

What is the real link between biomass energy and forest fires?

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BACKGROUND

Renewable electricity is being heavily promoted in order to decarbonise the economy. It can also play an important role in the protection of ecosystems and human health. Pollution caused by dirty energy has major negative effects on public health. But are all sources of renewable electricity associated with decarbonisation and a reduction in pollution?

The generation of electricity from burning forest wood has been expanding due to the fact that emissions from it are not accounted for in the energy sector. This international policy framework (based on United Nations Framework Convention on Climate Change (UNFCCC) carbon accounting rules) allows nations to burn forest biomass instead of coal or other fossil fuels, without having to account for the carbon emissions from biomass as energy-related carbon emissions. This helps them meet carbon targets under the Paris Climate Agreement. Science now shows that burning forest biomass can be even more damaging than burning coal, and that one of the best ways to slow climate change and sequester carbon is to allow forests to continue growing. The European Union's treatment of forest biomass energy as carbon neutral is wrong, according to scientists who advocate for a change in global policy.

INTRODUCTION

The [Pilling on the Pressure](#) report, published at the beginning of 2023, together with Biofuelwatch, revealed a worrying trend (see graph on page 7): according to the data presented in that report, there has been an ongoing upward trend in forest and in total land areas burnt by wildfires at the same time as the electricity generating capacity of wood biomass power and heat plants has been increasing.

Over the past two decades, Portugal has been one of the worst affected countries by fires in Europe. For three years in a row, from 2016-2018, it registered the largest burned area following wildfires within the EU. The data for the five-year period 2016-2020 reveals another worrying trend: during this period, contrary to what used to be the case in the past, a larger area of forest (as defined by the UN Food and Agriculture Organisation) was burnt compared to the combined area of scrubland and agricultural land. This situation has continued in recent years.

The installation of biomass power stations burning forest wood, which has been accelerating since 2006, has been justified primarily by the need to reduce fire risks. This assumption is based on the belief that removing 'residues' or 'fuel' from forests in order to burn it in power plants is of fundamental importance for reducing the area burnt in Portugal.

Based on the data presented in graphs in the 2023 report, the supposed 'benefit' of such plants is paradoxical. The claims made raise two questions:

- What feedstock do the plants actually burn?
- Has the installation of multiple biomass power stations throughout mainland Portugal contributed to reducing or increasing the risk of forest fires?

This new study intends to answer these questions, particularly the second one. We focus on a specific case: the Fundão Biomass Power Plant, located in the Cova da Beira region, between the Gardunha and Estrela mountain ranges, in central Portugal. The geographical area affected by the project includes the municipality of Fundão, the municipalities of Covilhã, Belmonte and Sabugal to the north, the municipalities of Idanha-a-Nova and Penamacor to the east, the municipalities of Oleiros and Pampilhosa da Serra to the west, and the municipality of Castelo Branco to the south.

THE FUNDÃO BIOMASS POWER STATION

The Fundão Biomass Power Plant resulted from the merger of two proposals submitted to the Portuguese Government's public tender process for new biomass electricity power stations, which was launched in 2006 by the Directorate-General for Energy and Geology (DGEG). The plant is located on the road Rua das Peónias, in the Fundão Industrial Estate, in central Portugal. In September 2015, the Fundão plant obtained approval from the Centro Regional Coordination and Development Commission (CCDRC) with regards to the location of the plant, subject to also obtaining approval from the Regional Entity of the National Government's Agricultural Reserve. This was obtained in October 2016.

In November 2015, the Portuguese Environment Agency (APA) ruled that the biomass power plant project did not require an Environmental Impact Assessment (EIA), provided that the proposed mitigation measures were taken into account during the licensing process.

In June 2016, the Fundão plant obtained an environmental permit from the Directorate-General for Energy and Geology (DGEG). In November 2018, it was granted its operating licence, by the DGEG, subject to a 15 MW cap on the amount of electricity which it can inject into the grid, as well as to compliance with the General Noise Regulations (Decree-Law no. 9/2007 of 17 January 2007).

At the end of 2019, the Fundão plant began burning biomass. It currently operates 24 hours a day for 337 days a year, and is closed for maintenance of the turbine and boiler for around 480 hours annually.

This industrial-scale plant uses steam from the combustion of forest wood to generate electricity, which is fed into the grid and distributed to consumers. Thermal energy produced by burning biomass is used to drive a turbine connected to a generator, transforming mechanical energy into electrical energy.



FIGURE 1 - Fundão Biomass Plant, located in the Centre of Portugal

The Fundão plant's operations emit small particulates and cause wood dust nuisance, noise and vibrations. The plant produces bottom ash (slag) and fly ash, resulting from the burning of fuel in the grate-fired boiler. The operators use wood chipping machines adjacent to the power station, in an area designated as the biomass storage depot. Wood chipping causes

noise and a large amount of dust. It also emits PM10, including PM2.5 particulates. These PM_{2.5} particulates, as stated in a sentence from the Castelo Branco court¹, enter the lungs and can cause respiratory and vascular problems, as well as affecting the cardiovascular, digestive and reproductive systems.

Also, contaminated rainwater from the biomass storage depot is channelled into a small dam on the site. The reservoir then discharges its water into a watercourse that flows into the Meimoa river.

Flaws in the licensing process for the Fundão Biomass Plant

The Fundão Biomass Plant operates without a Water Utilisation Permit. Furthermore, DGEG granted its operating licence in the absence of an Air Emissions Permit (TEAR), contrary to the provisions of Article 5(1) of the Air Emissions Regulation (REAR).



FIGURE 2 - Location of the Power Plant in urban space (Google Earth)

There are indications that the presence of semi-permeable soil on the plant's biomass storage depot, which is part of the National Agricultural Reserve (RAN), contravenes the recommendations by the Regional Entity of the RAN.

There is also evidence of non-compliance with the operating licences granted. Furthermore, the operations of the plant have been non-compliant with the General Noise Regulation and thus a condition of the operating licenses since at least 2019.

As stated in the ruling of the Castelo Branco court referred to above, during the operations of the Fundão Biomass Plant, NO_x emissions were very significantly higher than the limit value for a reference period of 1 hour (200 µg/m³) in September and in December 2022. The Emission Limit Values (ELVs) for a new Large Combustion Plant are listed in Part 2 of Annex V of article 46, paragraph 4, of Decree-Law No. 144/2009. 127/2013, of August 30, 2013.

Local impacts:

The small particulates, ash and dust emitted through the chimney and the dust that results from wood chipping are carried more than 150 metres away from the plant and deposited onto houses, water tanks, agricultural land and on the fruits and vegetables grown by the residents of Gramenesa.

¹ https://drive.google.com/file/d/1NS7tDqbp8P1QNwLlO_2464atWwvclErR/view?usp=sharing

As a result of the release of air pollutants and dust, the residents of Gramenesa have stopped eating the vegetables that they have been growing on their own land.

With regards to water pollution, during the first half of 2021, water in the water pipe and the well downstream from the plant was found to be greyish in colour. During the same period, the waterproofed area for storing wood had rainwater drainage ditches full of water of a strongly brownish colour. Around this time, the plant operators were placing accumulated waste on the southern boundary of the site, next to a rainwater dam.

Since the commissioning of the Fundão Biomass Plant, some residents of Gramenesa have suffered interruption to their normal sleep pattern on a daily basis, because they are woken by noise and vibrations from the plant. This prevents them from resting and leads to constant and increasing levels of stress and anger.

When residents of Gramenesa open their windows to ventilate their homes during the summer, they are exposed to noise and dust from the operation of the power station.

There have been irregularities in the operation of the biomass plant, with non-compliances with the General Noise Regulation recorded at different times in 2019 and 2020 and 2023, sometimes above the level considered to cause discomfort.

METHODOLOGY

Going back to the two questions identified in the introduction to this study, investigations into the type of forest biomass burnt in the Fundão plant have revealed that a large majority consists of whole logs. This is based on direct observation of supplies seen on the biomass storage depot at the site over a period of time, especially in the period following recent wildfires.

So called “wastes” are actually forest residues, i.e. biomass left over from logging activities. Those have a high silica content linked to the way they are collected from forest areas. Silica causes damage to and increased maintenance costs for power stations, resulting in more frequent shutdowns. Whole logs from burnt areas are cheaper and have a lower moisture content, which is an obvious advantage for biomass energy companies.



FIGURE 3 – Photo of biomass supplies at the plant

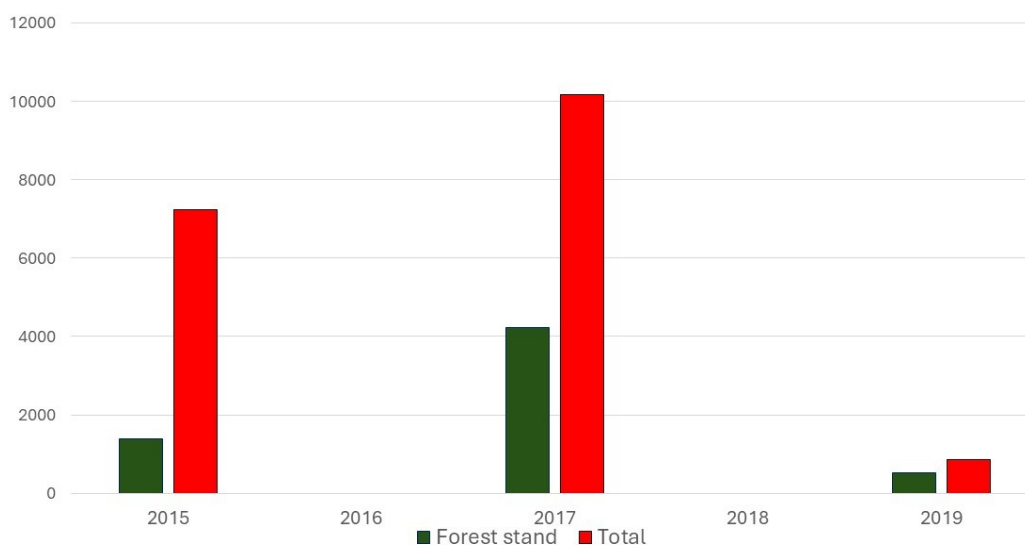
In order to analyse the impact of the Fundão Biomass Plant on forest fires in the region covered by this study, we used the data contained in specific reports² issued by the national forest authority, the Institute for Nature Conservation and Forests (ICNF).

For this purpose, we considered fires that have burnt an area exceeding 100 hectares in the municipalities of Fundão, Covilhã, Belmonte, Sabugal, Idanha-a-Nova, Penamacor, Oleiros, Pampilhosa da Serra and Castelo Branco.

To analyse the evolution of the fire danger trend, specifically in forested areas (which can provide optimal feedstock for the Fundão Biomass Plant), considered the 5 years prior to the commissioning of the plant, specifically from the years from 2015 to 2019, and compared them to the 4 years when the plant was operating, that is, from 2020 to 2024 (provisional data).

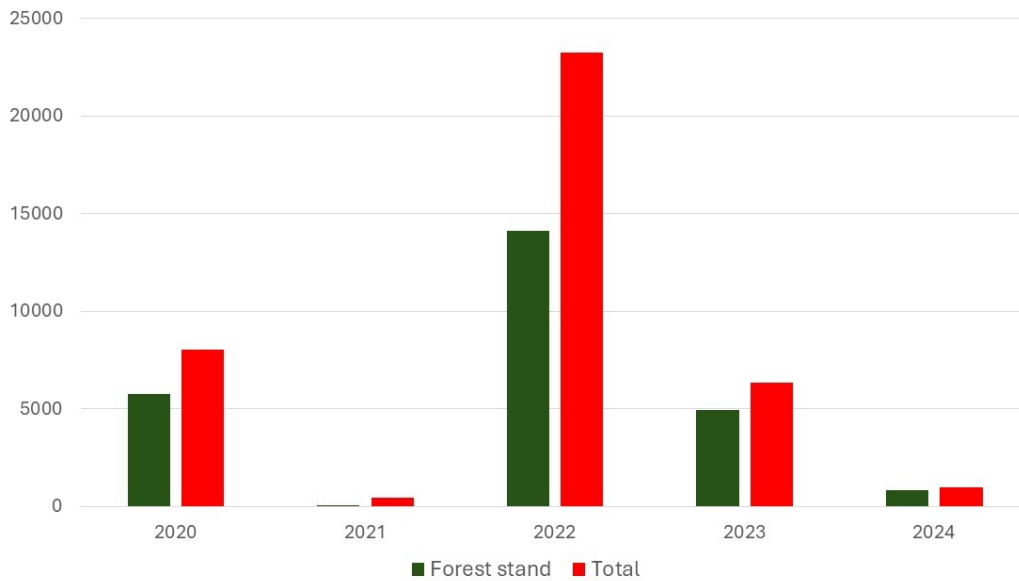
RESULTS

According to the methodology used in this analysis, the following results were obtained for the five years before and after the Fundão Biomass Plant began operating:



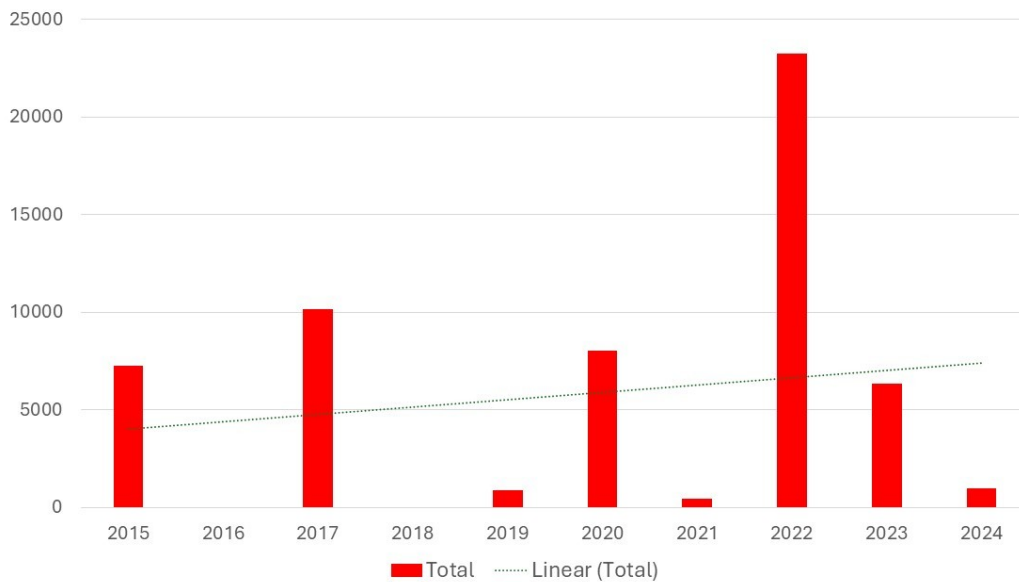
GRAPH 1 - Total burnt areas and burnt forest stands larger than 100 hectares that fall within a 50 kilometre radius of the Fundão Biomass Plant prior to the start of its operation (2015 to 2019).

² <https://www.icnf.pt/florestas/gfr/gfrgestaoinformacao/grfrelatorios/areasardidaseocorrencias>

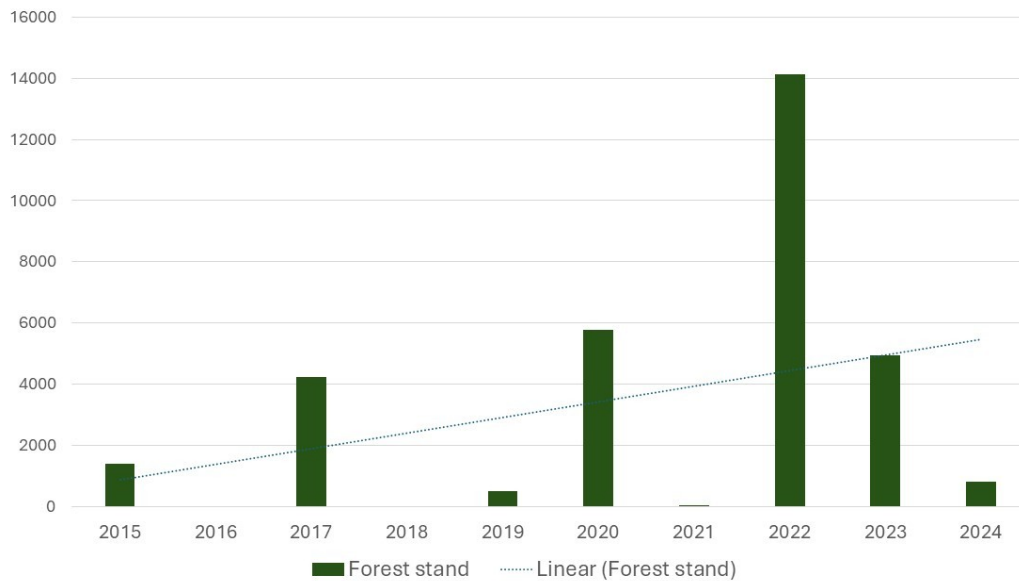


GRAPH 2 - Total burnt areas and burnt forest stands larger than 100 hectares that fall within a 50 kilometre radius of the Fundão Biomass Plant after the start of its operations (2020 to 2024)

According to official data for the most recent decade (2015-2024), there has been an increasing trend in forest fire risk in the region included in this study, i.e. within a radius of 50 kilometres from the location of the Fundão plant, both in terms of the total burnt area and, even more so, the burnt forest area.



GRAPH 3 - Total burnt areas and trends for risks of fires larger than 100 hectares within 50 kilometres of the Fundão plant over the most recent decade (2015 to 2024)



GRAPH 4 - Burnt areas in forest stands and changes in fire danger trends for fires over 100 hectares, within 50 kilometres of the Fundão plant, over the last decade (2015 to 2024)

The burned area in the region is represented spatially³ in the diagram below for each year between 2014 and 2023, based on polygons sourced from official data.

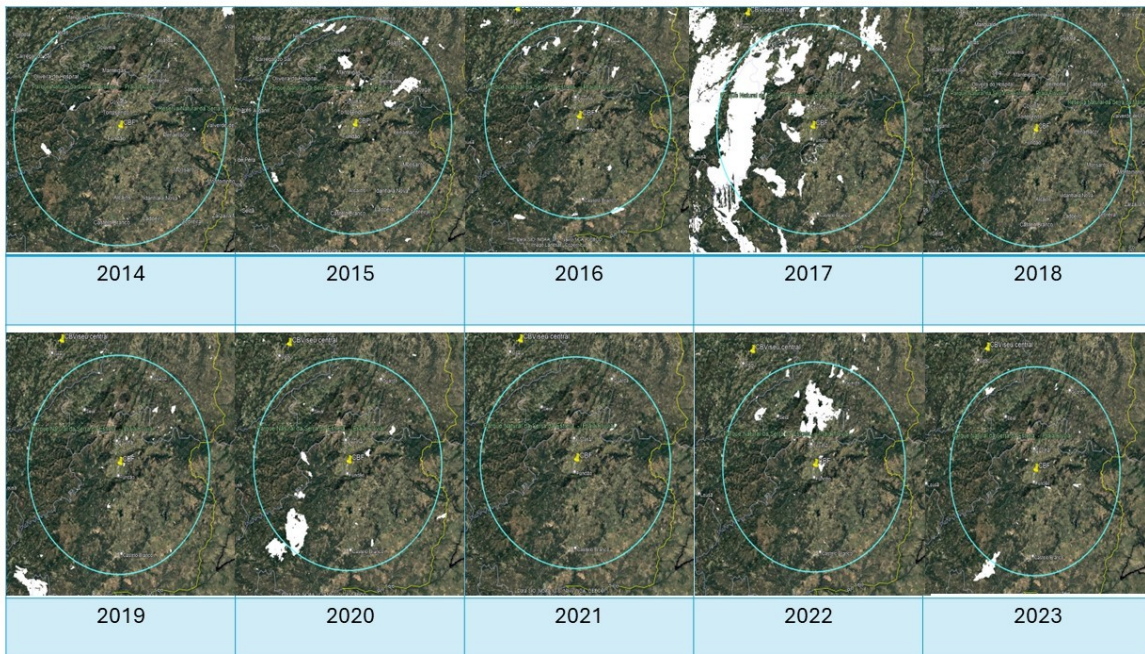


FIGURE 4 - Burnt areas in the period 2014-2023 within 50 kilometres of the Fundão plant location highlighted each year

Associated with the burnt areas, specifically in forest stands, is the loss of tree cover.

The most recent National Forest Inventory was based on 2015 data, although it was adjusted in 2018 in light of the 2017 fires. Another Inventory is planned in 2025. There is thus no reliable data on the recent loss of tree cover. However, given the area burnt in forest stands, it is

³ https://geocatalogo.icnf.pt/catalogo_tema5.html

possible to estimate a corresponding area of tree cover loss. Regrowth of this tree cover, if it occurs, will take decades, bearing in mind that most of the forest area in this region consists of native tree species.

CONCLUSIONS

Contrary to the claims made in favour of burning forest biomass for energy, what this study shows is a continued upwards trend in the risk of forest fires. In other words, it is the same regional trend that was shown in the graphic from the [Pilling on the Pressure](#) study, drawn up and presented at the beginning of 2023, for the whole country.

Instead of reducing fire risks, especially in forest areas, the existence of biomass plants could, on the contrary, be a cause of increased risk. Wood affected by fires, due to its lower price to forest producers and lower moisture content, is more advantageous for bioenergy. These factors seem to be a double bonus.

In addition to the need for public funding to make the biomass energy business viable, it is important to keep an eye on the use of partially burnt wood in energy generation.

Although the research into the impacts of the Fundão plant has especially focussed on noise, it will be important to pay special attention to the impacts of air pollution on public health in the near future.