

PORTO REFINERY COGENERATION PLANT

Environmental Impact Assessment

Non-Technical Summary

June 2007

These reports are an English translation of the original ones, filed at the competent authority and available in Galp Energia's site.

The Portuguese official version should also be read in order to confirm and evidence these data.

1. What is a Non-Technical Summary?

This Non-Technical Summary is an independent section of the Environmental Impact Assessment of the Porto Refinery Cogeneration Plant. As its name indicates, it is intended to be a document for general distribution, written in a language accessible to all. For this reason, if you wish to obtain more in-depth information about the effects that the project will have on the environment, you should consult the environmental impact assessment, which is available at Matosinhos Municipal Council and the Portuguese Environment Agency in Lisbon.

2. What is the Porto Refinery Cogeneration Plant? Does it have associated projects?

The aim of the Cogeneration Plant to be installed at GALP ENERGIA Porto Refinery is to meet a significant part of the Refinery's steam demand, ensuring a reduction in the air emissions produced in the current energy production system, while also making it more efficient.

The Cogeneration Plant, which is currently at the preliminary design stage, will be made up of the following Functional Elements (see Drawing 1):

- Two generator sets, comprising the association of two natural gas-fired turbines with their alternators;
- Two gas turbine-waste heat boilers, equipped with additional firing systems, using natural gas to produce, at the most, 150 tonnes of superheated steam per hour, each.

The following auxiliary systems are also present:

- High-voltage electrical system and transformers;
- Medium-voltage electrical system;
- Low-voltage electrical system;
- Fuel system;
- Compressed air system;
- Pipes, ducts and mechanical connections system;
- Instrumentation, supervisory control and data acquisition system;
- Fire protection system.

Porto Refinery Cogeneration Plant

Cogeneration Plant Layout

As an **associated project** there is a Transmission Line (TL), which is a 60 kV overhead power line from the Porto Refinery substation to the Custóias substation, with a length of around 4.3 km. In this phase, there is no Line Design and therefore a possible corridor between those two substations was studied.

The gas supply pipeline is not an associated project, because the high-pressure gas pipeline is currently being developed and licensed, by REN Gasodutos which will supply the Refinery.

3. Where is the Cogeneration Plant located?

The Porto Refinery Cogeneration Plant is located within the boundaries of this industrial site which is situated on the coast, between Boa-Nova and Cabo do Mundo, in Leça da Palmeira, municipality of Matosinhos, occupying an area of 290 hectares north-west of the city of Porto and around 2 km to the north of the Port of Leixões. Drawing 2 shows its location on the Military Map at a scale of 1:25 000.

It is to be noted that the site of the Cogeneration Plant is reclaimed land with fill deposited from excavations during the building of the Port of Leixões.

Other activities coexist in the Refinery surroundings, such as LPG storage and road tanker loading located to the northeast and at around 150 metres from the fencing (Parque de Perafita), canned food factories, vehicle repair shops and garages.

As an associated project there is a Transmission Line (TL), which is a 60 kV overhead power line, from the Porto Refinery substation to the Custóias substation, with a length of around 4.3 km, crossing the parishes of Leça da Palmeira, Santa Cruz do Bispo, Guifões and Custóias from west to east.

In this phase, there is no Line Design and therefore a possible corridor between those two substations was studied.

Location of Study Area

Municipality of Matosinhos

Extract from the Military Map of Portugal, Scale 1/25 000, sheets 109, 110 and 122, IGeoE

Drawing 2 - Location of the Porto Refinery Cogeneration Plant (Military Map, Scale 1:25 000)

title:

Cogeneration Plant

Refinery Substation

Custóias Substation

TL Route - Mitigating route

TL Route

For the definition of the TL corridor, the most recent aerial photograph of the area was studied (dating from 2005), as well as the Google Earth satellite photograph, and it was found that both are already outdated due to the highly dynamic development of the land surrounding this whole area. In this context, the company chose to consider, as is common practice in the EIA process whenever the connection point is known and there is no Line design yet, a corridor with a “straight line” alignment over an area shown in the 2005 orthophotos as being less infrastructures.

It was this corridor that was studied for the purpose of analysing constraints (including heritage). However, the development of the EIA and contact with several entities showed that this is a crossing that will require particular care, since the whole area undergoes currently a significant change.

It is felt that the work carried out in connection with this EIA is highly useful for the TL project designer, who should in turn once again contact the various Authorities.

In addition to these significant territorial dynamics resulting in a dense urban infrastructure, the EIA developed for the TL corridor demonstrated and concluded that there would be impacts of reduced significance.

4. Who is promoting the Project? What body will be licensing it?

The company Galp Power is the entity that is promoting the Porto Refinery Cogeneration Plant project. For this reason it is referred to as the project promoter.

The project licensing body is the Portuguese Directorate-General of Energy and Geology (DGEG).

5. What are the advantages of building the Cogeneration Plant?

The purpose of installing a cogeneration plant at the Porto refinery is to supply high pressure steam to the refinery, thus benefiting from the advantages of combined production of electricity and steam through the burning of natural gas. This technology offers greater energy efficiency. The steam to be produced in the new cogeneration plant will replace most of what is currently produced in the boilers, which burn fuel oil, and all the electricity produced will be exported into the Public Electricity System (SEP) network.

When starting the Cogeneration Plant (with two generator sets), the Refinery will decommission four of the six current boilers. The other two existing boilers will operate only as support for the Cogeneration, on a batch basis.

As regards atmospheric emissions, reductions compared with the current situation will be significant for elements such as sulphur oxides (since the fuel for the cogeneration plant will be natural gas) and even particulate matter, nitrogen oxides and carbon dioxide (particularly in the component associated with thermal energy).

6. Why an Environmental Impact Assessment? What is it for?

An Environmental Impact Assessment (EIA) has been carried out to review the direct and indirect effects (impacts) of the Porto Refinery Cogeneration Plant on the environment, to identify and assess the positive and negative effects resulting from construction and operation of the plant, in line with the applicable environmental legislation. Understanding these effects helps to implement the project, as it takes into account important local environmental assets. It also offers a means of understanding and demonstrating the environmental benefits that the plant brings.

The study was conducted in the period between January and June 2007 and examined aspects such as:

- Climate,
- Geology, Geomorphology and Hydrogeology,
- Surface Water Resources,
- Soils,
- Land Use and Spatial Planning,
- Air Quality,
- Acoustic Environment,
- Landscape,
- Socio-Economic Aspects,
- Heritage,

of which Air quality, Acoustic Environment and Land Use and Spatial Planning are considered the most important environmental aspects. Therefore they were paid more detailed attention, given the type of project and its associated project (the Power Line) and the general characteristics of the power plant construction site and area crossed by the Line, respectively.

To analyse aspects of Land use, Landscape, Acoustic Environment, Air Quality, Heritage and Socio-economic aspects, on-site visits for fieldwork were conducted, in addition to the visit by the EIA coordination team.

7. What effects (impacts) may this Project have on the Environment?

As regards **geology and geomorphology**, whereas the work to construct the infrastructure necessary for the Cogeneration Plant and substation (of the Refinery) does not involve earthworks or excavations that mean changes to the site, major impacts are not expected. Also for the Power Transmission Line, interventions will be local, for erection of transmission towers, and all the work platforms will be subsequently restored, and so substantial impacts are also not expected, even in the areas of the river Leça crossing.

When the Cogeneration Plant is in operation, the impact of the presence of these facilities will hardly be noticed. As they are integrated into the Porto Refinery facilities, their presence shall not have a very large negative impact.

It was also considered that any accidental spillage of pollutant substances will not lead to contamination of **groundwater**, since the Cogeneration Plant area will have sealed zones and rain water drains will be equipped with oil/water separators before discharge into the Refinery's rainwater system. Moreover, the Refinery is equipped with various types of drainage systems that can be used to separate the different wastewaters produced within the Refinery site and sent for treatment. These systems will also serve the area of the future Cogeneration Plant.

As for the **surface water resources**, the study area is a flat zone and consists of landfill resulting from the deposit of excavation land from the construction of the Port of Leixões – which means zero interest in the **land** as an agricultural resource. It is therefore an area that has been significantly changed by Man, with its own rainwater drainage (drained into the sea) and with some non-sealed areas where rainwater infiltrates. Here there are also no notable **groundwater resources**. For this reason, no impacts are expected on soils and on surface water and groundwater resources.

From the standpoint of **land use**, the area considered by the study area was that which will actually be affected by the implementation of the Cogeneration Plant, as well as the area of construction of the power line to the Custóias Substation, plus a 500 m strip. The main land use is by infrastructures (a significant part corresponding to the facilities of the Refinery itself), agriculture, buildings, woodlands, scrub and uncultivated land, beach and riparian vegetation. Part of the area intended for the Cogeneration plant building is currently occupied by unused buildings which are due to be dismantled. Given that the site where the Cogeneration Plant is to be built is located in an industrial area, there are no significant impacts on land use.

With regard to **Spatial Planning** and constraints, the analysis made enabled the following conclusions to be reached:

- The construction of the Cogeneration Plant will have very little negative impact on land use and spatial planning since it is envisaged for an area of industrial use (currently with unused buildings or wasteland, but already included within the premises of the Porto Refinery, as a zone awaiting development) without any legal restrictions. This will have a permanent and irreversible impact of local scope.
- The power line will have a negative impact, although not very significant, since there will be no need to substantially change the current land use along the line, but only ensure the removal of larger trees. Only the construction areas of the transmission towers will be modified, on a local level. This is not a very significant, permanent and irreversible negative impact of local scope. With regard to spatial planning, the final design of this infrastructure may conflict with some land use plans, as well as with the National Agricultural Reserve. However, in the current project development phase, it is not possible to envisage the magnitude of these impacts, which may even be avoided by the project team.

With regard to **Air quality**, an assessment of impacts arising from implementation of the new cogeneration plant was carried out using an atmospheric pollutant dispersion model, taking into account the possible Cogeneration operating conditions. The results obtained enabled the following conclusions to be reached:

- i) According to the simulations performed on a local level in the environment surrounding the Porto Refinery, the applicable legislation is expected to be complied with as regards levels for nitrogen dioxide (NO₂), carbon monoxide (CO), particulate matter (PM₁₀) and sulphur dioxide (SO₂) in the surrounding ambient air, with regard to both maximum values and the number of times they occur.
- ii) The implementation of this project offers a positive significant impact for the pollutant sulphur dioxide (SO₂), with a significant reduction in levels of sulphur dioxide (SO₂) concentration in the ambient air, of around 34%, in both hourly and daily terms, with cogeneration in full operation.
- iii) The cogeneration plant is expected to cause an increase in maximum hourly concentration of nitrogen dioxide (NO₂) of around 35%, although the number of hours and days that would represent passing the legal limit will not be reached. This increase may be a consequence of different emission conditions associated with chimney heights, since nitrogen dioxide (NO₂) emissions are lower with the Cogeneration Plant.

- iv) For the pollutant carbon monoxide (CO), the implementation of the project does not present significant impacts. The maximum concentration expected is however relatively high when compared to the legal limit, reaching nearly 60% of the legally stipulated level. The maximum levels are recorded close to Francisco Sá Carneiro Airport, leading us to believe that this will be one of the main sources influencing the levels measured.
- v) To sum up, the study concluded that the installation of the Cogeneration Plant at the Porto Refinery has visible advantages as regards air quality levels of sulphur dioxide (SO₂), without any notable impacts for the other pollutants.

For purposes of characterizing the reference situation for the **Acoustic environment**, noise measurements were taken in the area surrounding the Refinery, considering the legal reference periods (day, evening and night), for a series of situations identified as noise sensitive. The analysis and assessment made enabled the following conclusions to be reached:

- i) In the construction phase lorry traffic accessing the works should flow through the accesses on Rua Belchior Robles (with connection to the A28), or through Avenida da Liberdade (with connection to Rua Belchior Robles, or to Rua Comandante Hélder Ribeiro). However, as the construction of the Cogeneration Plant will include only occasional transport of equipment to be set up on the site and since the aforementioned accesses already have high volumes of traffic, lorry traffic accessing the site in question is considered negligible and thus should not have any significant effect in terms of daily average sound levels at Sensitive Receptors located in the area surrounding the access roads.
- ii) With regard to the construction of the Cogeneration Plant itself, it is located at relatively long distances from the closest receptors, and so, in average daily terms, the estimated increase in sound levels at identified Noise Sensitive Receptors is also considered negligible.
- iii) The construction of Power Lines is normally characterized by very sporadic and time-limited circulation of machinery and equipment; for this reason these activities are not expected to cause an increase in existing sound levels.

With regard to the **Landscape**, the visibility analysis for the Cogeneration Plant project covers a total of around 2030 ha (of land surface), of which only 76% are within the visual basin of the project, because the area intended for the Cogeneration Plant is situated in a zone that has almost exclusively a low visual absorption capability. It should be noted that this figure falls to 50% if the two main chimneys (60 m high) are taken out of the visual analysis. In other words, of 26% of the potential visibility area of the project under consideration, only the main chimneys will be visible. Taking into account the area surrounding the Cogeneration Plant, it can be said that it will be barely seen by viewers. It can even be said that all the structures that comprise the project under consideration, even if they are visible from a

quite extensive area, they will have a quite limited effective visual impact on the landscape due to a mimetic effect (disguise) with their surroundings.

With regard to **Heritage**, the following was concluded:

- i) The area of the Cogeneration Plant is reclaimed land with fill deposited from excavations during the building of the Port of Leixões and for this reason it is not studied within the scope of this analysis.
- ii) With regard to the Transmission Line, no critical impacts were identified in the area corresponding to the route of the projected corridor that cannot be mitigated.
- iii) It is recommended that various mitigating measures concerning the pre-construction phase be taken, as well as archaeological supervision of the earthmoving and excavation work during the construction phase, to mitigate any negative impacts on already identified or unknown Heritage. Included in this context is the signposting (delimitation), agricultural structure (2) and mills (3) respectively, to prevent damage during the work.

With regard to **Socio-economic aspects**, the following was concluded:

- i) The building stage of the Cogeneration Plant will involve around 100 jobs, on average, with an estimated peak of 300 jobs, which will have a positive effect locally if the labour is hired in the region and above all in the district of Matosinhos, from the population of the parishes or locations existing in the study area or in its vicinity. The construction can have a local and regional scope.
- ii) As regards the mechanical and electrical assembly of part of the equipment, including gas turbines, recovery boilers, steam turbines, water treatment plant, and others, there may be a broader, national scope depending on the incorporation of national materials and equipment and an international scope depending on the origin of the manufacturers of specific components such as turbines, which requires specialized labour for their assembly, by manufacturers.
- iii) Electricity generation from the energy potential of natural gas will help to improve power generation efficiency and reduce power generation based on more pollutant fossil fuels such as fuel oil, currently used in the six generator sets existing in the Porto Refinery. Thus, the construction of the Plant complies with the national energy policy, in its search for energy efficiency and for a reduction in imports, given that Portugal is dependent on imports of fossil fuels.

8. What measures are foreseen to safeguard the project's environmental performance?

A number of measures have been provided for to safeguarding the project's environmental performance. Firstly steps and actions have been considered that could help reducing the negative effects identified. These are referred to as "mitigating measures".

The main mitigation measures identified in the Environmental Impact Assessment are as follows:

- The building yards shall be contained within the boundaries of the Porto Refinery, in an area near the Cogeneration Plant construction area. This means that setting up yards to support this project will not cause major negative effects at the level of land use or indeed landscape. Nevertheless the yards must be dismantled after work is complete and provisional support structures must be removed;
- Thus all soil sealing/waterproofing materials deposited on the ground and all debris must be removed, leaving the site clean;
- Special care must be taken with regard to the handling of oils and fuels, and legislation on waste oils must be complied with during the construction and operation of the Cogeneration Plant;
- Waste produced during the construction and operation of the Cogeneration Plant must be handed over to operators authorised by the Portuguese Environmental Agency (formerly Institute of Waste) and sent to an appropriate final destination;
- Cleaning of wheels whenever temporary roads are used that lead to an increase in suspended particles (dust) in the atmosphere;
- Spraying of the ground where increased dust emission is expected as a result of the various activities associated with the work;
- Materials liable to cause particulate emissions into the atmosphere must be carried in closed containers where possible.
- Noisy activities during the construction phase may only take place between 8.00 and 20.00.

At the same time, the development of a series of campaigns to measure the atmospheric pollutant emissions of the Cogeneration Plant has been planned, as provided by law. A specific programme for measuring the effect of cogeneration on air quality was not deemed necessary, since a programme for measuring air quality levels in the area around Porto Refinery in which the cogeneration will be included is already underway.

In terms of noise, a campaign to measure noise levels has been proposed in accordance with the applicable legislation: its duration and need will be monitored on the basis of the values that are recorded.

These measurement campaigns, which will be carried out on the basis of the characterization of defined parameters, analysed in samples taken at identified sites with a specific frequency, are called “monitoring”. The results obtained, duly recorded and processed, will then be assessed by the Portuguese Environmental Agency (APA). This follow-up by APA is known as the “post-assessment phase”, as provided for in applicable environmental legislation, and is a way of ensuring that the Cogeneration Plant will be well supervised in environmental terms.