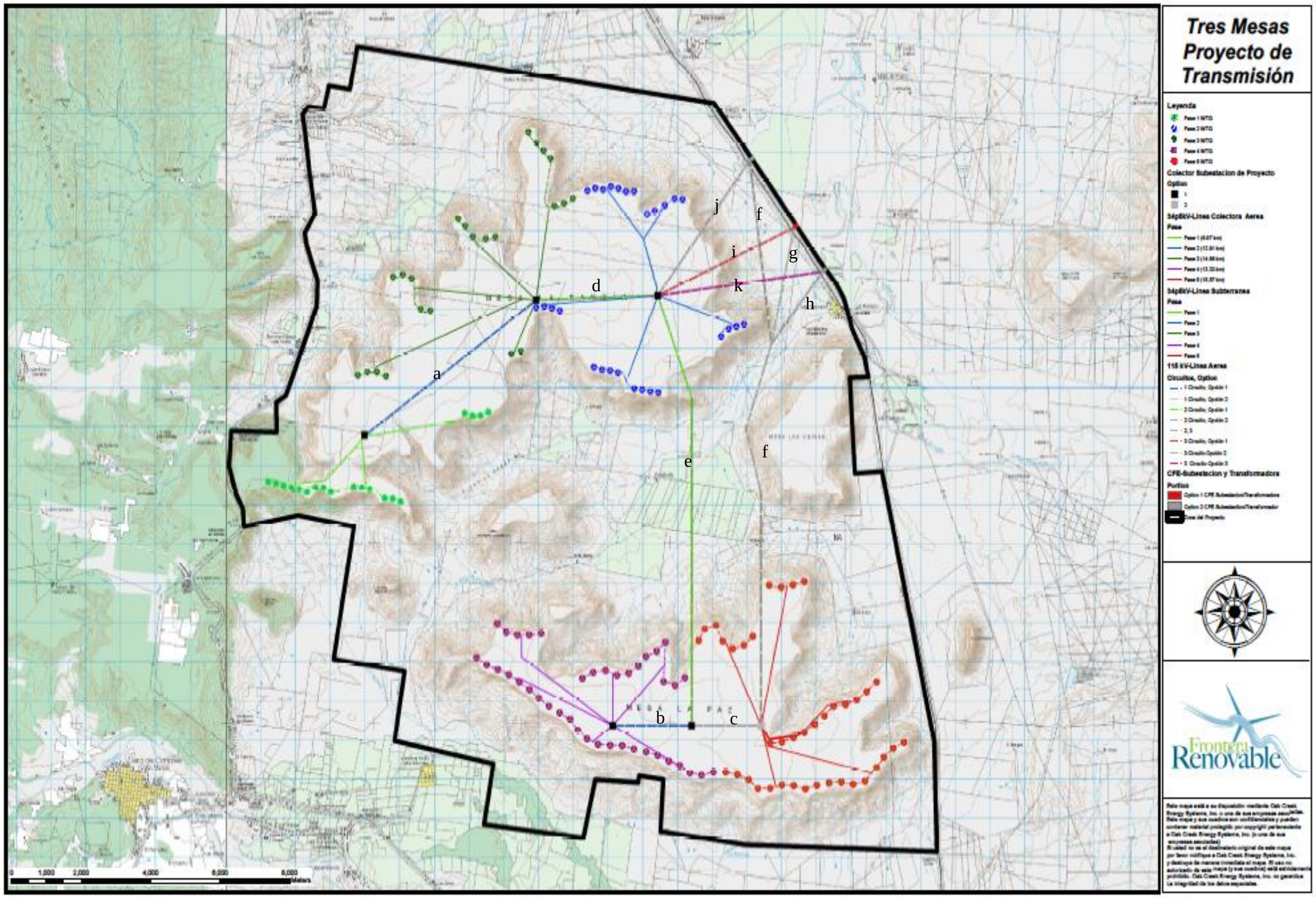


Figure II.7 Options for the collecting overhead line of 69/115 kV

The following table shows the temporary and permanent impairment area (poles and road width of 5 meters, equivalent to 1.72 Ha per kilometer), considering the two assessed options.

Table II. 10. Distance and overhead line impairment area, Option 1.

ID	Stage	Option	Length (m)	Right of way width (m)	Total area[1]	Permanent area[2]	Temporary area[3]
A	Stage 1	1	6,000.10	50	30.0005	10.320172	19.680328
B	Stage 4	1	2279.48	50	11.3974	3.9207056	7.4766944
d	Stage 1	1	3,512.14	50	17.5607	6.0408808	11.5198192
e	Stage 4	1	11175.17	50	55.87585	19.2212924	36.6545576
I	Stage 1	1	4271.65	50	21.35825	7.347238	14.011012
J	Stage 1	2	4350.11	50	21.75055	7.4821892	14.2683608
K	Stage 1	3	4773.30	50	23.8665	8.210076	15.656424
Total area considering the worst-case scenario					**138.70095**	**47.7131268**	**90.9878232**

	Worst-case scenario

[1] Length width right of way
[2] Lenght of 1.72 Ha. of permanent impairment per kilometer
[3] Total area minus permanent area

Table II.11 Distance and overhead line impairment area, Option 2.

ID	Stage	Option	Length (m)	Right of way width (m)	Total area[1]	Permanent area[2]	Temporary area[3]
A	Stage 1	1	6,000.10	50	30.0005	10.320172	19.680328
B	Stage 4	1	2,279.48	50	11.3974	3.9207056	7.4766944
c	Stage 4	2	1,997.74	50	9.9887	3.4361128	6.5525872
f	Stage 4	2	14,673.53	50	73.36765	25.2384716	48.1291784
g	Stage 4	2	3,040	50	15.2	5.2288	9.9712
h	Stage 4	3	2,367.72	50	11.8386	4.0724784	7.7661216
Total area considering the worst-case scenario					**124.75425**	**42.915462**	**81.838788**

	Worst-case scenario

[1] Length width right of way
[2] Lenght of 1.72 Ha. of permanent impairment per kilometer
[3] Total area minus permanent area

As shown in the tables above, option 1 would have the greatest length, and consequently the largest area of impairment, so for purposes of this demonstration that option for impairment assessment purposes was considered.

- *Collecting sub-stations*

In Mesa la Sandía, it is estimated that there will be three collecting substations, while in Mesa La Paz, two collecting substations and a third option are estimated. Within each substation, there will be transformers raise the voltage of power so that it can be sent to the Main Substation.

The area to be occupied by each substation is approximately of 2,510 m2 (0.251 Ha), so it is estimated that an area of 12,550 m2 (12.55 Ha) maximum will be the total impairment, considering the worst-case scenario, that would be three substations in each plateau.

- *Main Sub-station*

The Main Substation will receive all electricity of the Project and connect to the network through the CFE going through the limit of the Project polygon boundary. It is estimated that this substation occupies approximately 15,060 m2 (1,506 Ha). There are three location options, which are being evaluated, and they are shown in the plan contained in Appendix II.7.

II.2.8. Summary of temporary and permanent impairment areas

The following table shows a summary of the temporary and permanent impairment areas, which, as already mentioned, they are considering options or scenarios with the largest impairment area.

Table II.12 Impairment areas

Works	Total permanent impairment area (Ha)	Temporary impairment area	Total
Wind-turbine (436 wind turbines)	34.88	192.71	227.59
Operations and Maintenance Offices (O&M)	2.18	1.28	3.46
Helipads	0.33		0.33
Meteorological towers (10 towers)	7.80		7.80
Access Roads	352.69		352.69
Collecting lines	48.87	109.81	158.68
Transmission lines	47.71	90.99	138.70
Collecting sub-stations	12.55		12.55
Main Sub-station	1.51		1.51
Concrete plants		3.93	3.93
TOTAL	508.51	398.72	907.23
PERCENTAGE	1.69 %	1.32 %	3.01 %

Notes: All figures are approximate.

II.2.3 Works Schedule

The Project Tres Mesas Wind Farm is planned in three stages, starting in November 2013 and ending in March 2017. It is important to point out that this works schedule is estimated and it could have variations.

Table II.13 shows the works schedule in stages, while in Table II.14 shows the works schedule for each of the stages. It is noteworthy that many activities are performed simultaneously, so some of the turbines will already be installed and running while others are being assembled

Once in operation, it is expected that the wind farm has a lifetime of 20 to 50 years, during which preventive and corrective maintenance activities will take place.

Table II.13 Activities schedule per stage

	2013		2014												2015												2016												2017		
	N	D	E	F	M	A	M	J	J	A	S	O	N	D	E	F	M	A	M	J	J	A	S	O	N	D	E	F	M	A	M	J	J	A	S	O	N	D	E	F	M
Stage I:	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																									
Stage II:					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																					
Stage III:														■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
Stage IV:																					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
Stage V:																										■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Table II.14 Activities schedule for the site preparation and construction of each stage

	ACTIVITY	MONTH																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Delimitation of working zones.	■	■	■	■													
2	Land clearing and clearance	■	■	■	■	■	■											
3	Construction, rehabilitation, and extension of roads		■	■	■	■	■	■	■									
4	Construction and/or provisional installations		■	■	■	■	■	■										
5	Cutting, filling, leveling and foundation of the wind turbines		■	■	■	■	■	■	■	■	■							
6	Materials and equipment transportation to the wind turbines site		■	■	■	■	■	■	■	■	■	■	■					
7	Wind turbines assembling							■	■	■	■	■	■	■				
8	Collecting system (SARE) transformers and connection lines (LCE)					■	■	■	■	■	■							
9	Tests (Pre-starting)									■	■	■	■	■	■			
10	Electrical connection									■	■	■	■	■	■	■	■	
11	Starting of commercial transactions												■	■	■	■	■	■

II.2.4 Site preparation and construction

For the site preparation and construction of the PETM, specialized companies services will be hired. It is believed that one specialized company will be hired to perform all work, however, it is possible to hire a company for civil works and another for electrical works.

To prepare the site, the execution of the following activities will be considered:

II.2.4.1. Negotiation with owners (change of land use)

Prior to the activities of site preparation and construction, it will be necessary to conduct negotiations with the owners of the properties affected by the project in order to make the payment for the purchase or lease of the land, because the owners may not use the area occupied by wind turbine for productive activities, or carry out constructions in surrounding areas.

The properties are private and ejido, and most already have the relevant leases. On the Plan contained in Appendix II.1 shows the properties that will be affected by the Project.

II.2.4.2. Delimitation of working zones.

In order to start the construction activities, the path staked areas where construction works will take place, according to the works schedule. Work areas should be demarcated and, if necessary, temporary works to stabilize will be performed, and then proceed with the land clearing and clearance.

II.2.4.3. Land clearing and clearance

First, the areas occupied by roads and areas occupied by complementary works should be cleared:

- Construction offices and **machinery and equipment storing area.**
- Concrete plant
- Helipads

Later, it should proceed with the clearing of the areas to be occupied by the different permanent components of the project, following the works schedule and timelines.

The clearing will be performed as far as possible by hand and, if necessary, equipment and chainsaws will be used. Each area to be cleared, the complete removal of trees, shrubs and herbs will be performed, running grubbing, slashing and uprooting operations, so that the area is clear of wood and waste.

The vegetal soil layer removed should be kept separate from the rest of the material from the excavation to be subsequently used for fillings and restoring areas temporarily impaired. The remains of vegetation that will be removed will be "chopped" and stored in a specific site for subsequent return to the ground and / or use in reforestation areas or local nurseries.

In areas where vegetation removing is required, the Fauna and Flora Rescue Program will be implemented which will mitigate the effects on these elements.

It is estimated that about **508.51** Ha of will be removed permanently and **398.72**Ha temporally. It is noteworthy that these clearing areas are the worst scenarios, considering the installation of 436 wind turbines, which is the maximum range that is being managed, and the facilities of the longest routes of transmission lines are being evaluated.

II.2.4.4. Rehabilitation and expansion of roads

As mentioned above, as far as possible, the network of existing on-site roads will be used, however, it will be necessary to build new roads and expand and rehabilitate some that do not meet the specifications required for heavy vehicles and do not have the breadth to allow passage to the equipment and materials needed for each stage. These roads will allow access during construction and operation of the farm.

It is estimated that in general the roads have a width of approximately 14 meters between the internal roads and 60 meters of main access roads. It is important to point out that this amplitude is the maximum impairment scenario, and considers the width of the road, the shoulder, sidewalk and buffer zone. The width (w) and finish (final cover) thereof may vary depending on the service provided within the Project. However, all roads will comply with applicable regulations and with the requirements for transit of heavy machinery.

In general, new roads, as well as the roads to be expanded and rehabilitated comply with the requirements for heavy vehicle traffic.

II.2.4.5. Construction and/or provisional installations

During the site preparation stage, the construction of the temporary works that will support during the construction stage of the farm will take place, including:

- Construction offices and machinery and equipment storing area.
- Concrete plant

All these buildings will be dismantled and removed from the site upon completion of the construction stage.

II.2.4.6. Rocks removal and blowing up

Due to the soil hardness, it is estimated that approximately 30% of the areas where the activities of digging for laying foundations for wind turbines will take place, blowing up with explosives will be required. For the first stage, it is estimated that approximately 2 tons of explosives will be used. A geotechnical study to determine more accurately the areas that will require blowing up, as well as the quantity of explosives to be used for each stage will be done.

The material resulting from the blowing up will be crushed and will be used for roads and for filling in the areas where necessary.

II.2.4.7. Excavation, cuts, and filling-in

Excavation consists of the removal of land in areas where some type of construction or foundation will be performed. Cuts and fills consist of earthworks during construction, always ensuring that the amount of material cuts matches the amount necessary to fill embankments. Considering that the land where the project is intended to perform two plateaus with small slope, will seek to minimize the amount of cut and fill.

Excavations, cuts and fills will be made as provided in the design drawings, trying at all times to minimize the impact, maintain profitability and comply with all applicable safety standards. Materials product of these activities may be used to fill and embankments provided they meet the required specifications.

Rocky Excess material will be crushed and used as aggregate for roads. The rest of the excavated material will be dispersed on site, therefore, is not expected to have to carry excavated outside the Project area material. However, if necessary, excess material will be available in landfills duly authorized by the authorities.

II.2.4.8. Compaction and leveling

In order to ensure that soils are stable and minimize unusual loads on the foundations or structures, compaction and leveling of the ground is required. When landfills are performed, these will be placed in layers, compacting different at different levels depending on the requirements of the facility and / or infrastructure. All compaction should comply with all applicable local and national standards.

All land will be leveled according to the specifications required for each structure or element. This leveling should be designed to maintain slope stability and minimize disturbance to natural drainage patterns. The leveling of the roads meets the specified minimum requirements regarding the turning radius, width and grade of road and design load.

II.2.4.9. Wind-turbines construction

To start with the construction of wind turbines, it is necessary that road construction and corresponding access is already completed. A brief description of parts required for the assembling turbines activities is presented, although it should be noted that the order may have small variations and some activities may be simultaneous:

a) Foundation

The foundation of the base of the turbines aims to securely anchor the turbine to the ground.

In the installation of wind turbines, two types of foundations are typically used, which depend on soil conditions and the wind turbine manufacturer's requirements. The first type of foundation is a continuous base plate ("*mat*"). Figure II.8 shows an example (picture comes from a wind power project in Albany, Australia). The second type is a pier, and is shown in Figure II. 9. The mat foundations are wide and shallow, while the pier one is narrow and deep. There are also two other types of foundations, one named "pile anchors support" or another called "rock anchors." Considering the terrain conditions, it is assumed that the foundation type to be used is the pier one, however, this will depend on the results of geotechnical studies, wind farm final design, the specifications of the manufacturer of the wind turbine, and constructability. Although there are several types of foundations, they all require approximately the same area.

The concrete used for the foundations will be produced in plants and concrete, and it will be transported to the site using mixer trucks or tops.

Figure II.8. Example for installing a mat foundation.

Figure II.9. Example for installing a pier foundation.

b) Assembly of wind turbines.

Wind turbine blades and tower sections are very long and very heavy elements, so specialized equipment and skilled labor to install them correctly and safely are required. Specialized vehicles and truck mounted cranes towers are required to properly transport these structures to the site, as well. Considering that security is the paramount concern, there are plans to develop and implement a security plan and a plan of assembly according to the manufacturer's specifications.

Once construction has started, the components will be delivered directly to the sites where the turbines will be located or in the office building and machinery and equipment storage area to be moved subsequently to specific sites. This will depend on the location of each wind turbine, access roads, and the size of the tower sections, blades and nacelle.

On the site, the lower sections of the towers will be placed immediately in the foundations, and the remaining components will be located around in a planned layout. Crews crane will lift the turbines as soon as possible as well as all components when they arrive, to minimize the time that the team remains on the ground.

For the assembly of wind turbines, it is estimated that two cranes of 90/100 will be used and platforms of 9 m x 11 m will be installed. Once cranes are installed, the wind-turbine assembly can take place.

Once towers have been mounted, internal and external electrical connections follow.

The table shown below contains samples of the turbines options that are being evaluated for this project; the Vestas V112 model remains the most feasible for Stage one and two.

Table II.15. Wind-turbines options

Manufacturer	Model	Capacity	Blades diameter	Post Height
REpower	MM100-2.0	2.05 MW	100 m	80 m – 100 m
RE power	3.2 M	3.2 MW	114 m	93 m
Vestas	V100 - 110	2.0 MW	100 – 110 m	80 – 95 m
Vestas	V117	3.0 – 3.3 MW	117 m	91.5 m
Vestas	V112	3.0 – 33. MW	112 m	84 m
Vestas	V126	3.0 – 3.3 MW	126 m	117 m
Siemens	SWT2.3	2.3 MW	108 m	80 – 99.5 m
Siemens	SWT3.0	3.0 MW	113 m	80 – 100 m
GE	1.6/1.7 - 100	1.6 – 1.7 MW	100 m	80 – 86 m
GE	2.5	2.53 MW	120 m	110 m
Nordex	N117	2.4 MW	117 m	90 m

II.2.4.10. Installation of meteorological towers

Ten (10) meteorological towers will be installed on the site in order to make accurate readings of the weather. These data are used to monitor the performance of wind turbines, and include wind speed and direction, barometric pressure, humidity and temperature. The tower will be assembled on site and anti-perching points will be used on horizontal surfaces to prevent birds from landing and nesting in it. Figure II.10 shows example of a meteorological tower with metal straps.

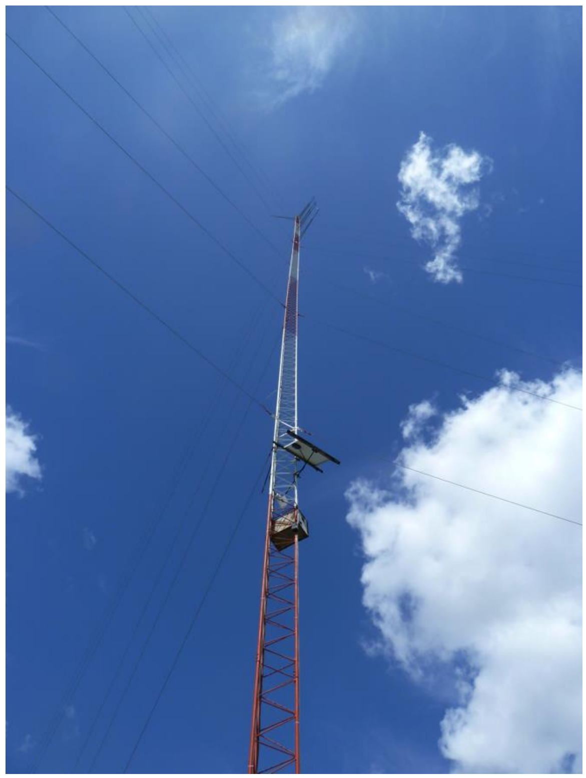


Figure II.10. Typical meteorological tower with single pole and metal straps.

In general, to build the meteorological tower once clearing, cleaning and leveling the ground have been finished, the following activities are necessary:

- Foundations installation
- Meteorological tower raising

For foundations, concrete will be used, which will be prepared in the field using portable mixers, which will be located on the access roads. Once the site has been prepared, the base and anchors will be installed later to assemble the towers using the method of vertical stack to minimize environmental disturbance.

A guidepost will be installed, which includes 3 basic parts: (1) a pulley to assist in lifting the tower sections, (2) a pole to get the height needed to connect each section of the new tower (this may be thick-walled steel pipe or a lattice structure for large towers), and (3) a set of clamp to secure the system to the tower.

The process begins with the installation of the lower section of the tower to the base pad. The guidepost is then secured in the side of the first section, with the pulley at the top, and the second section is lifted. The guidepost is then raised and attached to the second section. This process is repeated until the tower is fully built. A crewmember climbs the tower to align and hold the tower sections. The work is done by lifting the ground staff or a winch on the bottom of the tower.

II.2.4.11. Construction of transmission lines and substations

a) Underground collecting lines layout

There are two methods to install underground cables. The first method is to open a trench to the desired depth, directly put the cable and then fill the trench with the same material. The second method is to use specialized machinery that is opening the trench exactly the desired size while placing the cable goes and closing the trench. This machinery is usually used in rocky terrain and has great benefits in terms of time efficiency and impact reduction.

The material with which the trenches are filled will be the same material removed, however, if this material had insufficient thermal conductivity (ie, that do not allow heat to properly dissipate) it may be necessary some other use as a fill any other material with special specifications to allow radiating the cables heat. In this case, the material extracted from the trenches would be used as fill material in areas where needed, and if there were surpluses; they would be arranged in duly authorized sites.

b) Overhead lines layout

The overhead power line will be supported on wooden posts or concrete on concrete foundations. The assembly and mounting of towers consist of assembling and installing towers at sites determined by the project and leave them ready for laying and tensioning cables. Once the base is leveled and the foundation built, can the assembly and rising of the higher bodies can follow.

Once the tower is mounted, it is proceed with the placement of the land system and cable laying and tensioning, which consists of placing the cable and then stressing it to leave it at a certain height from the ground as well as the placement of fittings and necessary adjustments to the upper ends of the structures. For cable laying, iron pulleys are used. Finally, the fastening hardware and all related accessories are placed.

b) Construction of substations

The energy generated by the turbines will be transported to the substations via ground and / or overhead collecting lines.

The construction procedure for the substations will be typical of any civil works, consisting of grading and backfill if necessary, foundations, bricklaying, and finally finishes and details. The substations will be surrounded by a fence with barbed wire and will have safety signs; coupled with the cables counted with a protective cover that prevents accidental electrocution of birds.

The components that will be installed in substations consist of switches, power transformers, lightning arresters, SCADA system, grounding system, control circuit wiring, power reactor, capacitors, etc.. The substation will comply with all security requirements and design contained in the applicable regulations.

II.2.4.12. Test connection, set each turbine control, fine adjustment and acceptance of the work.

Finally, once the infrastructure and completed electrical connections are ready, the connection tests are carried out, and generally, the operation of each turbine and electrical installation are verified, as well as, if necessary, fine adjustments necessary for such operation are made.

II.2.4.13. Restoration, cleaning, and signaling

Restoration and cleaning start once wind turbines and supporting equipment have been installed. Work areas will be leveled, considering those pending before the building unless otherwise required to do so in order to maintain soil stability. During cleaning, waste remaining in work areas shall be provided in areas approved for it.

Work areas will be restored to achieve its original condition as far as possible and where this is practical, erosion control measures will be implemented, such as permanent terraces in areas with steep slopes.

II.2.5 Description of works and interim project activities

For site preparation and construction, work fronts as they proceed through the construction will be located. Workers will preferably stay in nearby towns; so the establishment of fixed workers camps will not be necessary. If necessary, mobile trailers will be installed at strategic locations or nearby communities, where dining services, housing and health services will be provided. Additionally, and if necessary, there will be mobile latrines in work areas, considering one every 20 workers.

As mentioned above, there will be other support services during the stage of site preparation and construction, including: Concrete plant, crushers and screens material from the excavation, administrative offices, warehouse machinery and equipment and parking. These facilities have already been described above.

II.2.6. Operation and maintenance.

II.2.6.1. Operation

The operation of a wind farm can be divided into three main processes:

> **1. Generation:** It refers to obtaining electric energy from harnessing the kinetic energy of wind. The wind turns the rotor of the wind turbine, which rotates at very slow speeds, between 5 and 20 revolutions per minute.
>
> Wind turbines generate power at a voltage of about 690 V (depending on the manufacturer, this voltage can be up to 12 kV) and rise by up to 34.5 kV transformer. This energy is conducted to a collecting substation.

To convert wind energy to electricity, a wind turbine captures the kinetic energy of wind through its aerodynamic rotor and converts it into mechanical energy that concentrates on its axis of rotation or main shaft. The rotor hub is the element to which the blades are assembled, and by which the power collected by the rotor is transmitted to the main shaft. The nose of the rotor is a front cone-shaped cover that serves to deflect wind towards the drive train and improves ventilation indoors, eliminating undesirable turbulence at the front center of the rotor and improves aesthetics.

2. Conversion: The energy received in the collecting substations, transformers is high by 34.5 kV to 69 kV or 115 and then is sent to the CFE substation, where it will climb back up to 400 kV.

3. Electrical Conduction: The energy generated in the park is sent from the substations to the Principal Collecting Substation through overhead transmission line. The main substation is finally connected to a line of CFE in order to provide clean and renewable electricity to the domestic market in the region in order to meet the characteristics of individuals or companies needs. The sale of power generated by the park has not yet been agreed with an entity or company, so the destination of this energy is not fully defined.

Each turbine is equipped with meteorological sensors that measure wind direction, wind speed and room temperature. Also, each turbine will be equipped with a built-in automatic control system to regulate all operational aspects of the turbine. All the regulating and controlling features of the plant are carried out with a cutting-edge control system. It will also install a Supervisory Control and Data Acquisition System known as "SCADA" which remotely monitor the operation of each turbine.

In general, the operation of wind turbines is automatic; therefore, operators are not necessary. The manager and staff in charge only monitor the performance of the turbines from a control room in the office and if they detect a fault, they determine if it is necessary to move the turbine for inspection. The staff in charge, from the control room, can begin the manual control if required or for maintenance purposes or quick troubleshooting. Wind turbines are monitored 24/7.

On the other hand, they are also receiving signals from the tower meteorological sensors continuously.

Operations staff monitor these signals and order corrective maintenance if necessary. They also generate monthly reports turbine energy production and total incidents, including accidents and failures and possible changes in the parameters of the control systems.

II.2.6.2. Maintenance and surveillance

Wind farm maintenance is performed according to the requirements established by the suppliers and manufacturers of the turbines. The 24-hour monitoring is done during day 365 days a year remotely. If during this monitoring, it is detected that a wind turbine is operating in an unusual way, the unit may be stopped (remotely) until the problem is resolved.

Additionally, land tours scheduled will be carried out by visual inspection; the purpose is to identify any obvious problem with wind turbines that may require maintenance. This inspection is a redundant verification, because the turbine has a number of internal sensors for monitoring any potentially unsafe operating condition.

Normal maintenance activities include the inspection and cleaning of equipment, changes in lubricant / grease oil, and preventive maintenance activities (housekeeping activities). Maintenance frequency will depend on the user equipment manufacturing, as well as good industrial practice.

Along with the wind turbines, the staff will also review the status of access roads and other visible aspects of plant infrastructure. This will include reviewing the status of its components and fences, cleaning areas and verification of the presence of vandalism activities.

Scheduled Maintenance of Wind Turbines

As with all machinery, regular and scheduled preventive maintenance is the best way to ensure that the turbines operate safely and efficiently. PETM will execute agreements with companies dedicated to the maintenance of the wind turbines up to 10 years, whereupon a long-term maintenance in order assure that the park operates safely and efficiently.

The Plan of Operation and Maintenance activities include PETM minor and major maintenance scheduled for calendar year and generally anticipates these activities for a longer period.

Various inspections and scheduled preventative maintenance activities will be performed on a daily, weekly or monthly basis. The results of these inspections will be recorded in the appropriate logs, and used for planning maintenance activities in the future. Visual inspection within the rotor head, the nacelle and the bottom of the tower and run regular scheduled basis. Special attention to identify small oil leaks will be paid, seeking to ensure that repairs can be made before such leaks pose a potential environmental problem.

Two cycles of annual maintenance of the wind turbines are anticipated. It is likely to be scheduled during tough times of the year. During the operational period of the project events, maintenance or repair of large magnitude will be registered, so that their causes can be determined and analyzed. The result of these analyzes may be modifications to the turbines, the operation of the wind farm or maintenance practices to improve efficiency and safety of the PETM.

Non-scheduled Maintenance of Wind Turbines

The internal inspection and maintenance of the turbines will be performed on a scheduled basis. However, in case of problems performing unscheduled maintenance activities, to maintain operational efficiency of the system may be required.

During the early years of operation, the turbines are new and no major repairs are required, however, they cannot be discarded. Any turbine presenting mechanical difficulties that may result in risks to safety or the environment, or equipment damage will be put out of service until repairs are completed. Otherwise, the repairs will be planned for the first convenient opportunity.

Three general levels of unscheduled maintenance are discussed bellow. All potential repair activities are described in more detail in the operation manuals and maintenance of the PETM.

Minor Repairs and Replacement of Components

Minor repairs of wind turbines or replacing internal components that fail, are the most common forms of unscheduled maintenance of wind turbines. Such repairs include:

- Replacement sensors for wind turbines
- Replacement of small engines (such as the orientation of the rotor mechanism)
- Replacement of small pumps (such as the hydraulic or cooling system)
- Change oil and filter gears
- Change of coolant
- Change of Hydraulic Fluid
- Change of generator seals or gearbox.

All these repairs can be made with small tools and the built-in pulley system to the turbine. In general, no vehicles other than the pick-up trucks or enclosed cab of the Project will be needed. These vehicles could remain on the roads of the Project or in free space under each wind turbine.

Major Repairs and Replacement of Components

Although much less common, it is possible that the main components should be replaced during the operational phase. These components include:

- Blades
- Generator
- Gearbox
- Transformer

These replacements would require at least a large crane to the site again, using the trucks needed to bring it to the location of each wind turbine, which would be mounted. If the platform for the crane used during the construction phase of the project and it is not available, it would be necessary to install it again.

If a major component is damaged and require to be replaced, the turbine would be arrested and taken out of service until the change is completed. Once the crane and spare reached the site and were ready for change, the actual replacement would take only one or two days. When the new component was installed, the crane would be removed from the site and enter the turbine in operation again. This activity would be planned to minimize the residence time of the crane at the site as well as the overall impact to the environment.

Replacing Wind Turbines

Replacing a wind turbine before being dismantled in the wind farm is very rare. This occurs only if there are problems with the turbine tower or foundation, since the other components can be replaced without removing the entire unit.

Replacing a wind turbine requires the same crane assembly described in the construction phase. Each component would be removed in the reverse order in which it was installed. Each one of the components removed that will not be used for turbine replacement should be loaded into trucks and removed from the site. After the old components are removed, the replacement parts must be brought to the site, and arranged in a similar manner to that discussed previously. Then, the wind turbine should be erected again using the right combination of original and replacement components. Given the need to remove the old components and bring new parts to the site after the original wind turbine was disassembled, the activity of replacing the entire unit may require crane to remain in place for a week or more.

Roads Maintenance

Most road maintenance will be performed as needed. It is expected that small leveling tasks are required after periods of heavy rain, or on a regular basis for maintenance due to traffic. Any needed repairs will be made shortly. In addition, all channels, drains or other attachments for handling water must be kept clear of obstructions to allow effective drainage.

During construction, the surfaces of the roads will be watered or treated by other means as control measures to mitigate the generation of airborne particles (dust). The frequency of treatments depends on the weather conditions and the level of traffic on the roads.

II.2.7 Abandonment Stage

There are many factors to determine the lifespan of a wind farm; the most critical are the rights to the land, the demand for energy and maintenance receive the park. The PETM seeks a lifespan of between 20 and 50 years, however, this life can be extended with appropriate maintenance measures and if energy demand prevailing in the area. Additionally, it is now possible to replace turbines and equipment in order to keep the park running smoothly for much longer periods of time.

When the project reaches the end of its useful life and Dismantling and Abandonment Plan according to the regulations applicable at the time, whose goal will be to remove power generating equipment installed, and return to the site closest condition possible as the pre-construction state condition.

II.2.8 Use of Explosives

Just as mentioned above, it is estimated that approximately 30% of the areas where the activities of digging for laying foundations for wind turbines will take place, blowing up with explosives will be required. For the first stage, it is estimated that approximately 2 tons of explosives will be used. A geotechnical study to determine more accurately the areas that will require blowing up, as well as the quantity of explosives to be used for each stage will be done.

The blowing up shall take place as per the applicable regulations and the best engineering practices, using methods and techniques to minimize the excessive fracture of indicated limits and preserving the rock outside such limits in the best possible conditions. It is likely that we use techniques such as pre-splitting or line drilling. Before starting operations we will prepare a blowing up plan including detailed specific information of all procedures, materials and equipment to be used. The blowing up plan should describe the procedures and precautions to be taken to protect the staff, existing structures and structures to be built. Said plan should indicate the specific operations for drilling, blowing up, removal and towing of rocks. We will have the corresponding permit from SEDENA.

II.2.9 Generation, management and disposal of solid, liquid waste and air emissions

II.2.9.1. Stage of site preparation and construction

- **Non-hazardous solid waste**

During the stages of site preparation and construction, the following solid waste could be generated:

a) domestic (food scraps, paper and plastic),

b) non-hazardous industrial (Debris and recyclable waste such as wood and metal)

c) material product of excavation (soil and plant material that will be generated during excavation and grubbing)

Non-hazardous waste is temporarily arranged in containers located in work areas. Inside the office building an area for temporary storage of waste, which complies with the specifications of the applicable regulations, so are kept separate until collection to ensure their use, treatment and / or disposal shall be conditioned properly. Finally, the waste will be collected by an authorized to be taken to the private company authorized sites. Recyclable waste such as plastics and steel will be sorted by categories to be sent for recycling.

The wind farm will feature a program of management of hazardous and non-hazardous waste, and the contractor will be responsible for implementing the plan and make the appropriate management of non-hazardous solid waste (collection, transportation, and temporary and final confinement).

- **Hazardous waste**

In the stages of site preparation and construction, hazardous waste generated mainly during maintenance activities and equipment consist primarily of used oils, packaging, tow and impregnated with oils and solvents, rags soaked with gasoline and diesel rags and cans painting and welding slag.

The aforementioned hazardous waste will be handled in accordance with applicable regulations and taking into account the hazardous characteristics (CRETIB).

The management of hazardous waste (storage, collection, transportation, treatment and disposal) will be provided by the contractor, who will be responsible for hiring companies authorized for this purpose.

In the workplace, there will be properly identified containers with lids for storage of this waste, which will be identified and classified according to the provisions of the NOM-052-SEMARNAT-2005. These drums were placed on trays to contain spills and will be transported to the buffer to be located inside the office building construction. The warehouse will be built according to the specifications of the applicable regulations, and all relevant documentation according to applicable regulation will be prepared (as guidelines for the generator, delivery, transportation and disposal, log generation, etc.) {UT1}

The Wind Farm will feature a program of management of hazardous and non-hazardous waste, and the contractor will be responsible for implementing the plan and make the appropriate management of non-hazardous solid waste (collection, transportation, and temporary and final confinement).

- **Wastewater Management**

During the production process of concrete, water for mixing the components and obtaining setting is employed, whereupon the water is also required for the cleaning of the containers after casting. Wastewater from this activity contains concrete waste and receives a collection tank for further processing by the contractor in charge of construction.

With respect to sanitary sewer, the contractor should provide portable toilets, depending on the number of workers per working site. There will be a specialized company for the maintenance and cleanliness of the toilets so no sanitary water will be generated in the Project area.

- **Emissions to the atmosphere**

During the stages of site preparation and construction, emissions mainly from combustion gases (nitrogen oxides and carbon monoxide) by the use of machinery and equipment as well as powders or particulates generated by earthmoving will be generated during the clearing for access roads and platforms for cranes and during excavation for the foundation of the turbines.

To minimize the impact this could generate, it will be monitored at all times that the equipment, machinery and vehicles are in top condition, therefore, the contractor will be asked to provide a maintenance program.

Raw water irrigation in earthworks and gaps that are used will be made, as well as work areas where earthworks were carried out, in order to minimize the generation of dust and particles.

Furthermore, they will also generate dust and particles in the concrete floor for material handling. However, it will always be monitored that the permissible limits according to regulations are not exceeded and that the staff uses the personal protective equipment required to prevent damage to health.

- **Noise**

During the stages of preparation of the construction site, the noise sources are vehicles, machinery and equipment used. It is important to point out that the wind farm is not close to any population center so the only directly affected ones would be the workers who are working at the site.

To control the noise levels emitted during the stage of site preparation and construction, the physical plant and equipment that enter, restricting access to computers that do not have the devices installed by the manufacturer to control noise inspections, are performed.

When the work needs concentration and equipment on site, workers are exposed to levels above 85 dB (maximum limit for emissions in the workplace) noise, security surveillance team will require workers to carry hearing plugs that meet the specifications of the standard established by the Labor Department.

II.2.9.2. Operation Stage

- **Non-hazardous solid waste**

During the stage of operation and maintenance, the waste generation would be minimal and consist only of:

- Vegetal material will be removed during road maintenance activities and marshaling yards of machinery and cranes that will be required to perform some activities such as spare parts changing.
- Household waste that would be generated in offices and warehouses, and consist mainly of paper and cardboard.

Services of a private company authorized to handle such waste will be hired. There will be a program for managing all types of waste. In this program all the elements required for each waste management (collection, temporary storage, transportation, and final confinement) will be established)

- **Hazardous waste**

The operation of the wind farm itself will not involve the generation of waste, which is one of the benefits of wind generation. Waste would only be generated during maintenance activities. These wastes consist mainly of: oil, coolant and hydraulic fluid (for periodic changes in the team), rags and oil impregnated tows and / or lubricants, solvents, paints and replaced parts (which will be returned to the supplier).

The waste generated during maintenance will be transported to the operation and maintenance building, where there will be containers properly identified for the storage of such waste, which will be identified and classified according to NOM-052-SEMARNAT-2005. The warehouse will be built according to the specifications of the applicable regulations, and all relevant documentation according to applicable regulation will be prepared (as guidelines for the generator, delivery, transportation and disposal, log generation, etc) The handling and disposal of such waste will be in accordance with applicable regulations and through companies authorized for management and disposal.

- **Sewage water**

The operation of the wind farm will not generate sewage water, except those generated in the health office and maintenance arising from the cleanup, which will be channeled to septic tanks, pretreatment. The petitioner should ensure that these waters are within the maximum permissible limits of NOM-001-SEMARNAT-1996 {UT1}

- **Emissions to the atmosphere**

During the operation stage itself, there will be no fixed or mobile sources of air pollution. Emissions would only be present during the maintenance activities due to the use of machinery and equipment that generates combustion gases.

- **Noise**

The operation of wind turbines produces mechanical and aerodynamic noise. Usually, the amplitude of the sound is 90 to 105 dB at a distance of 40 meters, and 35 to 45 dB at a distance of approximately 300 m (Ibid 2007: 159).

The wind turbine is located at a considerable distance from the closest population, which is a small town called San Francisco, at the east border of the project's polygon of impact, but at a distance of approximately 3 km from the closest wind turbine. To the southwest of the polygon the town Llera de Canales (county seat) is located, but the distance to the nearest wind turbine is more than 4 km.

It is also important to mention that the measurement of sound from wind turbines accurately is very difficult because, at wind speeds of 8 m / s and above, the background noise completely masks any turbine noise.

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II.2.9.3. Abandonment Stage

Waste generated during the abandonment stage will depend on what is determined in the dismantling plan, which should be developed in due course. This should include assessment of the elements that can be reused or recycled and those to be definitely disposed in a controlled fashion. It is noteworthy that a second-hand wind resale market with emerging economies as major customers, where many of these components for this type of projects that drive the development of their economies and, at the same time, do not generate meaningful adverse environmental impacts, already exist.

In addition, during this stage, sewage water or sludge will not be generated. The emissions and noise, can be compared with those presented during the construction stage due to the use of machinery and equipment, but it is important to note that for those dates there should be new technologies that minimize the generation of pollutants into the atmosphere and noise.

II.2.10. Management infrastructure and proper disposal of waste

Although the infrastructure for waste management (hazardous, non-hazardous and special) is scarce in the region, services to local authorities the project area will be requested to municipal, state and federal (according to their competence) authorities, in order to make a proper waste management. In the Project site, divided into work areas, there will be plastic or metal container with lid, properly marked according to the type of waste they contain. This waste will be temporarily stored in an area specially equipped for this purpose and will later be collected by a company authorized by the competent authorities to be brought to recycling plants and disposal sites authorized; for this, a Management program for hazardous and non-hazardous waste will be developed.