

# THE REAL COSTS OF COAL MUĞLA



**AUTHORS:**

Deniz Gümüřel and Elif Gündüzyeli

**Translation from Turkish:** Ayře Bereket

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For full methodologies, project background, and resources, see the original report in Turkish at <http://costsofcoal.caneurope.org/>

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# CONTENTS

Table of contents .....	03
Foreword .....	04
Executive Summary .....	08
About This Research .....	14
The History of Coal in Muğla .....	15
The Environmental Costs of Coal .....	21
Land Change, Ecosystems .....	22
Forests and Nature Conservation Areas .....	24
Water Resources and Soil .....	27
Air Pollution .....	32
Reliability of Emission Data and Access to Environmental Information .....	34
The Health Costs of Coal in Muğla .....	37
Right to Access Environmental Information .....	44
Coal's Contribution to Climate Change .....	46
Forests as Carbon Sinks .....	51
Social and Cultural Costs of Coal in Muğla .....	52
Agricultural Production of Coal .....	58
Muğla Coal's Burden on the Economy .....	62
Just Transition into a Low-Carbon Future .....	72
Conclusions and Recommendations .....	74
References .....	75



# WE CANNOT AFFORD ANY MORE COAL! THE TOLL

**The story of coal exploitation in Turkey's Muğla region told by this study has many of the regrettable hallmarks so characteristic of obsolete energy systems based on last century's fossil fuel technologies. It's a recognizable story of environmental degradation assumed by many to be unavoidable in the face of growing needs for affordable energy.**

The enormous costs of coal exploitation to livelihoods, air, land and water, and to our climate, are often not readily visible or are considered in a compartmentalized fashion, which – intentionally or not – often serves only to blur our vision and decision-making.

This study is different. It pulls together the many pieces of the enormous puzzle often referred to as externalities of coal exploitation, yet another term blurring our appreciation of the entire toll we all pay for continued reliance on coal - in Mugla and elsewhere. This study does more than bring home the big picture made up of real and visible costs of coal to our environment. It illuminates the closely intertwined lives of people, communities and social capitals inexorably linked to that environment.

By so doing, this study goes a long way towards preventing decision makers from turning a blind eye to just how many and how much is being threatened by the prospect of extending the lifespans of Mugla's coal mines.





### **The time**

That we cannot afford the real costs of coal is truer today than it was yesterday. It will be an even more pressing fact tomorrow. Time to face up to this is running out. The landmark IPCC Special Report on Warming of 1.5 °C demonstrating that the impacts of climate change will only get worse if we don't limit the temperature rise to 1.5 °C, made the necessity of ending coal crystal clear.

This study, you are holding in hands, shows that continued coal exploitation in Turkey's Mugla region will not only accelerate climate change but may spell the end of livelihoods for thousands in Turkey and across borders. The study shows how pollution from Mugla's coal is carried by air and by sea far and wide bringing the real costs of coal to people and communities as far as Greece, Cyprus, Egypt and the Near East. A coal plant in any one country is a problem for us all.

The clock is ticking. The more we snooze, the more we all lose.

### **The transition**

Finally, the study offers valuable lessons to all that decide to wake-up and commit to accelerating our energy transition away from fossil fuels and toward energy-efficient, renewable and - hence - sustainable systems of the future. The transition is not going to work unless its costs and benefits are distributed fairly. Either it will be just, or there will not be a successful transition. In practice, this means that local communities - whether affected by current exploitation of coal or involved in the emerging new patterns of production, distribution and use of energy - cannot be considered as just another, optional voice in this change otherwise to be governed by policy makers in capital cities. Local communities should be at the steering wheel, driving the required change. Last but not least, this report sends its solidarity messages to the villagers, especially to the women of the region who have been fighting to protect their lives and livelihoods for so long that they became inspiration for many of us.

*CAN EUROPE Board Chair, Céline Charveriat*

# THE 'BLACK COAL' DISEASE, DIAGNOSIS AND TREATMENT REPORT

**Linguistics experts have identified three distinct definitions for the word "report": The first states that a report is a written account of the findings, comments and observations of an investigation or research. The second defines it as a form of narration and expression, while the third refers to a medical report, a written document that describes a patient's current state and diagnosis.**

*The Real Costs of Coal – Muğla* report published by CAN Europe reflects all three of these definitions. First, it calculates the "often overlooked, but real 'external costs' of coal-fired power plants and coal production facilities". Second, it focuses deeply on a single region, analyzing the impacts, dangers and alternatives of coal using the striking metaphor of an "open-air laboratory". Third, it is a full medical report presenting the finding of the tests carried out in this "laboratory", including:

- a) The rapid collapse of the planet's climate;
- b) The rapid degradation of the region's air, water, sea, soil, forests and living things; and
- c) The severe disease contracted by the region's human population, whose culture, history, economy and basic rights in other words, whose entire civilization — is under heavy assault.

The report also includes recommendations on treatment methods for this condition.

*The Real Costs of Coal – Muğla* report follows other recently published reports showing that:

- "Evidence of human-caused climate crisis has now reached gold-standard-level certainty."
- Ice melting and ocean warming in Antarctica are accelerating faster than previously predicted.
- The past four years were the four warmest years ever recorded.
- At least one-third of the Himalayan glaciers will melt by the end of the century, leaving no fewer than 1.5 billion people without food and water and in a state of conflict.
- Stratocumulus clouds will vanish within a century, leading to an additional hellish global temperature rise of 8 °C.

- Coal and other fossil fuels constitute the biggest threat to human health, with 90 percent of all children globally exposed to dangerous levels of air pollution.
- The plastic-waste invasion has reached the world's deepest ocean trench.
- Arable land productivity has decreased by 20 percent over the course of the past two decades, greatly endangering food security.
- The world's plants, insects and microbes are rapidly disappearing, and we are heading toward an "insect apocalypse".
- Turkey's dependence on coal-fired power plants increased its greenhouse-gas emissions by 49 percent from 2005 to 2016 and caused the air quality in large cities and industrialized regions to drop well below World Health Organization standards.

*The Real Costs of Coal - Muğla* report is thus the latest -for the time being- in a series of reports that pre-diagnose a disease worse than the bubonic plague, the "black death" of the medieval ages, while also showing that this disease can be tackled, so long as we take rapid action. In January 2019, Turkey's Minister of Treasury and Finance tweeted: "We achieved our '100 million tons of coal production' target, which was the most important part of our domestic coal push directed at reducing our current account deficit. I congratulate everyone involved for their contributions." He also shared the following tweet from the country's Minister of Energy and Natural Resources: "We broke the Turkish Republic record with 101.5 million tons of domestic coal production. With our people's energy and our country's strength, we provided an important contribution to reducing our current account deficit on the path to 'Independent Energy, Strong Turkey'."

*The Real Costs of Coal - Muğla* report, on the other hand, diagnoses a severe disease through the following statement: "Coal has become one of the most important factors shaping the historical geography of Muğla for the past 35 years, as the province hosts three coal-fired power plants and several lignite mines that provide fuel to these power plants. This geographic change has brought with it heavy ecological, social and economic costs." Do you think that "reducing the current account deficit" will be sufficient to cure this disease?

**Ömer Madra**





# AIR: THE BREATH OF OUR PLANET

...  
Air is where the seasons are writ  
The seasons' cycle is what limits  
Human desire.  
Should Nature's balance ever be upset,  
Oh should the climates change, should seasons  
flounder,  
Oh then that fool called man will forever  
Be hunted !  
If the climate cycle falters  
Mankind will fall prey to his greed and arrogance  
He will exhaust the fish and the dolphin in the seas  
The deer and the fawn in the forest  
The tree, the olive, the beech in the earth  
The melon in the field the grape on the vine  
The bird in the tree, the goat in the mountain.  
He will forget he is a part of Nature  
He will consume, deplete, destroy nature  
He will suppose himself master of the world  
That is why the world's balance is held by Air.  
Air.  
For should the order of the climate change  
Should the seas rise  
Oh there is no longer a Noah to build an ark  
So remember  
The law of the air is written in the skies  
Raise your head to the sky  
Look up there  
Read !  
Air  
Our life  
Our breath  
Our sacred, our holy Air !

...  
**Buket Uzuner**

\*This quote is an excerpt from the novel called "AIR" (Hava) by Turkish ecofeminist writer Buket Uzuner. "AIR" is the third novel of her "Nature Quartet", which include "Water", "Earth" and "Fire". The piece is translated by Pelin Ariner from Turkish.

# EXECUTIVE SUMMARY

**For the past 35 years, coal has been reshaping the province of Muğla in western Turkey, which is home to three coal-fired power plants and several lignite mines that provide fuel to these facilities. This geographical transformation has brought with it heavy ecological, social and economic burdens.**

Although these three coal-fired power plants are all nearing their retirement age, plans to rehabilitate them and increase their capacity were designed after the facilities were privatized in 2014, with an aim toward extending their lifespan for an additional 25 years. This extension would lead to the permanent destruction of the province's natural environments and habitats through the expansion of existing coal mines and ash dams, adding to the environmental stress already caused by coal-fired power plants.

As part of the extensive research launched by CAN Europe in 2018, *The Real Costs of Coal – Muğla* report uses the Muğla province as a case study to reveal the actual costs of coal-fired power plants as they are borne by the environment and by society. The report also demonstrates how available alternatives can put an end to these costs, which are generally defined as “externalities,” and thus

disregarded when calculating the price of investments in coal-based energy production and related policies.

This report is the result of technical modeling based on original data, information requests, ethnographic data collection, literature review and contributions from various scientists. It summarizes the impacts of coal and coal-fired power plants in Muğla.

## **The environmental costs of coal**

Assessing the environmental impacts of coal in Muğla province requires a holistic approach that takes into consideration both coal mines and coal-fired power plants. Coal mines in Yatağan and Muğla are spread over a wide geographical area, causing extensive land degradation, ecosystem damage, water pollution and air pollution. Pollution from the Yatağan, Yeniköy and Kemerköy coal-fired power plants harms plants, forests, wetlands, bees and other animals. The unsafe disposal of wastewater from coal-fired power plants and of coal ash further pollutes and damages the environment.

According to the contributing report *The Impacts of Muğla's Three Coal-Fired Power Plants and Open-Pit Lignite Mining Facilities on Forest Ecosystems*:

- After 13 mine operating licenses were granted to the private sector in 2014, the total land area allocated to lignite mines reached 21,000 hectares in Yatağan and 23,000 hectares in Milas. Of these totals, 47.3 percent are forested areas.
- The total area covered by open-pit lignite mining operations in the region since 1979 is 5,000 hectares (equivalent to 7,800 football fields). Data about the extent of forest and agricultural areas destroyed as a result is unavailable.
- If all areas licensed for coal production were to become operational over the next 30 years, it could lead to the destruction of an additional 11,200 hectares of forested area in Milas and 7,250 hectares in Yatağan, a total area equivalent to 30,000 football fields.
- Forest ecosystems of the region are also impacted by the environmental pollution created by coal-fired power plants. For example, the ash dams where hazardous solid and liquid waste from all three of Muğla's coal-

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**"In modeled 1.5 °C pathways... of global electricity in 2050, the use of coal shows a steep reduction in all pathways and would be reduced to close 0% of electricity." IPCC Special Report: Global Warming of 1.5 °C**

fired power plants is collected cover a total forested area of 300 hectares (equivalent to 470 football fields).

According to the results of The Real Costs of Coal's air-pollution dispersion modeling:

- Annual mercury emissions from the Yatağan, Yeniköy and Kemerköy coal-fired power plants exceed 1 million tons. Twenty percent of these emissions are deposited in the waters of the Mediterranean, where they accumulate in fish tissue and enter the food chain. If these plants remain operational, they will emit 435,000 tons of sulfur dioxide, 355,000 tons of nitrogen oxide, 29,000 tons of dust and 22,000 kilograms of mercury between 2018 and 2043 (even if the required investments are made in them in accordance with environmental regulations).
- Air pollution caused by Muğla's coal-fired power plants reaches the highest concentration levels in Yatağan, Milas, Kavaklıdere and Ula. However, due to prevailing winds and other atmospheric factors, primary particulate matter ( $PM_{2.5}$ ) emissions travel across the Mediterranean Sea to the Greek island of Rhodes and to Egypt in the south, reach the province of Aydın in the north, and extend to Greece in the west, and to Palestine and Israel in the east.





The three coal-fired power plants in Muğla, for example, emitted **360 million** tons of CO<sub>2</sub> between 1982 and 2017 and will continue to contribute to global warming even after the planned upgrade investments are made.

The three coal-fired power plants are expected to emit an additional **328 million** tons of CO<sub>2</sub> in total if they continue to operate until 2043.



### The health costs of coal

According to the health-impact modeling carried out as part of The Real Costs of Coal report, coal imposes a very heavy burden on human health in Muğla.

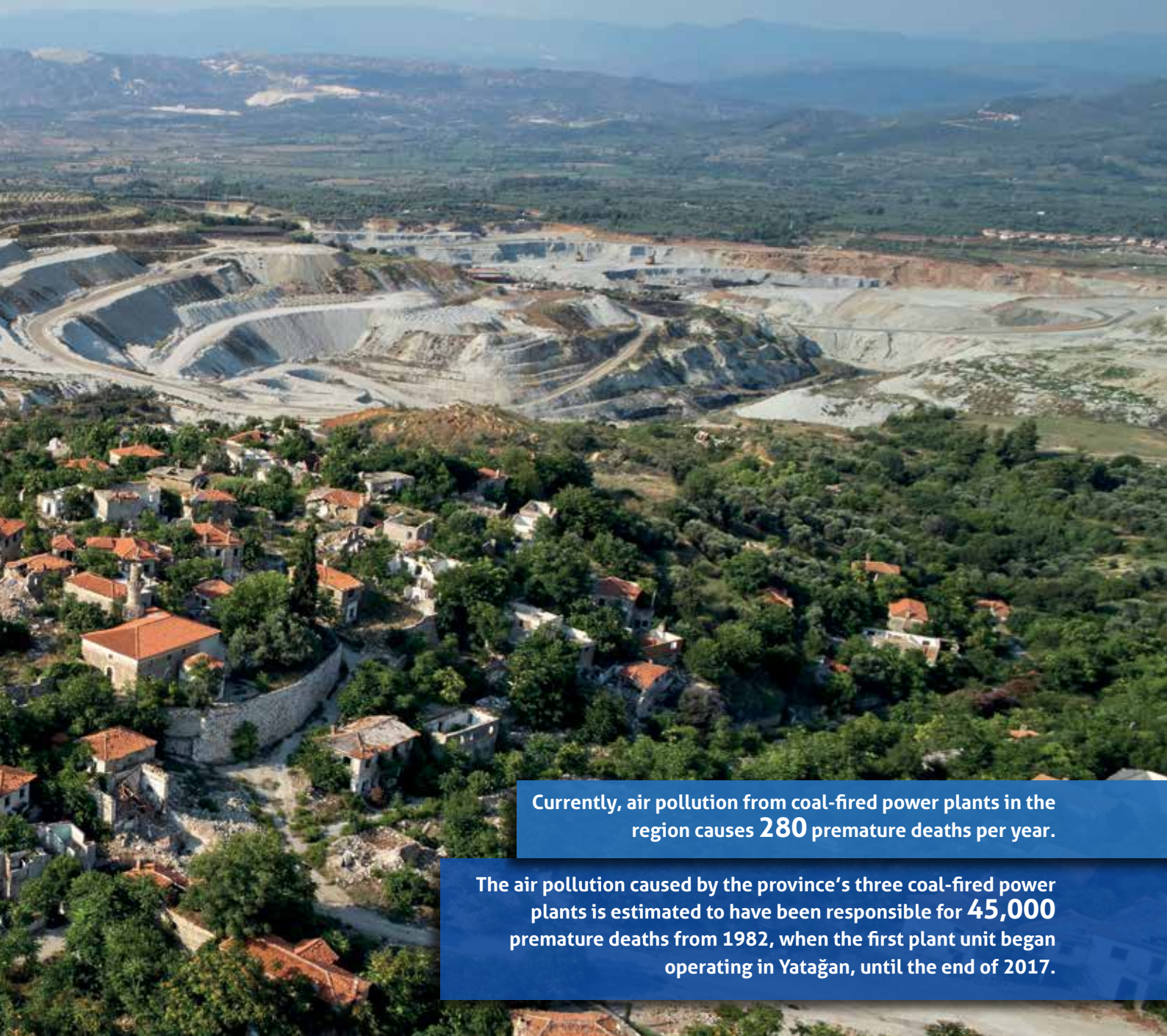
- Currently, air pollution from coal-fired power plants in the region causes 280 premature deaths per year. A total of 61,000 work days per year is lost due to diseases and premature death.
- The air pollution caused by the province's three coal-fired power plants is estimated to have been responsible for 45,000 premature deaths from 1982, when the first plant unit began operating in Yatağan, until the end of 2017.
- If these coal-fired power plants remain operational for 50 years, they are expected to cause 5,300 additional premature deaths even if the required investments are made in them in accordance with environmental regulations.

### Coal's contribution to climate change

In a report published in October 2018, the Intergovernmental Panel on Climate Change (IPCC) laid out the reasons it is essential to limit global warming to 1.5 °C above pre-industrial levels, a target that is still achievable. According to the report, one of the most crucial steps necessary to meet that target is to urgently phase out coal investments, and to realize net-zero carbon consumption by 2035 for OECD countries, including Turkey, and by 2050 for non-OECD countries.

However, there is still no economically feasible technology that can capture carbon dioxide, a greenhouse gas that contributes significantly to global warming, before it is released to the atmosphere. The three coal-fired power plants in Muğla, for example, emitted 360 million tons of CO<sub>2</sub> between 1982 and 2017 and will continue





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The air pollution caused by the province's three coal-fired power plants is estimated to have been responsible for **45,000** premature deaths from 1982, when the first plant unit began operating in Yatağan, until the end of 2017.

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According to calculations made by Professor Doğanay Tolunay for *The Real Costs of Coal – Muğla* report, if the forest ecosystems located within the boundaries of the Yatağan and Milas coal-mining lease areas are entirely destroyed for coal extraction, the loss of biomass, soil, aboveground dead organic matter and dead wood will create a carbon-sink-area loss equivalent to 9 million tons of carbon dioxide. Losing this carbon-sink potential would result in 66,200 additional tons of CO<sub>2</sub> emissions per year, or a total of 2 million tons of additional CO<sub>2</sub> emissions over 30 years of mining activity.

### **The social and cultural costs of coal in Muğla**

Coal-fired power plants and coal production facilities in Muğla also cause significant harm to the region's socio-economic structure.

Over the past 35 years, eight villages have been forced to relocate -some more than once- when coal mines became operational. If the capacity of these plants is increased and their lifespans extended as planned, more areas licensed for coal mining will become operational, leading to 40 additional villages being forced to entirely relocate or for their residents to leave their homes due to the expropriation of olive groves and agricultural forest areas that they rely on for income. This would entail the direct or indirect displacement of approximately 30,000 people: 8,300 people in Milas and 20,400 people in Yatağan and Menteşe.





Farmers in the area around the Yatağan coal-fired power plant have filed lawsuits charging that pollution from the power plant has caused significant decrease in agricultural yields and therefore financial losses. Courts have ruled that this pollution has indeed impaired agriculture in the area, damaged plants that had not yet completed their leaf development stage and decreased yields.

Muğla's archaeological heritage is also threatened by the coal-fired power plants and coal mine expansions in the region. The triangle today formed by Yatağan, Yeniköy and Kemerköy was referred to in antiquity as Caria, and contains many registered archaeological sites within the boundaries of the areas where lignite extraction permits were awarded, according to an analysis carried out by the

Archaeology Society for The Real Costs of Coal report. The archaeological sites most affected by the coal extraction fields are the ones located between the ancient city of Stratonikeia, a candidate site for UNESCO World Heritage designation, and Lagina. A total of 880 archaeological sites, including first- and third-degree sites where excavations are ongoing, lie within the impact zone of the Yatağan, Yeniköy and Kemerköy coal-fired power plants.

### **Muğla coal's burden on the economy**

The Yatağan, Yeniköy and Kemerköy coal-fired power plants in Muğla had already reached retirement age when their lifespans were extended through privatization. The burden of the significant state subsidies and incentives provided to these three old and dirty coal-fired power





plants is directly reflected in the tax-paying consumers' electricity bills. In other words, the cost of continuing to operate these power plants, which should have been shut down a long time ago, is borne by the citizens, both financially and in terms of the harm they continue to cause to human health and ecosystems.

Where actual data was available, the following subsidies for the Yatağan, Yeniköy and Kemerköy coal-fired power plants were analyzed for The Real Costs of Coal report:

- Each of the three coal-fired power plants benefit from VAT exemption, Customs Duty Exemption, Tax Reduction, Social Security Premium Support (Employer's Share), Land Allocation and Interest Support through the "prioritized investments" scheme on the grounds that they produce electricity from domestic resources.
- In 2017, 30 percent of the total electricity purchased from the Yatağan, Yeniköy and Kemerköy coal-fired power plant operators was done under a guaranteed fixed-price incentive given to power companies that produce electricity from domestic resources. This amounted to a total of 1.10 billion Turkish Lira.

- The allowances that were paid to these three coal-fired power plants under the Regulation on the Electricity Market Capacity Mechanism, which entered into force in January 2018, to enable them to maintain a certain operational capacity, cost the state budget approximately 187 million Turkish Lira for the period between January and December 2018.

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# ABOUT THIS RESEARCH

**Coal has negative impacts on the natural environment during every stage of its use: from its extraction and transportation, to its preparation (through crushing, sieving and washing) and burning, all the way through to the disposal of the waste produced in each of these stages. It destroys forests, valleys and mountains, while contaminating or depleting ground- and surface-water resources.**



**"If the remaining lignite mining areas in Muğla region of Turkey become operational as planned: we stand to lose 18,450 hectares of forest"**  
**Association for the Research of Rural Environment and Forestry Issues**

It emits a wide range of contaminants and hazardous materials that pollute the soil and air, harming or depleting non-living (or "abiotic") elements of the ecosystem that are essential to all life, and exhausting the world's supply of fossil fuels. The disruptions it causes to the life-giving water, carbon and nitrogen cycles are difficult to reverse. The habitat destruction and pollution it creates harms and can even drive into extinction plants, animals and essential microorganisms.

When the ecosystems in which humans live and on which they depend become unhealthy, this also impairs -and even imperils -people's health and their social, cultural and economic wellbeing. For the past 35 years, coal has been reshaping the province of Muğla in western Turkey, which is home to three coal-fired power plants and several lignite mines that provide fuel to these facilities. This geographical transformation has brought with it heavy ecological, social and economic burdens. Using the Muğla province as a case study, *The Real Costs of Coal – Muğla* report reveals the actual price borne by the environment and by society of generating power with coal. The report also demonstrates how available alternatives can put an end to these costs, which are generally defined as "externalities" and thus disregarded when calculating the price of investments in coal-based energy production and related policies.

Detailed research went into *The Real Costs of Coal – Muğla*. The report's authors reviewed academic studies and official documents available to the public; filed requests for additional data that should be open to public access under freedom of information frameworks; consulted the testimonies of local Muğla residents and various experts; and examined fieldwork conducted by volunteer experts and nongovernmental organizations. The available technological and emissions data on the three coal-fired power plants in Muğla was used to model the health impact of these facilities and the dispersion of the air pollution they create.



# THE HISTORY OF COAL IN MUĞLA

**Coal investments in the province of Muğla began at the end of the 1970s when increasing demand for electricity in Turkey coincided with an economic crisis in the country. These investments were in line with energy policies based on utilizing domestic coal resources as a solution to both problems.**

In 1979, the Turkish state began operating the Yatağan and Milas lignite mines in Muğla that would provide coal to the province's new power plants. The first unit of the Yatağan coal-fired power plant, designed by a European consortium under an intergovernmental barter agreement and built with local construction partners, became operational in 1982. The Yatağan facility was followed by the Yeniköy (1986) and Kemerköy (1994) coal-fired power plants, which were built through the same model and put into operation gradually. After being state-operated for nearly 30 years, Muğla's coal-fired power plants and lignite mines were privatized at the end of 2014 as part of Turkey's post-2012 energy-liberalization policies.

Today, five years after their privatization, these power plants are in a new phase in which their lifespan is planned to be extended for an additional 30 years past its technical completion. These extension plans apply to a total of 12 coal-fired power plants, state investments planned as of 1950s, built in Muğla and other provinces. Some have already been privatized while the privatization of others is still in process.

Lifespan extensions for coal-fired power plants require high-cost investments in upgrading these facilities. Even though such investments do reduce the amount of environmental pollution created by these plants, they cannot eliminate their negative impacts on ecosystems and human health. On the contrary, extending the lifespan of Muğla's coal-fired power plants implies expanding the lifetimes of the province's existing coal mines by putting into operation all or most of its licensed private-sector lignite fields, and producing energy from the coal extracted from these mines, regardless of all the cost to be bared.

These plans have brought Muğla and the other provinces hosting these coal-fired power plants -and indeed, the entire country- to an important crossroads. Turkey can decide to calculate the real costs of coal -rather than continuing to treat it as an "inexpensive" energy source- and opt instead to design an energy future that is more

socially and economically equitable, and more environmentally friendly. Or it can decide to continue down the path of increasing the burden created by coal on nature and society, condemning future generations to bear the direct environmental problems caused by coal as well as the irreversible consequences of climate change.

Muğla holds a historically important place in the development of environmental awareness and campaigning in Turkey. Residents of the province have been mobilizing against the negative health and environmental impacts of coal mining and coal-fired power plants since the 1980s, taking both legal action and non-violent direct action. The Yatağan and Gökova campaigns, which began locally and reached national and even international scale through the efforts of local campaigners, are cornerstones of the Turkish environmental movement. In the late 1980s, local communities, labor unions, prominent legal experts, NGOs and environmental activists came together to warn decision-makers about the many hazards -most notably air pollution- of the coal-fired power plants in Yatağan, Yeniköy and Kemerköy.

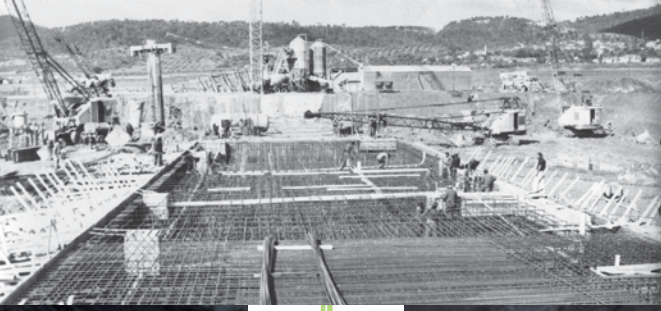
Activists initiated a variety of legal proceedings, and brought their case before the European Court of Human Rights (ECHR) when all appeals before Turkey's domestic courts were exhausted. Recognizing the applicants' right to bring legal action over the serious health impacts of these power plants, the ECHR ruled that their right to a fair hearing had been denied and that the Turkish state should pay compensation to the applicants. Following this decision, the Parliamentary Assembly of the Council of Europe called on Turkey to "either take the appropriate environmental measures or to close down these three power plants".

If decision-makers in Turkey had listened from the outset to the civil-society actors who spoke with one voice to warn them of the dangers of coal, and had closed down or cleaned up these plants early on, the country could have minimized the costs it incurred and avoided future risks.



1977

- Foundations laid for the Yatağan Power Plant.



1979

- Yatağan-Eskihisar and Milas-Sekköy lignite mines go into operation.

1980

- Agreement signed with the Polish government to build the Yeniköy Power Plant (identified as the Sekköy Power Plant in the contract text).



1982

- First unit of Yatağan Power Plant goes into operation.
- Turkish Electricity Administration starts urgent expropriation process to build social facilities and a dock in the village of Ören, some 3-4 km away from the current location of the Kemerköy Power Plant.
- Villagers and the Milas Chamber of Agriculture file a complaint to the country's then-president and prime minister against the urgent expropriation process in Ören, bringing Kemerköy onto the public agenda for the first time.

1983

- Second unit of Yatağan Power Plant goes into operation
- High Coordination Board of Economic Affairs decides to build another 3x210 MW coal-fired power plant in Kemerköy.

1991

- Yatağan Environmental Association established to fight against the environmental pollution created by the coal-fired power plant.

- Second unit of Yeniköy Power Plant goes into operation.

1987

- First unit of Yeniköy Power Plant goes into operation.
- Foundations laid for the Kemerköy Power Plant.

- Villagers take non-violent direct action by lying down in front of the excavators and other heavy equipment brought in to build the Kemerköy Power Plant.

- Yatağan State Forestry Enterprises sues Turkish Electricity Administration on the grounds that the air pollution caused by the Yatağan Power Plant had caused forested lands to dry out.

1986

- Third unit of Yatağan Power Plant goes into operation.

- Women of Kemerköy block the bridge entering their village to keep out a team from the Turkish Electricity Administration who had come to do fieldwork for the power plant construction.
- A group of villagers from Kemerköy meanwhile travels to Ankara to file a complaint against the project.
- Petition campaign No to Kemerköy Power Plant is supported by local newspapers, the Bodrum Municipality, chambers of agriculture and commerce, and hunters' and tourism associations.
- The Kemerköy Power Plant is brought onto the agenda of the Turkish Parliament and politicians from different parties visit the region in support of the local people's objections to the project.

- Legal entities representing villagers in the area file a lawsuit with the Council of State against the Prime Ministry, on the grounds that it chose an inappropriate location for the Kemerköy Power Plant.
- Council of State dismisses the villagers' lawsuit.

1984



# 1993

- February 17: Radiation early warning system in Muğla alerted due to radioactive fallout created by the Yatağan Power Plant, which is shut down temporarily as a result.

- Hundreds of farmers file suit against the Turkish Electricity Administration, winning a compensation order totaling billions of Turkish Lira, over losses to their yields caused by environmental pollution from the Yatağan Power Plant.
- Volunteer environmental lawyers file administrative appeal to the Ministry of Health, the Ministry of Energy and Natural Resources, the Ministry of Environment, the Turkish Electricity Transmission Corporation and the Muğla Governorship, demanding closure of the Yatağan and Yeniköy Power Plants, and cancelation of the plans for the Kemerköy Power Plant.

- More than 7,000 people from Yatağan march in protest of the radioactive fallout created by the power plant.
- Members of a group in Muğla called "Mothers who love their children" organize protests and announce that they won't give birth to any more children until the power plant is closed down.
- March 8: Some 3,000 people – including local residents and environmental activists, associations and professional chambers from around the country – protest in the village of Ören against the Kemerköy Power Plant following a call by the Muğla Provincial Environmental Coordination Board.
- The Gökova Constant Action Group is founded by local communities and environmental associations in the region
- September 1: Members of the Gökova Constant Action Group travel to Ankara to object to the Kemerköy Power Plant, bringing sheep, lambs and turtles from their hometown with them.

# 1994

- First and second units of the Kemerköy Power Plant go into operation.
- Construction begins on the Yatağan Power Plant electrostatic filter unit, 11 years after the facility first became operational.

- West Mediterranean Environmental Platform established to unite environmental movements in the cities of Muğla, Denizli, Burdur, Isparta and Antalya.

- Following the non-response of the administrative authorities, three different cases are filed in the Aydın Administrative Court by volunteer environmental lawyers.

- The Council of State's Administrative Law Chambers Assembly finalizes the decision to suspend and cancel the execution of power-plant operations, rejecting the defendant's request for rectification.

# 1999

- Turkey's Supreme Court of Appeals upholds the decision of the Aydın Administrative Court to suspend and cancel the execution of power-plant operations.

# 1998

- The Yeniköy Power Plant is closed based on a decision by the Aydın Administrative Court, but reopened a day later when the court is overruled by the Council of Ministers.

# 1997

- July: An expert report is presented to Aydın Administrative Court, demonstrating the damage caused by the lack of flue gas treatment systems on all three power plants.
- August: Based on the expert report, the Aydın Administrative Court rules that all three power plants are polluting the environment and that their operations or construction should be suspended or cancelled.
- September: The Council of Ministers overrules the Aydın Administrative Court, allowing the power-plant operations to continue on the grounds that their closure would cause energy-supply constraints and loss of jobs, thereby affecting the region's tourism income.
- An appeal is made to the administrative authorities, requesting the implementation of court decisions, but subsequently rejected.
- Members of the Council of Ministers file a criminal complaint against power-plant managers and Turkish Electricity Transmission Corporation officials.
- Ankara Chief Public Prosecutor's Office dismisses the demand for prosecution for the prime minister and other ministers.
- Ten lawyers make individual applications to the European Court of Human Rights based on the non-enforcement of the court ruling against the power plants.

# 1996

- Third unit of the Kemerköy Power Plant goes into operation.

# 1995

Development of coal-fired power plants and coal mines

Actions by local communities and the ecology movement

Legal struggle



2000

- A privatization auction for the three power plants is held for the first time and a contract signed for the transfer of operating rights, though it could not be enacted due to local resistance and legal obstacles.
- The Yatağan Platform is established to bring together civil society organizations and local authorities.
- Some 6,000 people attend a demonstration in Yatağan, No to Environmental Pollution and No to Privatization of Coal-fired Power Plants, supported by 47 organizations, including the Yatağan Municipality, various trade unions, political parties, public institutions and nongovernmental organizations.
- The Turkish Medical Association publishes a report, "Assessment of Air Pollution in Yatağan," revealing that air pollution in the area was observed to be high enough to pose a danger to public health.

- Farmers carrying out agricultural activities around the Yatağan Power Plant open nine separate lawsuits, charging that the quality and quantity of their olive and tobacco production is being negatively affected by the ash and toxic gas emitted by the facility, therefore causing them to suffer material damage.
- The Yatağan Civil Court of Peace accepts the plaintiffs' claims and rules that material damages were caused.
- The decisions are finalized by the Supreme Court of Appeals.
- The governorship of Muğla shuts down the Yatağan Power Plant approximately 50 times from the beginning of 2000 until the end of 2001.
- The Yatağan Civil Court of First Instance recognizes claims by two citizens who had sued for damages, saying that the Yatağan Power Plant was damaging their mental and physical health. The court convicts the Turkish Electricity Transmission Corporation head office, ordering it to pay 500 million Turkish Liras (500 Turkish Liras in today's currency) to each claimant, but the decision is subsequently reversed by the Supreme Court of Appeals.

2004

- The investors' consortium of national and foreign companies that signed a contract for the transfer of operating rights of the three power plants in 2000 appeals for arbitrage to the International Chamber of Commerce over the failure to privatize the facilities, resulting in compensation from Turkey of US\$90.3 million with interest operation.

2005

- The European Court of Human Rights rules that the right to a fair trial was violated by the failure to implement judicial decisions, sentencing Turkey to pay 1,000 euros in compensation to each plaintiff.

- An announcement is made that a fourth coal-fired power plant will be built in the region, in the Karacahisar village of Milas.
- August: A decision is made to privatize the Yatağan, Yeniköy and Kemerköy Power Plants, along with their immovable assets, and both movable and immovable assets used by the South Aegean Lignite Pits and Yeniköy Lignite Pits, through the "Asset Sale" method; and the Kemerköy Port Area as a whole, along with 12 mining licenses belonging to the sites that provide coal to these power plants and the mining sites comprised by these licenses, through the "Transfer of Operating Rights" method.
- November: Privatization auction launched for all three power plants and mining sites.

- The organization Karacahisar Volunteers initiates resistance against the planned Karacahisar project, working with national-level NGOs.

2013

- Hundreds of millions of Turkish Lira are transferred from the public budget within the scope of Public Investment Programs to rehabilitate the electrostatic and flue gas desulphurization facilities of the Yatağan and Yeniköy Power Plants, and the generator of the Yeniköy Power Plant.

2012-14

- The Ministry of Health commissions research by the Muğla Provincial Health Directorate on cancer cases in Yatağan, but the final report on the results of the study is labeled "confidential" and released only for ministerial use.
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2012

- A flue gas desulphurization facility is commissioned for the Yatağan Power Plant, 25 years after it was established.

2008

- A flue gas desulphurization facility is commissioned for the Yeniköy Power Plant, 21 years after it was established.

2007

- A flue gas desulphurization facility is commissioned for the Kemerköy Power Plant, 12 years after it was established.

2006



## 2014

- May: ANT Energy Industry Trade and Limited Company (Çalık Energy I.C.), receives an approved Environmental Impact Assessment report for its Ant Energy Thermal Power Plant Project, a coal-fired facility with 1x160 MW installed power capacity in the Kırıkköy area of Yatağan.
- December: Contracts to sell and transfer the operating rights for all three power plants are signed, with Yatağan Power Plant and its coal mines transferred to Bereket Enerji I.C.; and Yeniköy and Kemerköy Power Plants and their coal mines, along with the Kemerköy Port Area transferred to the İC İttaş-Limak I.C. consortium under the YK Energy Production I.C.

- Workers at the Yatağan, Yeniköy and Kemerköy Power Plants and associated mines, and the unions representing them, continue sustained anti-privatization actions with strong public support in Muğla, Yatağan, Milas and Ankara from February to December, when the transfers are approved.

- The Muğla Provincial Directorate of Environment and Urbanization decides that an Environmental Impact Assessment report is not required for the underground coal mine project planned in Yatağan's Hacıbayramlar district.
- Conveyor belts carrying coal to the Yatağan Power Plant collapse, killing two workers and injuring more than 10.
- Environmental Impact Assessment process initiated for a new, open-pit coal mine license area of 167 hectares to be operated in Yatağan.

- January: The Milas City Council organizes an "Energy Panel" against the lignite mine expansions in Milas's Gereme district with the participation of Yatağan residents and other local communities in the Milas region.
- March: Residents of the Karadam neighborhood refuse to leave their villages, which are planned to be expropriated for the expansion of the İkizköy lignite field in Milas.

## 2015

- Exploratory and project development field studies are conducted for the lignite reserves in Karacahisar, Milas, by the General Directorate of Mineral Research and Exploration, Turkish Coal Enterprises and YK Energy Production I.C.

## 2016

- A worker dies by falling into the Yatağan Power Plant's ash silo.
- The Provincial Directorate of Food and Agriculture issues a response to the complaint made by the Turgut Association for Social Aid, the Protection of Cultural and Natural Assets over the illegal cutting of olive trees by the plant operator in order to expand the coal mine. The response confirms that this destruction was unauthorized, and that administrative action was taken due to the violation of Article 20 of Law No. 3573 on Improvement of Olive Cultivation and Inoculation of Wild Varieties.

- The Muğla Provincial Food, Agriculture and Livestock Directorate announces that administrative fines will be levied against the company operating the Yatağan Power Plant and coal mines for cutting the olive trees in Turgut village without permission.
- Turgut villagers file a lawsuit with the Yatağan Criminal Court of First Instance over the Yatağan Thermal Energy Production I.C.'s illegal intervention in the village's olive groves.
- The Turgut Association for Social Aid, the Protection of Cultural and Natural Assets files complaints to the Ministry of Environment and Urbanization, the Muğla governorship, and the Muğla Provincial Directorate of the Ministry of Environment and Urbanization about the coal mines not complying with the "health protection strip" rule.
- August: Volunteers with the Turgut Association for Social Aid, the Protection of Cultural and Natural Assets file a lawsuit against the decision not to require an Environmental Impact Assessment report for the mine expansion project in the Hacıbayramlar neighborhood.
- September: Residents of Turgut and Yatağan object to the project development file for the new coal mine license area, which was presented to the Ministry of Environment to initiate the Environmental Impact Assessment process.

## 2017

- The Turgut Association for Social Aid, the Protection of Cultural and Natural Assets initiates active resistance against lignite mine expansions with the support of Turgut villagers and the Muğla Environmental Platform.
- The Provincial Food, Agriculture and Livestock Directorate determines during a field visit to Turgut village that 1,483 olive trees on 35 parcels had been cut without permission for coal mining operations since 2013.

## 2018

### Sources:

- 1) From the archives of the Official Gazette; retrieved on 23 October 2018. <http://www.resmigazete.gov.tr/>;
- 2) From the archives of Milliyet newspaper; retrieved on 23 October 2018, <http://gazetearsivi.milliyet.com.tr/>;
- 3) "Gökova'da Bir İnat Abidesi [A Stubborn Monument in Gökova]," Nazmi Kozak, *Anatolia Turizm Araştırmaları Dergisi* [Anatolia Tourism Research Magazine], Book:4, Number:1, 1993, Ankara. <https://www.anatoliajournal.com/atad/?sayfa=dergi&sayi=1&yil=1993&lang=tr>; retrieved on 23

### October 2018.

- 4) "Yatağan Termik Santrali Etki Alanındaki Turgut Köyü Hak İhlalleri Raporu [Report on Rights Violations in Turgut Village in the Impact Area of the Yatağan Coal-Fired Power Plant]." Ekoloji Kolektifi Derneği [Ecology Collective], May 2018, Ankara. <http://ekolojikolektifi.org/portfolio/yatagan-termik-santrali-etki-alanindaki-turgut-koyu-hak-ihlalleri-raporu/>; retrieved on 23 October 2018
- 5) Personal interviews with the people of Yatağan-Turgut and Milas-Karacahisar. Date: February to July 2018.









# **PART 1: THE ENVIRONMENTAL COSTS OF COAL**

The residents of Muğla witness coal's impacts on a daily basis and are directly or indirectly exposed to these impacts. The footprint of coal on the province's geography continues to increase day after day and is also easily observed by visitors who travel to Muğla by air or land.



Forests, groundwater, surface water, valleys and mountains are destroyed to extract coal. Various soil, water, and air pollutants and hazardous substances are emitted during mining activities and electricity production. The high concentration of greenhouse gases in the atmosphere and the destruction of carbon sinks accelerate human-induced climate change. Humans, animals, plants and other life forms lose their habitats as well as their health or lives as a result of chemical and radioactive pollution and physical interventions. Academic studies and the experiences of local residents indicate that Muğla's nature and residents have been subjected to all of these adverse impacts for the last 40 years. Nevertheless, there are no environmental assessment (EIA) reports neither for the Yatağan, Yeniköy and Kemerköy coal-fired power plants nor for the lignite mines that have been providing fuel to these plants. The environmental performance monitoring and audit reports of these facilities, which have been operating for nearly 40 years, cannot be accessed -if such reports exist.



## LAND CHANGE, ECOSYSTEMS

The harmful impacts of coal on the ecosystems and human health begin with the extraction of coal, or the mining phase. Mining completely alters the topography, geological structure, water regime, local climate, flora and fauna and landscape of the land. Open-pit coal mining is a mining process where land degradation and the intervention to ecosystems are most visible.

In open-pit coal mining, trees that sit atop of the reserves are cut down in order to reach the coal seam situated at a depth of 5-100 meters from the ground surface. The topsoil, which has been formed over millions of years and is valuable for agricultural and forestry activities, is stripped. Rocks are crushed with detonators and heavy excavation machinery dig until they reach the coal. Along with the cut trees and stripped topsoil, all living organisms of the forest ecosystem such as shrubs, herbaceous plants, fungi, lichens, algae, bacteria, viruses, mammals, reptiles and birds are largely or entirely destroyed, resulting in the decrease of the biological diversity of the area. The loss of topsoil and removal of vegetation cover,

which have the function to retain soil water, triggers erosion (Palmer et al., 2010; Usta & Demirtaş, 2018).

And this is also the case in Muğla. Operations in Muğla's lignite mines began in 1979, when the state began to extract lignite from the the Yatağan-Eskihisar and Milas-Seikköy sites. Except for the Milas Alatepe site, which is partially an underground mine, lignite mines in both basins have been operated as open-pit mines. According to a calculation based on the forest management plans of the General Directorate of Forestry (OGM), open-pit lignite operations that have been conducted since 1979 cover an area of approximately 5000 hectares (or 7800 soccer fields) (Usta and Demirtaş, 2018). Quantitative data regarding forest and agricultural areas that were destroyed in this context are not accessible. However, taking into account that 68 percent of Muğla province consists of forested areas and 24 percent of agricultural land (Muğla Metropolitan Municipality, 2015), a comparison of yearly satellite images reveals a significant loss of forest assets in the region in the last 35 years.





**Figure 1: Comparison of Enlargement by Years for Yatağan Lignite Mine Fields**



“The forest areas between Milas and Ören, which use to stretch for kilometers, have vanished. In the center of the forested area in Sekköy, there is now a lake that did not exist before. The old mining fields are flooding and we do not know what is in the water that has accumulated there. Legally, the topsoil that is stripped for mining activities should be stored separately. However, this fertile forest soil is mixed with other excavation wastes and dumped into nature. At the very least, there should be a way to protect this soil. At the entrance of Ören, the wetland opposite the belts carrying coal from the mine site to the Kemerköy TES is filled with excavation waste from the mine. This area that lies behind the Fisheries Faculty of Muğla University was once a bird sanctuary and was known in history as a health and healing center. The wetland is now completely destroyed because of the mining wastes.”

**Meliha**, Executive Board Member of Milas City Council and Muğla Environmental Platform (MUÇEP)



# FORESTS AND NATURE CONSERVATION AREAS

Forests, which cover 68 percent of Muğla, are ecosystems where the destructive impacts of coal are visible to the naked eye. In some locations, old lignite mines expand into the heart of forest areas in the form of continuous giant crevices up to 10 kilometers in length. The Association for the Research of Rural Environment and Forestry Issues researched the forests, power plants and mining operations in the region and published a report titled "The Impacts of the Three Coal-Fired Power Plants and Open-Pit Lignite Mines to Forest Ecosystems in the Province of Muğla (Usta and Demirtaş, 2018).

According to this report:

- With the 15 mining operating licenses awarded in Yatağan and Milas, a total of 46,700 hectares are allocated to lignite mines (23,360 hectares in Yatağan and 23,340 hectares in Milas).
- Coordinates of only 43,800 hectares of the total licensed area could be accessed and 47.3 percent of this portion is forest land. According to the forest management plans, the regional forest ecosystem includes the dominant Calabrian pine, as well as more than 50 mostly woody plant species (trees and

**Table 1: Forest area (ha) that will be impacted by operating licenses, according to their function**

General Directorate of Forestry Directorate of Forestry	Total Licensed Area (ha)	ECONOMIC FUNCTION	Ecologic Function									Social Function	Total Forest Land (ha)
		Wood Production	Nature Conservation	Gene Conservation	Rehabilitation of Forest Ecosystems	Sites with Very Poor Growing Conditions	Seed Stands Pressure	Protection from Social Pressure	Archaeological Sites	Natural Sites	Research Forests	Hydrological-Aesthetic-Ecotourism Forest	
MİLAS	22,060	6925	817	107	0	2177	258	112	62	1078	40	462	12,038
YATAĞAN	21,786	4928	0	0	483	1346	0	167	0	113	96	1582	8714
GENEL TOPLAM	43,846	11.853	817	107	483	3523	258	279	62	1191	136	2044	20,752

<sup>1</sup> The forest area that will be impacted by each operating license was calculated based on the stand maps in OGM's forest management plans. The digitized operating license boundaries were also overlaid with digitized stand maps using Geographic Information Systems (GIS) software.



shrubs). These forests have many nature-related and social functions such as nature conservation, gene conservation, seed and wood production, maintaining the hydrological cycle and ecotourism (see Table 1).

- Since 1979, open-pit lignite mining activities expanded over a total area of approximately 5,000 hectares (equivalent to 7,800 soccer fields). Quantitative data regarding forest and agricultural areas that were destroyed in this context is not accessible, however a rough estimate would put half of these open-pit lignite mines in forest areas.
- If all the licensed areas become operational in the course of the next 30 years, an additional 11,200 hectares of forest area in Milas and 7,250 hectares in Yatağan will be wiped out, amounting to the destruction of a total area of 20,752 hectares or 30,000 soccer fields.
- Even if lignite were not extracted from all licensed areas, it will impact the ecosystem integrity of an area larger than the one in question; animals, plants and other living species, who live in these physically damaged habitats that are exposed to mining-related pollution and where the groundwater regime is disturbed, will be adversely affected, leading to a decline in biodiversity.
- According to legislation, the mines that are closed down should be rehabilitated and reforested. However, this is extremely difficult and expensive.
- According to legislation, the 'organic topsoil' must be stripped off and stored in the stock area before excavation operations begin. However, in the aftermath of mining activities that are predicted to last 25-30 years, the heaps of soil that have been stored up lose their organic quality and -even if the necessary resources are allocated to afforestation efforts- reestab-

lishing a forest ecosystem in the old mining areas in the short-medium term is not possible.

- Some token afforestation practices using fast-growing exotic species that are not native to the region, such as the fast-growing pseudo-acacia can be observed in a number of very small areas.
- According to official data, the Yatağan Forest Management Directorate planted tree saplings in only 11 hectares for the rehabilitation of the 1,000-hectare Eski-hisar lignite field. In the 2014-2018 Forest and Mining Fields Rehabilitation Action Plan, only 63.8 hectares of land in Muğla, that is, only 1.3 percent of the 5,000 hectares mined and abandoned so far have been included in the rehabilitation plan (Ministry of Forestry and Water Affairs, 2014).
- The region's forest ecosystems are also impacted by the environmental pollution created by coal-fired power plants. For example, the ash dams where hazardous solid and liquid waste from all three of Muğla's coal-fired power plants are collected cover a total forested area of 300 hectares (equivalent to 470 soccer fields). These ash dams are not equipped with any infrastructure that can prevent the hazardous waste from contaminating neither ground and surface waters, nor soil and air. The damage they cause to the ecosystem is irreversible.

The destructive impact of coal on forest ecosystems is not just through physical disturbance; air, water and soil pollution also threaten the flora and fauna in forests. For instance, every year 50 kilograms of acid ( $\text{SO}_2$  equivalent) per hectare is deposited on the 90 km<sup>2</sup> area surrounding the coal-fired power plants. Local residents have been expressing for years that acid pollution has destroyed the forests in the area and reduced olive yield by burning the



The gray-white bare limestone bedrock that is left after lignite extraction from the İkizköy coal mine. This causes a significant disintegration of the ecosystem, and threatens the ecological balance.



flowers of olive trees The damage caused by air pollution from the coal-fired power plants to Muğla's forests became visible shortly after the plants became operational.

Between 1985 and 1986, all of the Turkish red pine trees (*Pinus brutia* Ten.) in the 2,271-hectare natural forest at the Bencik Mountain located at 14 kilometers of the coal-fired power plant, dried and were cut down. This is one of the most important ecosystem destructions to have taken place and is etched in the social memory of the region. The fact that a vast forest has completely dried up has been an important warning sign for the residents of Yatağan regarding the air pollution caused by coal-fired power plants and its possible consequences.

The saplings that were planted as part of the reforestation process that ensued from intense public protests dried and the cypress trees that did not dry turned yellow (Karaöz, 1994; Tolunay and Egeli, 1994). Scientists who, at the onset of forest destructions, stated that the reforestation of forest ecosystems damaged by air pollution from coal-fired power plants may not yield results due to the permanent effects of pollution were proven right (Mol, 1986).

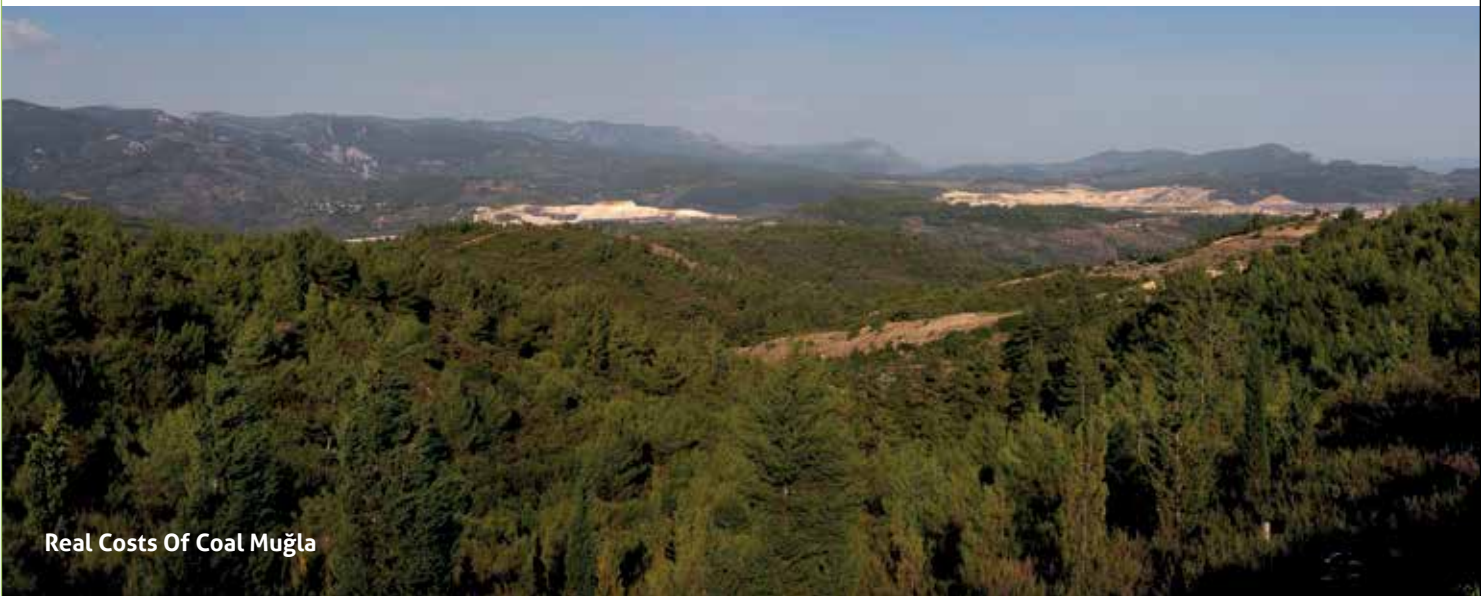
The impact of air pollution caused by coal-fired power plants on olive trees also holds an important place in the history of coal in Muğla. Olive cultivation is still an important source of livelihood in Muğla, and especially in Milas and Yatağan districts. However, the region saw serious drops in olive harvest when mines and coal-fired power plants became operational. The dust emitted by the facilities forms a dust layer on olive leaves preventing the leaf from getting sufficient sunlight thus reducing the tree's photosynthesis activity. As a result the tree's nutrition intake is restricted and the size, taste and oil content of the fruits are thereby negatively affected. The drying that is observed in olive trees occurs when dust particles smaller than 10 µm in diameter settle in the respiratory pores of the leaves and cause the tree to transpire continuously. Furthermore, fine dust, ash and sulfur dioxide (SO<sub>2</sub>) prevent pollination and reduce fruit yield. Prof.Kantarıcı, who has been monitoring for decades the pollution in Muğla

**“ We went to Şahinler village to prune my friend's olive trees. Ash fell down when I tapped the tree and when I touched the leaves. Ash fell down when you tapped the tree, as if it were a stove tank. It was unbelievable. ”**

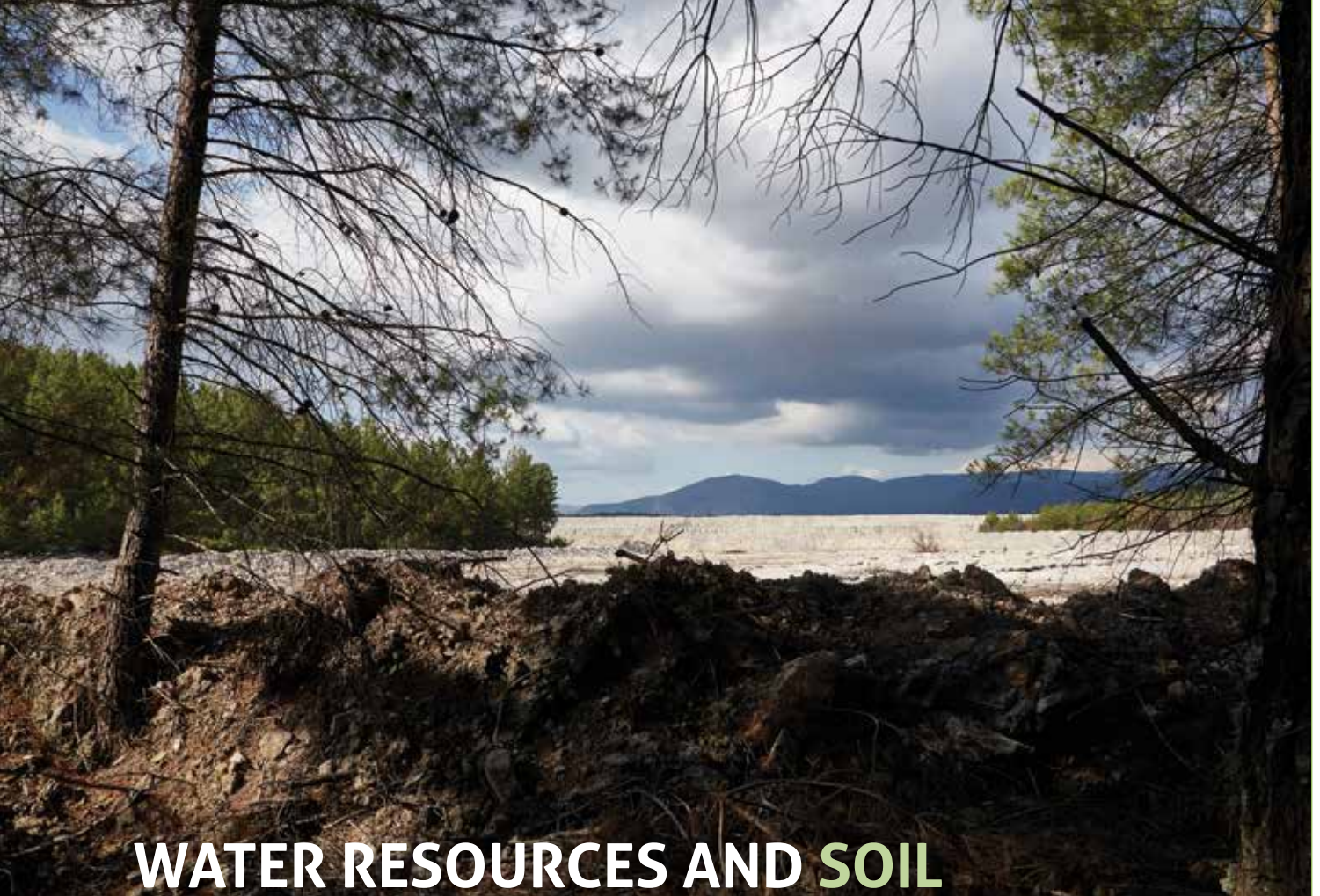
**Mesut, Yatağan, Turgut**

and its impacts on plants, points out that the open-pit mine traffic and the truck traffic density for coal transportation produce even more dust than the dust emitted by coal-fired power plants, thereby negatively impacting olive trees and regional forests (Kantarıcı, 2018).

In addition to the forests that cover more than half of the land area, Muğla boasts rich biological diversity and many nature areas in need of protection. The province is home to four special environmental protection zones, around 200,000 hectares of natural areas, two national parks, and over 100,000 hectares of wetlands that are important for the conservation of biodiversity, species, habitats and ecosystems. Muğla has 687 monumental trees and endemic species that are protected by international agreements, as well as 136 threatened species that are included in the International Union for Conservation of Nature (IUCN) Red List (MUÇEP Science Commission, 2017; Ministry of Agriculture and Forestry, Nature General Directorate of Conservation and National Parks, n.d.). However, these protected areas bear the brunt of environmental pressures caused by lignite mining and coal-fired power plants. For example, a part of Kafacakaplancık, which is located to the north of Yatağan and is designated as a protected area by the Ministry of Environment and Urbanization (MoEU), lies in area licensed for lignite mining and is under the threat of destruction. Many Priority One and Priority Two Natural Sites/Nature Conservation areas in Gökova, Datça, Marmaris and Muğla are located in areas where mercury pollution from the three coal-fired power plants is deposited in the soil and accumulates. There are no studies that provide a holistic examination of the impacts of Muğla's coal-fired power plants and lignite mines on nature conservation areas and species, and particularly on threatened species.







## WATER RESOURCES AND SOIL

“ Our water disappeared when excavations began at these coal mines. The water that was extracted from this mosque used to be enough to water the entire plain and all the fields. That is how much water there was. It used to be enough for all of the vegetables and fruits we grew, for everything... Nowadays, people drink bottled water at home. There is less water, people no longer grow food in their gardens. Only those who have wells can grow food, the rest cannot. If they excavate over there (referring to the 93 lots of olive grove that the mining company wants to acquire), we won't have any water at all. ”

— Şerifan, Yatağan, Turgut

Coal mining has very significant impacts on water resources. Coal extraction completely reshapes the topography; vast man-made pits and hills of mine waste and cover soil impact the hydrology of the region and the flow of surface water. The waste rock (rock-soil mixture with no economic value), which is generated during excavation, is often dumped into adjacent valleys near the mine site and covers streams. When stream beds are buried under waste rock (from upstream to downstream), they set off changes in the water regime and cause the irreversible destruction of ecosystems -which play a vital role in ecological processes such as nutrient cycling and organic matter production-, resulting in the death of many aquatic creatures living in these rivers (Epstein et al., 2011; Palmer et al., 2010).

Large amounts of water are used for various purposes such as suppressing the dust generated during production in mine sites, excavation using pressurized water, and for the hydraulic transportation of coal (Bayrak, 2014).



Furthermore, the removal of the entire vegetation cover, changes in topography, loss of topsoil and soil compaction caused by heavy machinery decreases the soil's infiltration capacity, which sets off surface water runoff and decreases the amount of water that can reach underground reserves (Palmer et al., 2010).



“ The Karacahisar, Çiftlik, Pınar and Fesleğen neighborhoods used to get their drinking water from our Suçikan. Since there is no more water at Suçikan, the village water comes from Işıkdere. However, we think that this water is contaminated because Işıkdere is located behind the Yeniköy mining site. ”

Şefik, Karacahisar Muhtarı, Milas



### High water usage in coal-fired power plants.

The average water consumption of lignite-fired power plants is 37.3 kg/kWh; this is higher than the amount consumed by hard coal and natural gas power plants (Atılgan and Azapagic, 2016). While two of the three power plants in Muğla (Yatağan and Yeniköy) use freshwater resources for their processes, the cooling water at the Kemerköy Power Plant is supplied from the sea. The Yatağan power plant meets its water demand from the Dipsiz Stream and its annual water consumption is 7.5 times the annual urban water consumption of the Yatağan district, home to 45,000 residents. The annual water consumption of the Yeniköy Power Plant, which meets its water demand from the deep wells of Geyik Dam and Dereköy and uses a closed cycle cooling water system, is almost 2.5 times the annual urban water consumption of the 132,000 residents of the Milas district.

Coal mining has negative impacts on the water regime and water volume in the basins, as well as on water quality. The water that is generated or used during coal production in open-pit mines is contaminated with physical and chemical factors. Runoffs from mining waste sites and coal stockpile areas, and wastewater generated during the pre-combustion phases of coal preparation and enrichment also pollute ground and surface waters. The wastewater's acidic characteristic and its content of suspended solids, ferrous compounds, chlorine compounds, sulfates and trace elements are the main factors behind water quality deterioration. Dissolved iron (acid mine drainage) and sulfuric acid, which is formed as a result of chemical reactions in high-sulphur coal mine discharges, pollute underground and surface waters by dissolving heavy metals such as copper, lead, mercury, arsenic (Bayrak, 2014; Epstein et al., 2011).

In Muğla, the relevant public institutions do not regularly, systematically or holistically track and monitor the impacts of the lignite mines on the water resources.

For example, the Büyük Menderes Basin Protection Action Plan, which includes Yatağan, states that a complete analysis of the impacts of diffuse (nonpoint) pressures on groundwater quality could not be carried out (TÜBİTAK MAM Environment Institute, 2010). Even though it is a known fact that the dry and wet depositions of airborne pollutants from Yatağan coal-fired power plant and mines, and other human activities (eg. road transport) pollute surface and ground waters, to the best of our knowledge there are no calculations regarding the impacts of these emission sources on the basin.

**Table 2: Urban water consumption and power plant water usage in Yatağan and Milas**

	Population (2014) <sup>ii</sup>	Urban water consumption <sup>i</sup> (million m <sup>3</sup> /year)		Power plant water usage (million m <sup>3</sup> /year)
Yatağan	44,783	2.15	Yatağan Power Plant (3 units)	16.43 <sup>iii</sup>
Milas	132,445	3.77	Yeniköy Power Plant (2 units)	8.76 <sup>iv</sup>

<sup>i</sup> Address Based Population Registration System Results, Turkish Statistical Institute. <https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr>; accessed May 2019.

<sup>ii</sup> Muğla Water Footprint and Clean Water Action Plan Report, Muğla Metropolitan Municipality, 2015

<sup>iii</sup> Turkish Energy, Water and Gas Workers' Union (TES-İŞ) Yatağan Branch, 2017. Turkish Energy, Water and Gas Workers' Union

<sup>iv</sup> Basin Protection Action Plans Preparation Project, West Mediterranean Basin Project Final Report, TÜBİTAK MAM Environment and Cleaner Production Institute, 2013.



Suçıkan is the recreation spot of the village and water rises above the ground surface in multiple points along the creek that passes through the village. Karacahisar residents recall that ten years ago the creek powered six watermills and that they use to fish from the creek. The creek and Suçıkan aquifers have almost completely dried up in the last two years. This will not affect only Karacahisar and its neighboring villages. The water that rises above ground surface at Karacahisar comes from Çamköy groundwater resources. 5.83 million m<sup>3</sup> of tap and drinking water is allocated annually from Çamköy to the Bodrum Peninsula, where summer population exceeds one million (TÜBİTAK MAM Environment and Cleaner Production Institute, 2013). Residents hold accountable the General Directorate of Mineral Research and Exploration (MTA), the company that bought the lignite mines and the thermal power plant, and the coal exploration and drilling activities, which have increased in the last couple of years.

Some of the most important threats imposed by coal-fired power generation to water resources are power plant wastewater, slag and volatile ashes from coal combustion processes. Wastewater from the Yatağan and Yeniköy coal-fired power plants is discharged into ash dams, where slag and fly ash captured by chimney filters are stored. The volume of Yatağan power plant's daily wastewater discharge -which is untreated-, is estimated to be 14,000 m<sup>3</sup> (Sistem Mühendislik Ltd.Şti, 2018). As for the Yeniköy coal-fired power plant, there is no information on the volume of wastewater or if there is a treatment plant. The Kemerköy power plant meets its daily cooling water demand with 1.7 million tons of sea water and the wastewater is discharged back to the sea (MoEU Environmental Impact Assessment Permit and Inspection General Directorate, 2017).



“ There is a rancid lake. It is very beautiful and graceful, but it was formed by ash and it is a sulfuric acid lake. One day, young girls went for a swim in the lake and they told me their feet burned. ”

— Kemalettin, Elected Neighborhood Representative, Kapubağ, Yatağan





It should be noted that none of the public institutions responsible for monitoring and supervising Muğla's water resources, reveal any kind of official information or documents regarding the waste water of coal-fired power plants in their reports (Muğla Metropolitan Municipality, 2015; Muğla Provincial Directorate of Environment and Urbanization, 2018, TÜBİTAK MAM, 2010, 2013).

According to data from the Muğla Provincial Directorate of Environment (2018), total annual slag-fly ash waste from Muğla's three power plants exceeds 4 million tons. The waste is stored in large forest areas without any treatment or security measures. For example, the ash mountain that rises on the ridge of Kapubağ village across from the Yatağan power plant and the pond formed by the wastewater cover approximately 130 hectares.

Low quality lignite combustion ash contains heavy metals such as lead (Pb), zinc (Zn), cadmium (Cd), nickel (Ni), copper (Cu) and cobalt (Co), and high concentrations of pollutants such as arsenic (As) and sulfate  $SO_4^{2-}$ . Scientific studies conducted in Muğla at the beginning of the 2000s revealed the adverse impacts of power plant wastewater and waste ashes on underground and surface water resources. During rainy seasons, water seeps through the cracks of the dry ash hill creating artificial flow pathways that carry the toxic substances to underground and surface water resources (Baba, Kaya, & Birsoy, 2003). Another independent research exposed that copper, lead and chromium concentrations in Sarıçay – the three power plants' common impact area - were well above Turkey's and EPA standards and they were rated as category IV by Turkey's standards. The study determined that coal-fired power plants were the main source of heavy metal pollution (Tuna, Yılmaz, Demirak, & Özdemir, 2007).

**“ Water does not taste the same. We used to drink water directly from the streams. We cannot anymore. How can we drink it when the poison from the mine is discharged into the streamlet. There are no fish left in the streamlet. There used to be plenty of fish in the streamlet. Nowadays, the stones are black from whatever they are discharging from the mines. The color of the stones has changed, the color of the water has changed. The streamlet was so clean, I used to drink from it. ”**

— Veli, Turgut, Yatağan

Radioactive and toxic substances, heavy metals and other pollutants that are released during the stages of coal mining and coal-fired electricity generation permeate the soil -in the same manner as they permeate the air and water-, they accumulate in the soil and cause pollution.

The public and scientists raised their concerns about radioactive pollution and brought the Yatağan power plant in particular onto the public agenda throughout the 1990s. Every interviewed resident recalls the radioactive fallout that caused the early warning system alarm to go off in the district center in 1993. No serious measures were taken in the aftermath. On the contrary, the radiation early warning system that was installed on the exterior wall of the Yatağan meteorology observation station was removed. Public institutions ignored the issue despite many scientific studies indicating that lignite and power plant waste caused radioactive pollution in the region.







A study determined that toxic trace elements and heavy metals originating from the Yatağan power plant contaminated soil surface throughout the Yatağan plain (depending on the wind direction and geological structures), with the highest concentrations measured around the ash dam. The study warned that the uncontrolled storage of waste ash would lead to the contamination of subsurface soil (Baba, 2003).

Soil samples from Gökova and Yeniköy's pine and olive groves, which were collected for a study that investigated heavy metal and sulfur pollution levels in olive and pine groves in the vicinity of the three coal-fired power plants, revealed nickel pollution (Tuna et al., 2005). Toxic elements from the power plant's fly ash, such as cadmium, cobalt, lead and zinc descend and pollute the soil and water bodies (Baba et al., 2003)

Furthermore, soil contamination poses an important threat to food safety in the region. A plant analysis of agricultural products grown in the vicinity of Yatağan power plant revealed that the levels of heavy metals -namely zinc, lead, cadmium and copper- in carrot and sesame samples exceeded the permissible values for heavy metals in vegetables for human consumption (Haktanır et al., 2010). Another study revealed that sheep in the vicinity of Yatağan developed chronic fluorosis, a disease that affects kidney functions and that the disease was caused by lignite burning. The study asserted that gaseous and particulate fluoride compounds emitted by the power plant during lignite combustion were the cause of chronic fluorosis (Altıntaş, Fidancı, Duru, & Başsatan, 2000).



In a more recent study, the analysis of pine honey from Muğla revealed high amounts of aluminum, iron, calcium, magnesium and potassium as well as heavy metals. The study states that these elements or their compounds are carried by the dust emitted by coal-fired power plants and open lignite mines. Sample analysis also revealed high levels of arsenic in pine honey (in three of five samples) (Kantarıcı, 2018).

Another study detected that levels of certain heavy metals such as zinc, copper, cadmium and chromium in various tissue samples taken from sparrows in the Yatağan region were well above normal levels (Albayrak and Mor, 2011). This finding is important as it indicates that pollution also affects wildlife species.



# AIR POLLUTION

**For the past 35 years, Muğla, and particularly Yatağan attracted national attention in connection with their high levels of pollution. And this was for a very clear reason: around 200 million tons of locally extracted high-sulfur and high-ash lignite was burned without any flue gas desulphurization (FGD) processes for 25 years at the Yatağan power plant, 21 years at the Yeniköy power plant and 12 years at the Kemerköy power plant. Over the years, high air pressure and calm air conditions in the region, and particularly in Yatağan, caused pollutants to remain suspended in the air (inversion), frequently resulting in alarming levels of air pollution. There were some instances when the governor closed schools, imposed curfews and suspended the power plant's operations.**

In the early 1990s, Yatağan residents became more vocal in their protests against air pollution and radioactive pollution and residents of Kemerköy- or Gökova, as it was referred to at the time- stepped up their efforts to stop the construction of the Kemerköy power plant. Yatağan and Kemerköy residents shone a light to Muğla's air pollution crisis, making it a topic of interest for national press and an agenda item for top level government officials.

When the power plants were state-operated, the FGD units that were installed were not routinely operated and often malfunctioned. After they were privatized, mandatory environmental permits and necessary investments were postponed to the end of 2019 through a disguised incentive in the form of a temporary article added to the Electricity Market Law. At this stage, there is no information on whether the FGD units are operated regularly as the same article impedes public environmental audits and enforcements.

Air pollutants emitted by the three power plants converge and create the highest air pollution levels in Yatağan and Milas district centers and no air quality measurements are taken at these locations. The Ministry of Environment and Urbanization has an air quality monitoring station at Yatağan, but it is not clear whether the station is operational because this station's data cannot be accessed from the ministry's website for the past three years (2017-2019). There has never been an air quality station at Milas, which has been home to two coal-fired power plants for 25 years.

Based on their observations, local residents believe that all three power plants frequently disable their dust filters and sulfur treatment units. This is likely to be true taking into account that FGD facilities consume 8-10 percent of the electricity generated by the plant, and the plants were exempted from environmental regulations by law

and that there have not been any air quality measurements for the past 2 years.

The state funded the refurbishment of the electrostatic dust filters during the three years leading to the privatization of the Yatağan, Yeniköy and Kemerköy coal-fired power plants and according to statements, the flue gas desulphurization plants were operational.

However, according to reports accessed from the MoEU air quality monitoring network website (Ministry of Environment and Urbanization, 2019), the air quality in Muğla - and particularly in Yatağan where the dust and sulfur dioxide gases emitted by these three power plants are the most concentrated- indicates another reality. In 2015, the atmospheric dust ( $PM_{10}$ ) concentration in Yatağan was 4 times the annual upper limit deemed safe by the World Health Organization's (WHO), and 3.5 times in 2016. During the two years following the privatizations, the dust levels inhaled by Yatağan residents exceeded the maximum atmospheric dust concentration set by the WHO during 80 percent of the year in 2015 and 75 percent in 2016.

The ambient sulfur dioxide ( $SO_2$ ) concentration levels in Yatağan exceeded WHO's mean guideline value of  $20 \mu g/m^3$  during 163 days in 2015 and 57 days in 2016. On the ministry's website,  $SO_2$  measurement data is missing for 277 days in 2017, for the entire year in 2018 and for January-July 2019.

Needless to say, coal-fired power plants are not the only cause of air pollution in Muğla and Yatağan. However, the extent of the pollution caused by coal-fired power plants is not being disclosed. According to the Regulation on the Control of Industrial Air Pollution, air quality and flue gas emissions should be regularly measured in power plant regions and the contribution of power plant emissions to pollution should also be monitored through modeling studies.



**Table 3: Ambient dust concentration ( $PM_{10}$ ) in Yatağan and national and international legislation.**

Annual average ( $\mu\text{g}/\text{m}^3$ )				
Years	Yatağan Air Quality Monitoring Station Measurement Results	National Legislation	European Union Legislation	World Health Organization Guideline
2015	79	56	40	20
2016	71	52	40	20
2017	Insufficient data	48	40	20
2018	No data	44	40	20
Daily average ( $\mu\text{g}/\text{m}^3$ )				
Years	Yatağan Air Quality Monitoring Station Measurement Results	National Legislation	European Union Legislation	World Health Organization Guideline
2015	Maximum value: 223	90 Days exceeding: 88 days	50	50 Days exceeding: 298 days
2016	Maximum value: 163	80 Days exceeding: 105 days	50	50 Days exceeding: 280 days
2017	No $PM_{10}$ measurements for 302 days	70	50	50
2018	No data	60	50	50

**Table 4: Ambient sulfur dioxide ( $SO_2$ ) concentration in Yatağan compared to national and international legislation. [24-hour average ( $\mu\text{g}/\text{m}^3$ )]**

Daily average ( $\mu\text{g}/\text{m}^3$ )				
Years	Yatağan Air Quality Monitoring Station Measurement Results	National Legislation	European Union Legislation	World Health Organization Guideline
2015	Maximum value: 144	225	125	20 Days exceeding: 163 days
2016	Maximum value: 182	200	125	20 Days exceeding: 57 days
2017	Insufficient data	175	125	20
2018	Insufficient data	150	125	20

<sup>(ii)</sup> Regulation on the Assessment and Management of Air Quality, Ministry of Environment and Urbanization, Official Gazette Date: 06.06.2008 Official Gazette Number: 26898

<sup>(iii)</sup> Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32008L0050>

<sup>(iv)</sup> World Health Organization Air Quality Guidelines, 2005.



# Reliability of Emission Data and Access to Environmental Information

**“The people’s struggle bore fruits. They took relatively easy and low-cost measures to prevent dusting, such as covering the ash conveyor belt, wetting the ash for storage, planting acacia trees on and around the ash dam; however, we had to wait fifteen more years for FGD installations.”**

**Bedriye, Hekim ve Aktivist, Yatağan**

This study requires access to up-to-date emission data, however access to power plant data, and particularly post-privatization data is severely limited. Mass flow rates of pollutants emitted by the chimneys of the Yeniköy and Kemerköy coal-fired power plants were accessed after numerous inquiries with the MoEU (MoEU General Directorate Environmental Impact Assessment Permit and Inspection, 2017). The MoEU replied that the SO<sub>2</sub>, NO<sub>x</sub>, CO<sub>2</sub> and O<sub>2</sub> discharges from the Flue Gas Desulphurization FGD units of these power plants are monitored using automated continuous emission measurement systems in accordance with the legislation. However, the mass flow rates provided by the ministry for each power plant were based on the results of three samples taken manually on three consecutive days in 2015-2016.

Furthermore, the ministry did not provide the power plants’ total annual emission volumes. Therefore, since these data are not long-term measurements obtained from comprehensive and continuous monitoring, they may not include high emission periods. The emission data that was provided at the end of 2017 are not based on regular reporting. The data are from 2015 and whether they reflect the power plants’ current environmental performances is unclear.

For the Yatağan coal-fired power plant, another study’s 2008 emission data (Güven et al., 2008) was used as the most recent emission data available because the ministry stated in its written reply that they did not have any data on Yatağan’s pollutant emissions.

Sectoral reports that could be accessed indicated that the electrostatic dust filters and desulphurization units of all three power plants operate with low-efficiency and are in need of rehabilitation. However, since state institutions did not officially confirm this during our correspondence with them, official emission data was used for the model in order to prevent speculations about the results. The reader should note that actual and current air pollution may be higher than the modeling results. Design efficien-

cy and current efficiency values of the flue gas treatment facilities at the power plants are provided in Table 5.

This study constitutes a current example of how limited the right of access to environmental information is in Turkey, as power plants’ air pollutant, toxic substance and CO<sub>2</sub> emissions data and their environmental performances should be available to the public. In international good practice, for instance, under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (CLRTAP) (“LRTAP Convention Large Point Source (LPS) ROD Eionet”) these emissions are continuously monitored, and annual emission rates (or mass emission volumes) are made available to the public.

The coal combustion stage is not the only coal-fired power plant stage that causes air pollution. Mining processes are also significant coal life cycle stages during which air pollutants are emitted. Seam-blasting, methane combustion with air-methane is released into the atmosphere in addition to coal-, and emissions from trucks that transport coal from the mine site to processing facilities and power plants constitute very significant sources of pollution.

Wanting to include these pollution sources in the air quality dispersion model, applications to obtain the pollutant emission data—and, particularly dust emission data—for open-pit lignite mining operations in Muğla were submitted. Neither the Ministry of Environment and Urbanization nor the General Directorate of Mining Affairs of the Ministry of Energy replied.

However, in order to show the potential magnitude of dust emissions from mining, we calculated the dust emissions of a similar lignite mine site in Kütahya. We used the dust emission data from the “Coal Bagging Facility and Coal Mine Capacity Increase Project Introduction” file in the Kütahya Provincial Directorate of Environment and Urbanization website’s announcements page for our air quality model. The daily and annual ground dust concentrations levels we obtained were alarming. According to the mod-



**Table 5: Technical properties of Muğla's coal-fired power plants and used fuels**

POWER PLANT SPECIFICATIONS	YATAĞAN POWER PLANT	YENİKÖY POWER PLANT	KEMERKÖY POWER PLANT
Units	3	2	3
Capacity	3x210 = 630 MWe	2x210 = 420 MWe	3x210 = 630 MWe
Annual nominal generation capacity	4,095,000,000 kWh	2,730,000,000 kWh	4,095,000,000 kWh
Date of commissioning	Unit 1: 20.10.1982	Unit 1: 17.09.1986	Unit 1: 04.03.1994
	Unit 2: 15.06.1983	Unit 2 : 23.02.1987	Unit 2: 20.08.1994
	Unit 3: 18.12.1984		Unit 3: 17.02.1995
Date of privatization	01.12.2014	23.12.2014	23.12.2014
Company	Yatağan Termik Enerji Üretim A.Ş. (Bereket Energy Group)	Yeniköy-Kemerköy Elektrik Üretim ve Ticaret A.Ş. (İC İÇTAŞ Energy-LİMAK Energy partnership)	Yeniköy-Kemerköy Elektrik Üretim ve Ticaret A.Ş. (İC İÇTAŞ Energy-LİMAK Energy partnership)
<b>FUEL USED</b>			
Type of fuel	Lignite		Lignite
Lower calorific value (design value)	2100 ± 200 kcal/kg	1750 ± 200 kcal/kg	1750 ± 200 kcal/kg
Coal consumption (design value)	1099 g/kWh	1352 g/kWh	1462 g/kWh
Specifications of locally extracted lignite*			
• Lower calorific value	1750 - 2100 kcal/kg	1775-2180 kcal/kg	1775-2180 kcal/kg
• Ash	20% (24-27%)	31% (15-31%)	30% (15-31%)
• Humidity	36% (27-38%)	33% (30-34%)	30% (30-34%)
• Sulfur	(2.41-3.10%)	(1.2-4.5%)	(1.2-4.5%)
Total coal usage (1982-2017)**	135 million tons	93 million tons	89 million tons
<b>FLUE GAS TREATMENT SYSTEMS</b>			
Electrostatic filter (dust)	Yes (added later on by EÜAŞ)	Yes (since commissioning)	Yes (since commissioning)
Design efficiency	98-99%	98-99%	98-99%
Current efficiency	75% (Require rehabilitation even though they were rehabilitated and became operational at the end of 2013)	75% (Require rehabilitation)	75% (Require rehabilitation)
Flue gas desulfurization facility	Yes (added by EÜAŞ in 2007)	Yes (added by EÜAŞ in 2008)	Yes (added by EÜAŞ in 2002)
Design efficiency	95%	95%	95%
Current efficiency ***	50% (Require rehabilitation)	50% (Require rehabilitation)	60% (Require rehabilitation)

Sources: Aytaç, 2018; TMMOB Chamber of Mechanical Engineers, 2017; Volkan Ş. Ediger, 2015

\* The power plants's total coal usage for 1982-2014 (pre-privatization) were compiled from EÜAŞ annual coal-fired power plants reports and TKİ archives. The post-privatization annual coal consumption figures for 2015-2017 were calculated using coal consumption (design value), nominal annual generation capacity and estimated average capacity utilization rates from the Chamber of Mechanical Engineers Power Plants 2017 report.

\*\* Information from sectoral reports

eling results, the daily average dust concentrations in the region are as high as 2,000 times the guideline values defined by EU Member States, World Health Organization and Turkish legislation. As for the annual average dust concentration, it is almost 250 times the legal limit.

The Kütahya project specified that, after capacity increase the open-pit mining capacity would increase to 5

million tons/year and underground mine capacity would increase to 11 million tons/year and the model was based on these data. The amount of coal used in Muğla power plants is around 18 million tons/year. Based on this data and knowing that open-pit lignite mining in Muğla employs similar methods, it can be asserted that dust emissions in Muğla may be much higher than the dust pollution in Kütahya.









## **PART 2: THE HEALTH COSTS OF COAL IN MUGLA**

The air pollution from the coal-fired power plants poses serious daily and long-term health threats to Muğla residents. Pollutants are transported by air currents and affect people in other geographies.





**“ The first health screening was done in 1992, and none of the results were recorded. About ten years later, pediatricians and pulmonologists conducted another screening, and once again the results were not disclosed. ”**

— **Dr. Hakkı Turan**, Head of Muğla Medical Chamber

The impacts of coal on human health are highly visible in the coal-fired power plant area of Muğla and particularly in Yatağan. The intense air pollution that began after the Yatağan coal-fired power plant became operational in 1982 brought along health problems that affected residents on a daily basis. The residents’ reactions triggered many scientists, lawyers, professional organizations and ecology volunteers to work towards preventing the ecological destruction of Yatağan.

Coal’s long-term impacts on human health in Muğla has been a topic of concern since the early 2000s.

Residents of Yatağan, Turgut and Yeşilbağcılar reiterate that asthma, bronchitis, goiter and COPD, as well as lung and throat cancer are widespread diseases in their villages. However, official health data does not reflect the villagers’ observations, and even if they were to reflect the situation they are not accessible by the public. For example, a study conducted by the Muğla Provincial Health Directorate in 2012 found that in the past two years 35 lung cancer deaths occurred in Muğla hospitals alone, and 60 people were

treated for the same disease. However, this report was not officially published and the public saw only the parts that were leaked to the press. Today, it is still not possible to access cancer data through official channels neither for Muğla nor for the districts that are most affected by environmental pollution from coal-fired power plants such as Yatağan and Milas. Just like environmental data, official health statistics cannot be accessed through the Right to Information Act. Public health monitoring in this region that is heavily impacted by industrial pollution is also insufficient.

In 2000, a team of public health experts appointed by the Turkish Medical Association went to Yatağan, where air pollution reached alarming levels, and prepared a comprehensive report on coal-fired power plant air pollution’s impacts on public health. The report determined that respiratory disease hospitalization rate in Yatağan was more than twice the rate in Muğla province center, where air quality was relatively better. (Turkish Medical Association, 2000).

A comparative study of the village of Bozüyük, located at 5 kilometers to Yatağan power plant, and three vil-





lages (Çitlık, Ataköy, Gökova) located at 30 kilometers of Yatağan performed respiratory function tests on 502 adults over the age of 15. Results showed that living in the close vicinity of the coal-fired power plant may lead to chronic obstructive pulmonary disease (Karavuş et al., 2002). Another study from 2002 analyzed lead and cadmium blood levels of 236 healthy children aged 6 months to 6 years residing in Yatağan. In 95.7 percent of the children, the blood lead level was 10 mg/dL and in 87.6 percent of the children it was higher than 20 mg/dL. The average blood cadmium level in all children was found to be  $1.319 \pm 0.72$  mg/dL. 85 percent of the children showed blood cadmium levels above the toxicity level of 0.5 mg/dL (Yapici et al., 2006), whereas the WHO recommends a blood lead level of 0 in children (Koller et al., 2004).

It is not hard to guess that the current public health situation is no different. Even though the MoEU and operators state that flue gas treatment units operate regularly, air quality data shows that pollution levels remain dangerously high. In a study conducted by the Turkish Thoracic Society Air Pollution Task Force, Muğla ranked fourth among the provinces with the highest monthly average particulate matter ( $PM_{10}$ ) concentration between November 2014 and October 2015 (Turkish Thoracic Society, 2017). According to the annual reports of Muğla Provincial Directorate of the MoEU, the ambient  $PM_{10}$  concentration in Yatağan in 2015 and 2016 was 4 times and 3.5 times higher than the WHO recommended maximum annual average  $PM_{10}$  concentration, respectively. In other words, the air that Yatağan residents breathed in 2015 and 2016 was much more polluted than the maximum concentration levels recommended by WHO.

**“Back in time when the coal-fired power plant was run by the state, the Directorate of National Education used to call us on some days and tell us to close down the schools. Why? Because the air was too toxic. What difference would closing schools make? Don’t children breathe when they go home. The children are going to go outdoors anyways.”**

— **Muammer**, Retired Teacher, Yeni Yeşilbağcılar, Yatağan





According to the results of the modeling study (Myllyvirta, 2018) conducted for the Real Costs of Coal Muğla:

- 9.5 million tons of sulfur dioxide, 890,000 tons of nitrous oxide, 65,000 tons of dust and 28,000 kilograms of mercury were released into the atmosphere between 1982 and 2017.
- 435,000 tons of sulfur dioxide, 355,000 tons of nitrous oxide, 29,000 tons of dust and 22,000 kilograms of mercury will be released into the atmosphere between 2018-2043 (if each plant continues to operate until the age of 50 and even if environmental investments are in accordance with applicable laws).
- Air pollution caused by Muğla's coal-fired power plants reaches the highest concentration levels in Yatağan, Milas, Kavaklıdere and Ula. However, due to prevailing winds and other atmospheric factors, particulate matter ( $PM_{2.5}$ ) emissions in particular travel across the Mediterranean Sea to the Greek island of Rhodes and to Egypt in the south, reach the province of Aydın in the north, and extend to Greece in the west, and to Palestine and Israel in the east.

Air pollution is one of the leading causes of premature death from noncommunicable diseases worldwide. The WHO classifies air pollution as carcinogenic to humans (Group 1), puts additional emphasis on particulate matter and calls on all governments to take urgent action against air pollution. Air pollution causes a wide range of serious

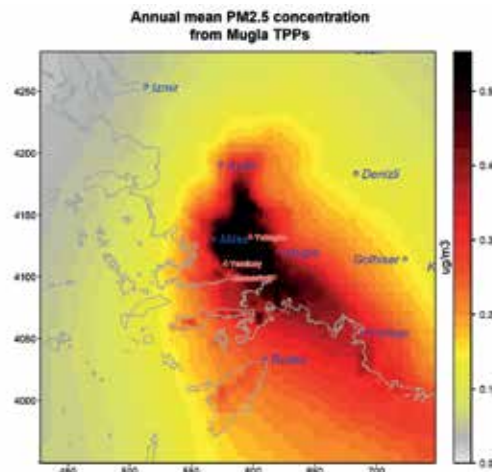


Figure 1. Atmospheric dispersion of estimated annual average  $PM_{2.5}$  in flue gas emissions from the Yatağan, Yeniköy and Kemerköy coal-fired power plants.

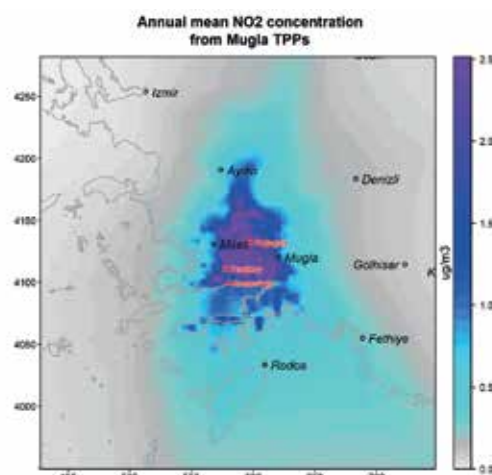
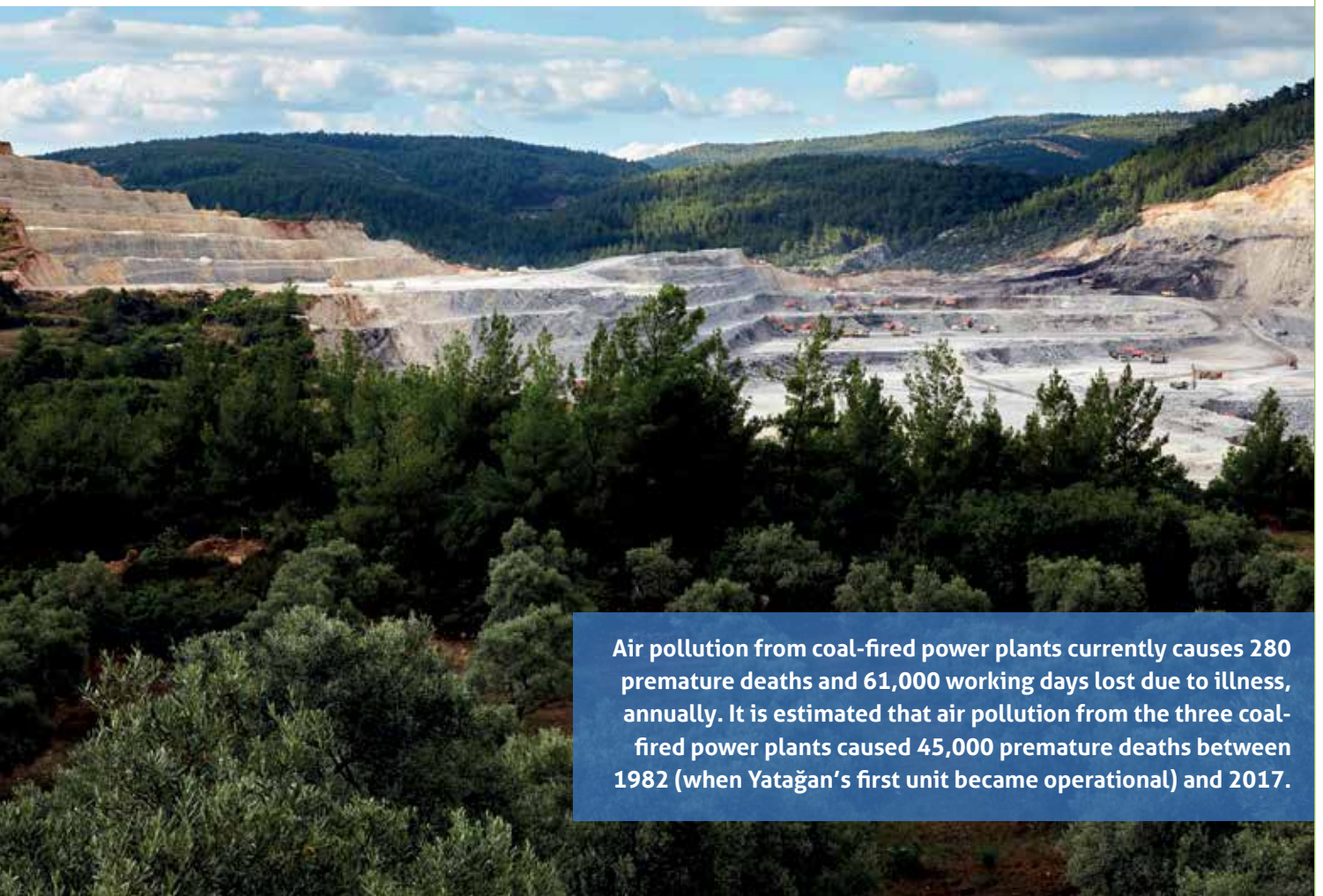


Figure 2. Atmospheric dispersion of estimated annual average  $NO_2$  in flue gas emissions of the Yatağan, Yeniköy and Kemerköy coal-fired power plants

The Real Cost of Coal – Muğla used CALMET-CALPUFF, an advanced meteorological and air quality modeling system, to study the atmospheric dispersion and concentration levels in and beyond Muğla of the main pollutants (particulate matter -  $PM_{10}$  and  $PM_{2.5}$ , sulfur dioxide  $SO_2$ , nitrogen oxides –  $NO_x$ ) emitted by the Yatağan, Yeniköy and Kemerköy coal-fired power plants. The findings were then used in another model to analyze the health effects of atmospheric pollution. The health impacts of mines could not be included in the modeling because information on air pollution from lignite mine sites in Muğla was not available. The main reason for using this modeling method is that official data regarding air pollution caused by these three power plants and their health effects could not be accessed.

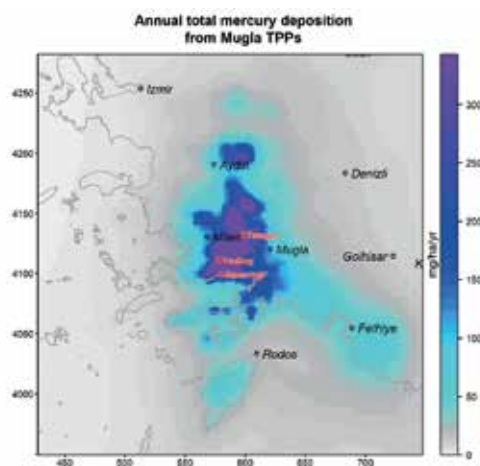




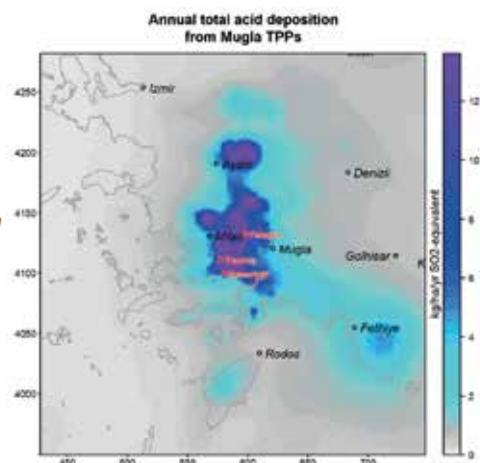


Air pollution from coal-fired power plants currently causes 280 premature deaths and 61,000 working days lost due to illness, annually. It is estimated that air pollution from the three coal-fired power plants caused 45,000 premature deaths between 1982 (when Yatağan's first unit became operational) and 2017.

**Figure 3.**  
Dispersion of  
estimated annual  
acid deposition  
from the Yatağan,  
Yeniköy and  
Kemerköy coal-  
fired power plants.



**Figure 4.**  
Distribution of  
estimated annual  
mercury deposition  
from the Yatağan,  
Yeniköy and  
Kemerköy coal-  
fired power plants.



health problems such as cardiovascular and respiratory system diseases, mental decline and developmental disorders in unborn babies and preterm birth.

The data obtained from air pollution dispersion modeling reveal that the pollution from the Yatağan, Yeniköy and Kemerköy coal-fired power plants impacts the food we eat. Every year, more than one ton of mercury is released into nature and 20 percent is deposited into the Mediterranean Sea, accumulates in fish tissue and enters the food chain. According to the health-impact modeling carried out as part of The Real Costs of Coal report, coal imposes a very heavy burden on human health in Muğla:

- Currently, air pollution from coal-fired power plants in the region causes 280 premature deaths per year. A total of 61,000 workdays per year is lost due to diseases and premature deaths.
- It is estimated that air pollution from the three coal-fired power plants caused 45,000 premature deaths between 1982 (when Yatağan's first unit became operational) and 2017.
- If each plant continues to operate until the age of 50 and even if environmental investments are in accordance with applicable laws, the air pollution from the coal-fired power plants are expected to cause 5,300 additional pre-mature deaths between 2018 and 2043.



**Table 6: Estimated cumulative health impacts of the Yatağan, Yeniköy and Kemerköy coal-fired power plants between 1982-2017**

Health impact	Pollutant	Cases (95% confidence interval)	Unit
Low birth weight	PM <sub>2,5</sub>	18,700	case
Asthma and bronchitis in children	PM <sub>10</sub>	1,310,000	case
Bronchitis in children	PM <sub>10</sub>	142,000	case
Chronic bronchitis in adults	PM <sub>10</sub>	26,400	new case
Hospitalization	NO <sub>2</sub>	2,300	case
Hospitalization	PM <sub>2,5</sub>	43,600	case
Total hospitalization	-	45,900	case
Sick leave days	PM <sub>2,5</sub>	246,000	case
Work days lost	PM <sub>2,5</sub>	12,000,000	day
Premature deaths	NO <sub>2</sub>	1,380	case
Premature deaths	PM <sub>2,5</sub>	43,900	case
Total premature deaths	-	45,280	case



If each power plant continues to operate until the age of 50, even if all the planned and announced power plant and environmental infrastructure improvement projects are implemented and the power plants are brought into compliance with national environmental legislation, they may cause 5,300 additional premature deaths. Approximately 1,300 premature deaths can be prevented in the next term if improvements are set to meet the EU Large Combustion Plants Best Available Technique (BREF) emission limit values. These limit values will become mandatory for EU member countries in 2024. Turkey has not made any commitments to implement the BREF, however if negotiations with the EU continue Turkey will need to implement EU environmental legislation.

This grim picture does not include dust (particulate matter) emissions from other sources, and particularly from lignite mines -which far exceed power plant flue gas emissions-, nor volatile organic compounds and the impacts of many environmental factors such as water, soil and food contamination by heavy metal and radioactive contents of ash and other wastes. Coal economy creates social, cultural and economic issues and their impacts on local residents' quality of life and consequently on their health require further research. The real costs of coal mines and coal-fired power plants to human health can only be exposed through a multi-aspect assessment.

### Health impacts of Yatağan, Yeniköy and Kemerköy coal-fired power plants\*

\* Only includes health impacts from particulate matter and NO<sub>2</sub> emissions.

#### IN THE PAST 1982-2017

(from date of commissioning to 2017, for each power plant)

More than **45,000** premature deaths  
Close to **46,000** hospitalizations (due to cardiovascular and respiratory diseases)  
**12 million** work days lost caused

#### TODAY Currently, within a year

even if flue gas treatment facilities are working on regular and continuous basis, when calculated with current official emission date)

**280** premature deaths more  
than **300** hospitalizations  
(due to cardiovascular and respiratory diseases **61,300**  
work days lost is causing

#### IN THE FUTURE 2018-2043

(if each power plant remains operational until the age of 50, even if environmental investments are in accordance with legislation)

**5270** premature deaths  
**5600** hospitalizations  
More than **1 million** work  
days lost will cause



**Table 7: Estimated Cumulative Health Impacts of Yatağan, Yeniköy and Kemerköy Thermal Power Plants between 2018-2043**

Health impact	Pollutant	Cases (95% confidence interval)	Unit
Low birth weight	PM <sub>2,5</sub>	1,880	case
Asthma and bronchitis in children	PM <sub>10</sub>	130,000	case
Bronchitis in children	PM <sub>10</sub>	14,100	case
Chronic bronchitis in adults	PM <sub>10</sub>	2,660	new case
Hospitalization	NO <sub>2</sub>	1,290	case
Hospitalization	PM <sub>2,5</sub>	4,350	case
Total hospitalization	-	5,640	case
Sick leave days	PM <sub>2,5</sub>	24,600	case
Work days lost	PM <sub>2,5</sub>	1,230,000	day
Premature deaths	NO <sub>2</sub>	840	case
Premature deaths	PM <sub>2,5</sub>	4,430	case
Total premature deaths	-	5,270	case

Based on the assumption that each coal-fired power plant will operate for 50 years and that all three plants will realize all investments required by Turkish environmental regulations.





# RIGHT TO ACCESS ENVIRONMENTAL INFORMATION

A number of applications, in cooperation with the Chamber of Environmental Engineers, were submitted under the Right to Information Act 4982 to obtain information and data regarding the current environmental performances of Muğla's three coal-fired power plants and lignite mine. Most of the replies indicated that they did not possess the requested information. As for the rest, the data they provided were not current (the reliability of the data obtained through official correspondence is further discussed in the relevant sections of this report.) Furthermore, we requested data, information and reports on the environmental performance of these facilities from the World Bank, who provided technical support during privatization, and from commercial banks that provided loans. None of them replied.

Environmental impact assessment (EIA) is one of the most important legal tools for the public's access to environmental information. Non-governmental organizations that provided support to The Real Cost of Coal – Muğla submitted information requests to the MoEU. According to the ministry's reply, Muğla's three coal-fired power plants were exempted from EIA processes under the Temporary Article 2 of the EIA Regulation on the grounds that they were commissioned before 07.02.1993. Although this is the case for the Yatağan (1<sup>st</sup> unit 1982, 2<sup>nd</sup> unit 1983, 3<sup>rd</sup> unit 1984) and Yeniköy (1<sup>st</sup> unit 1986, 2<sup>nd</sup> unit 1987) coal-fired power plants, it does apply to the Kemerköy power plant (1<sup>st</sup> and 2<sup>nd</sup> units in 1994 3<sup>rd</sup> unit in 1995). In other words, the decision to exempt the Kemerköy coal-fired power plant from EIA processes is against the law (MoEU General Directorate of Environmental Impact Assessment, Permit and Inspection, 2017; Ecology Collective Association, 2018).

On the other hand, the technological transformation and modernization of all three power plants began following their privatization. These technology renewal projects, which according to operator statements will increase capacity, should be subjected to EIA.

The ministry's replies also state that Muğla's open-pit lignite mining facilities, which have been operational for 40 years and provide fuel to these plants, have not yet been subjected to any EIA processes. These mines, most of which are being operated with mining licenses granted to thousands of hectares of land, have been expanding gradually for years. Every new quarry expansion in large-scale mining areas should be assessed as capacity increase and subjected to EIA in accordance with the legislation.



Submitted to	Request	Reply
Ministry of Environment and Urbanization, Muğla Governorship, Provincial Directorate of Environment and Urbanization	Re. environmental performances of the Yatağan and Yeniköy lignite mining facilities	No favorable reply or information received.
	Re. environmental performances of the Yatağan, Yeniköy and Kemerköy coal-fired power plants	
Ministry of Environment and Urbanization Directorate General of Environmental Impact Assessment, Permit and Inspection	Re. environmental performances of the Yatağan and Yeniköy lignite mining facilities	No information received regarding lignite mining facilities.
	Re. environmental performances of the Yatağan, Yeniköy and Kemerköy coal-fired power plants	Stated that they do not have data nor information regarding the Yatağan power plant's air pollutant emissions.
		Provided the Yeniköy and Kemerköy power plants' 2015 emission measurements. Did not provide current data.
Ministry of Energy and Natural Resources Directorate General of Mining Affairs	Re. operational plans and environmental impacts of lignite mining facilities in Muğla	No reply
Prime Ministry Privatization Administration	Re. coal-fired power plants' environmental performances prior to privatization	Trade secret

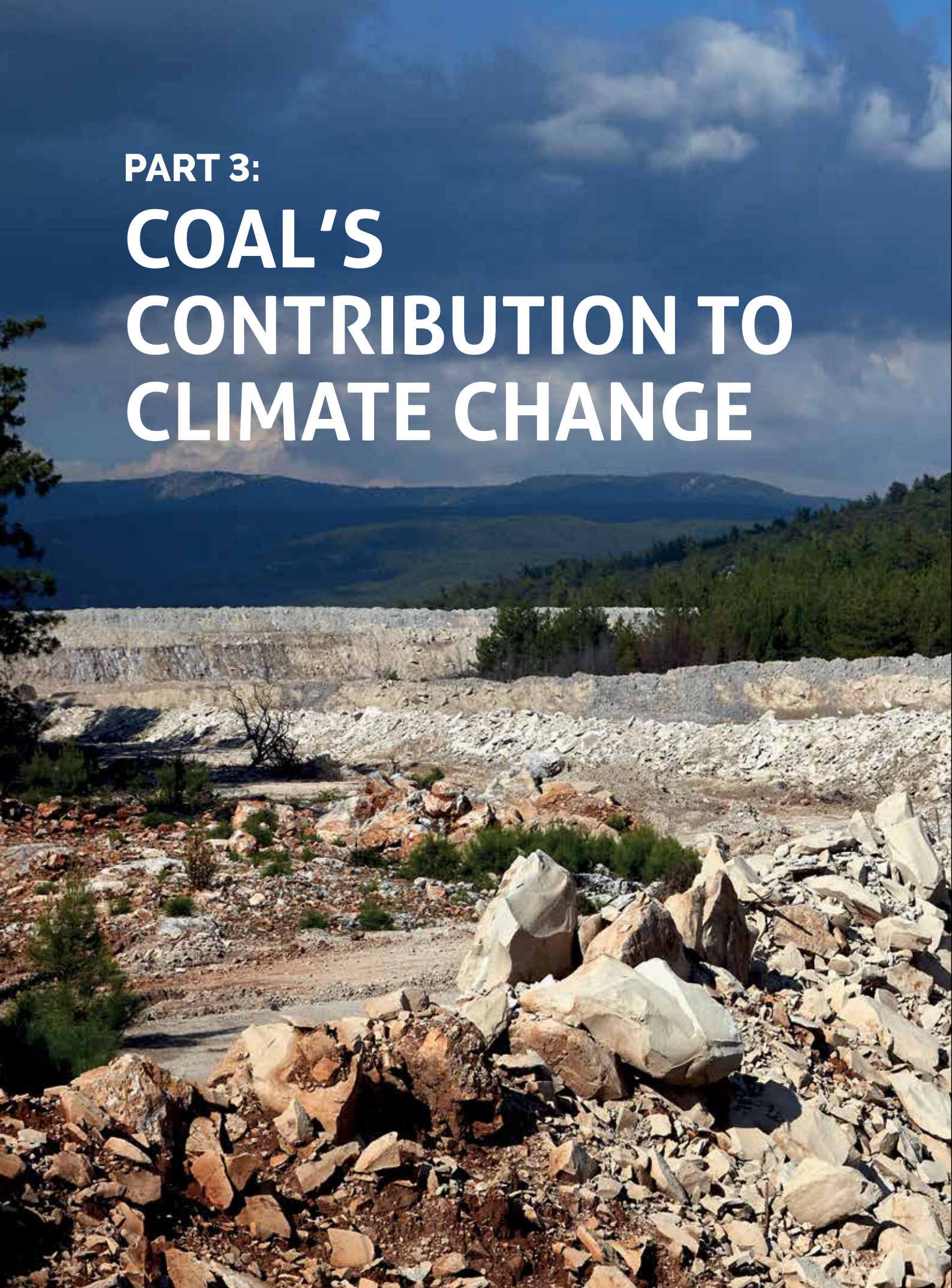
“ The project, which was privatized under the Privatization Law, carries out integrated mining and power generation operations, has increased its capacity according to media reports and underwent technological rehabilitations thereby increasing its impact and capacity above the 1993 levels when it was initially commissioned. For these reasons and furthermore because it was privatized for this purpose, this project cannot be exempted from EIA and the ministry should begin EIA processes for the integrated mining and power plant sites pursuant to both Article 10 and Article 3 of the Environmental Law. ”

Ecology Collective, 2018



**PART 3:**

# **COAL'S CONTRIBUTION TO CLIMATE CHANGE**







**We globally bear the costs of the climate crisis caused by the greenhouse gases that are emitted during the extraction, transportation and burning of coal.**



After long years of observations and complex modeling studies, scientific studies revealed that global average temperatures have increased 1°C above pre-industrial levels (the period between 1850-1900) (IPCC, 2018). The consequences of the current 1°C global warming are observed all over the world with the increasing frequency of extreme weather events, the destruction of agricultural lands, and tropical diseases spreading to new geographical areas.

Following the 2015 Paris Climate Change Agreement, the Intergovernmental Panel on Climate Change (IPCC) published the 1.5°C Special Report in 2018 and established that coal was the first fossil fuel that needed to be abandoned to ensure the world remained suitable for human life, that is, to limit temperature increase to 1.5°C. According to the computations of the International Energy Agency (IEA), CO<sub>2</sub> emissions generated by burning coal alone are responsible for approximately one-third of the current 1°C temperature increase. In other words, coal is the biggest contributor to global warming (International Energy Agency, 2018).

Furthermore, the carbon dioxide emissions from all currently operational coal-fired power plants in the world, and from those that are in development and pre-construction stages are significantly above the carbon budgets of international climate targets. The total carbon dioxide emitted by operational and under construction coal-fired power plants is 233 billion tons. This figure is far too high in light of the carbon budget that we have left if we want to limit global temperature increase to 1.5°C above pre-industrial levels, the target set to keep climate change at a level suitable level for human life. In order to meet this target, current development of coal-fired power must be canceled and many of the existing power plants must be retired before plants reach 40 years of age (Shearer et al., 2018).

The IPCC report that was published in October 2018 demonstrates that it is imperative to limit global warming to 1.5°C. The report states that this target is still achievable and that one of the most important steps to meet this target is to urgently phase out coal investments, and to achieve net-zero carbon by 2035 for OECD countries, including Turkey, and by 2050 for non-OECD countries.

## The Yatağan, Yeniköy and Kemerköy coal-fired power plants account for approximately 15 percent of Turkey's annual CO<sub>2</sub> emissions from power generation.

*CO<sub>2</sub> emissions from Muğla's three power plants, or these power plants' contributions to climate change, are considerably high: the CO<sub>2</sub> they emitted by burning coal to produce electricity amounts to 360 million tons between 1982 and 2017. There are no economically feasible technologies to capture CO<sub>2</sub> before it is released to the atmosphere. Hence, we will all globally bear the burden of burning coal even after the planned upgrade investments for the Yatağan, Yeniköy and Kemerköy coal-fired power plants are made: if these power plants are operational from 2018 to 2043, they will emit an additional 328 million tons of carbon dioxide. In other words, Turkey's insistence on coal will cost not only Muğla residents, but everyone from Fijians to Swedes.*

According to the Turkish Statistical Institute, the power generation sector in Turkey emitted 144.8 million tons of CO<sub>2</sub> in 2017. The same year, Turkey's total greenhouse gas emissions from power generation increased more than four times compared to 1990 levels (CO<sub>2</sub>e).

It should be noted that this figure does not include methane emissions from coal mines, CO<sub>2</sub> from vehicle exhaust gas during the transportation of coal from mines to power plants and other GHG emitted in various stages.

76 percent of the methane gas released into the atmosphere during coal mining occurs in underground mines and 24 percent in open-pits. Abandoned coal mines continue to emit methane gas.

**Table 8: Estimated CO<sub>2</sub> emissions of the Yatağan, Yeniköy and Kemerköy coal-fired power plants\***

In one year (with 2015 data)	Total for 1982-2017	Total for 2018-2043**
They emit 12.5-16 million tons of CO <sub>2</sub>	They emitted 360 million tons of CO <sub>2</sub>	They will emit an additional 328 million tons of CO <sub>2</sub>

\* Calculation based on the carbon content of lignite burnt in these three power plants (Vardar & Yumurtaci, 2010) and on the plants' capacity utilization rate (General Directorate of Turkish Coal Enterprises TKİ and Electricity Generation Company EÜAŞ data).

\*\* Based on the assumption that all three coal-fired power plants will be operational for 50 years.



Methane emissions from abandoned Turkish coal mines in 2016 increased by 79.5 percent compared to 1990 (TUIK, 2018). However, the total greenhouse gas emissions of Muğla's lignite mines, which have been operating for 40 years, is unknown. Although lignite mining falls under EIA in Turkey, most of the lignite mines in Muğla do not have EIA reports because they became operational before 1993.

The Muğla Metropolitan Municipality's 2015 "Muğla Climate Change and Sustainable Energy Action Plan" report states that, according to 2013 data, the province's total greenhouse gas emissions amounted to 11.2 million tons and 65 percent was emitted by Yatağan, Yeniköy and Keremköy coal-fired power plants. The report also indicates that total greenhouse gas emissions from coal combustion was 7.36 million tons of CO<sub>2</sub>e. This shows that emissions from coal for residential heating is 71,400 tons, and that coal-fired power plants account for 99 percent of the CO<sub>2</sub> generated by coal combustion. (Giray et al., 2015).

Located in the Eastern Mediterranean Basin, Turkey is a high-risk country in terms of the adverse impacts of climate change. Turkey's insistence on coal and other fossil



**According to the Turkish Statistical Institute, the power generation sector in Turkey emitted 144.8 million tons of CO<sub>2</sub> in 2017. The same year, Turkey's total greenhouse gas emissions from power generation increased more than four times compared to 1990 levels (CO<sub>2</sub>e).**







fuel-dependent energy and development policies make it one of the most vulnerable countries to climate change impacts. The Turkish State Meteorological Service indicates that temperatures in Turkey have been following an upward trend since the 1990s, with above normal increases since 1997. For example, average temperature in 2017 was 1.5°C warmer than 1970.

Scientific studies show that the highest temperature increases (up to 1.8°C) between 1979 and 2010 occurred in Western and Southeastern Anatolia, including Muğla (Gökmen, 2016; Şen et al., 2011). Average temperatures in Turkey are expected to increase by 0.5°C–4°C in 2020–2050, compared to 1970–2000 (Turp et al., 2014). The projected temperature increase from 1971 to 2099 is 6°C (Şensoy and Demircan, n.d.). Heat waves are expected to increase, particularly in southern regions.

According to the Turkish State Meteorological Service reports, Muğla is one of the provinces to have experienced the most severe and frequent occurrences of extreme weather events such as heavy rainfall, flood, storm, hail and frost. The typical forest fire season has become longer and the number of fires have increased as a consequence of climate change, making winter forest fires more likely to occur (Avcı & Korkmaz, 2014).

According to an international study, water per capita in 2030 in Turkey and Greece may be lower than 1,000 m<sup>3</sup> for the first time in history, indicating severe water scarcity (Cramer et al., 2018). Model studies for the Western Mediterranean Basin, including Muğla, predict that climate change will cause a significant decrease in water potential, underground water reserves and surface water flow (Ministry of Forestry and Water Affairs, 2016).

Climate change has serious impacts on economic sectors that are dependent on natural inputs and climate conditions. Agriculture, animal husbandry and tourism constitute the main sources of livelihood in Muğla and are already exhibiting some of the impacts of climate change. A project carried out by the Muğla Province Beekeepers As-

sociation and a large group of academics between 2012 and 2014 reveals the already visible regional impacts of climate change on beekeeping: "Muğla is the number one producer of pine honey in Turkey. The Marchalina hellenica Genn., a scale insect sucks the sap of Calabrian pine trees (*pinus brutia*) and produces a cottony secretion called honeydew and honeybees feed on this honeydew to produce pine honey. Recently (since 1994), warming and drought have become more prominent and (together with air pollution from coal-fired power plants and open-pit mines) begun to affect pine forests and dry up low elevation pine forests, thereby decreasing the scale insect's honeydew production" (Avcı and Korkmaz, 2014; Kantarcı and Avcı, 2014).

Olive cultivation, one of the most important sources of income in the region, is also expected to be impacted by climate change. Even though olives are drought-resilient, the increasing pressure on water resources and the changes in rainfall regime may cause a series of problems for olive production. Water stress in various seasons causes decreases in shoot growth, flower bud formation, fruit set and fruit fat ratio, as well as abortive (barren) flower and small fruit formation (Varol & Ayaz, 2012).

Climate change is not only an ecological crisis but also a global social, economic and political crisis; climate change puts a strain on urban infrastructure, poses a risk to food safety and security as well as human health and safety, it increases social inequality and rising sea levels threaten settlements, most notably in coastal areas. Extraction and burning of all fossil fuels, particularly coal, must be stopped as soon as possible in order to prevent the global, national and local irreversible impacts of this crisis.

**The Yatağan, Yeniköy and Kemerköy coal-fired power plants account for 65 percent of Muğla's carbon footprint (total GHG emissions)**



# FORESTS AS CARBON SINKS

Forests play a very important role in removing excess carbon dioxide. In forest ecosystems, carbon dioxide is stored not only in trees but also in the entire vegetative mass and soil. Human activities, such as coal mines, which destroy entire forest ecosystems, cause climate change by both destroying carbon sinks and triggering the release of carbon dioxide that has been stored in these areas.

Forest ecosystems, which are especially destroyed in open-pit mining in order to reach coal seams, are one of the most important carbon sinks that store atmospheric CO<sub>2</sub>. Forests remove carbon from the atmosphere by photosynthesis and use it to produce vegetative mass (for the growth of trees and other plants). Furthermore, in all terrestrial ecosystems, including forests, carbon is stored not only in vegetation but also in soil. In forest ecosystems, there is also the organic carbon content of forest floor leaves, rot and humus. (Tolunay & Çömez, 2008).

The total area covered by open-pit lignite mining operations in Muğla since 1979 is 5,000 hectares. There is no official data

about the extent of forest and agricultural areas that have been destroyed. However, an analysis of satellite images reveals that in the past 40 years the expansion of mining areas destroyed a significant amount of carbon sinks.

Although mining-related environmental legislation and transfer of operating rights agreements envisage rehabilitation and reforestation of lignite mine sites after operations are completed, this does not signify that carbon sink potential that was destroyed can be recovered. The growth and development of trees that are planted on tailings (post-extraction raw materials with no organic matter) is much slower than those on natural soils. It takes hundreds of years for coal mining tailings to turn into soil and regain their capacity to store 75-80 tons of organic matter per hectare. Tree carbon stock recovery may take less time depending on how effective afforestation proves to be. Furthermore, there are many cases in Turkey where opencast quarries and open-pit mines were not rehabilitated and were abandoned after mining operations were completed.

*If the forest ecosystems located within the boundaries of the Yatağan and Milas coal mining lease areas are entirely destroyed for coal extraction, the loss of biomass, soil, aboveground dead organic matter and dead wood will create a carbon-sink-area loss equivalent to 9 million tons of carbon dioxide. The total carbon loss that will occur as a result of carbon sink loss is 66,000 tons of CO<sub>2</sub>e per year. If mining continues for 30 years, more than 20,000 hectares of forest will be destroyed causing a carbon loss of approximately 2 million tons of CO<sub>2</sub>e (Professor Doğanay Tolunay's calculations for The Real Costs of Coal – Muğla report).*

**Table 9: Carbon sink areas lost - Yatağan and Milas (Yeniköy-Kemerköy) lignite mines and Muğla forests.**

	Threatened forest area (Hectare)	Total carbon loss* (Ton)	Total CO <sub>2</sub> e loss (Ton)
Milas (Yeniköy-Kemerköy)	12,038	1,435,653	5,264,062
Yatağan	8,714	1,039,253	3,810,595
<b>Muğla - Total</b>	<b>20,752</b>	<b>2,474,906</b>	<b>9,074,657</b>

\* includes biomass, soil, aboveground dead organic matter and dead wood.

**Table 10: Annual carbon sequestration potential lost - Yatağan, Yeniköy and Kemerköy lignite mines and Muğla forests**

	Threatened forest area (hectare)	Total carbon loss (ton/year)	Total CO <sub>2</sub> e loss (ton/year)	Total CO <sub>2</sub> e loss (ton/year) Total CO <sub>2</sub> e loss after 30 years of mining activities (ton)
Milas (Yeniköy-Kemerköy)*	12,038	10,473	38,401	1,152,027
Yatağan**	8,714	7,581	27,798	833,939
<b>Muğla - Total</b>	<b>20,752</b>	<b>18,054</b>	<b>66,199</b>	<b>1,985,966</b>

Calculations: Prof. Dr. Doğanay Tolunay, 2018\*\*\*\*

\*\* Calculated for two licensed areas with accessible coordinates. There are four licensed-areas in Milas, covering 23,339 ha.

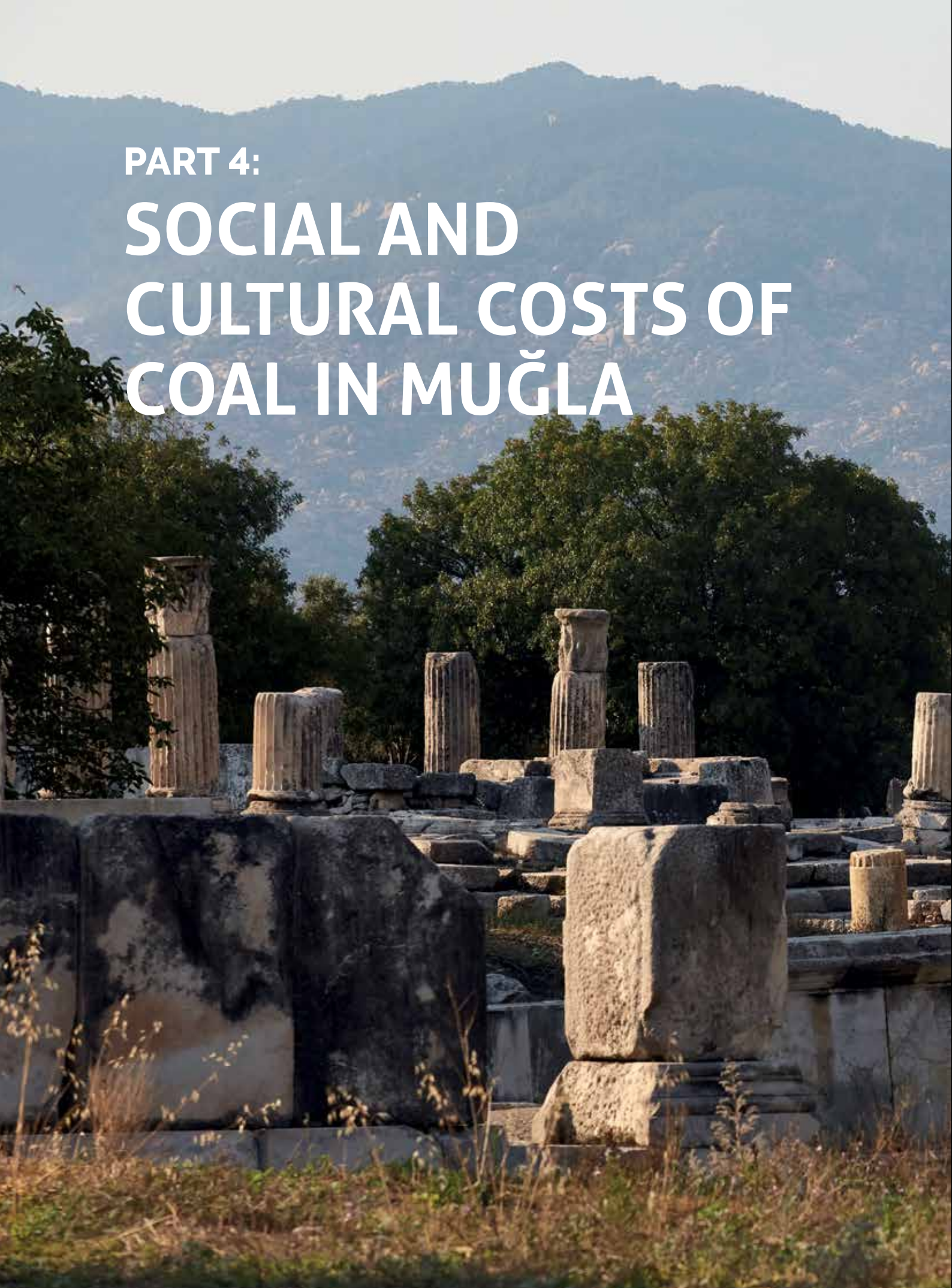
\*\*\* Calculated for seven licensed areas with accessible coordinates. There are ten licensed-areas in Yatağan, covering 23,358 ha.

\*\*\*\* Based on Research Association of Rural Environment and Forestry data.

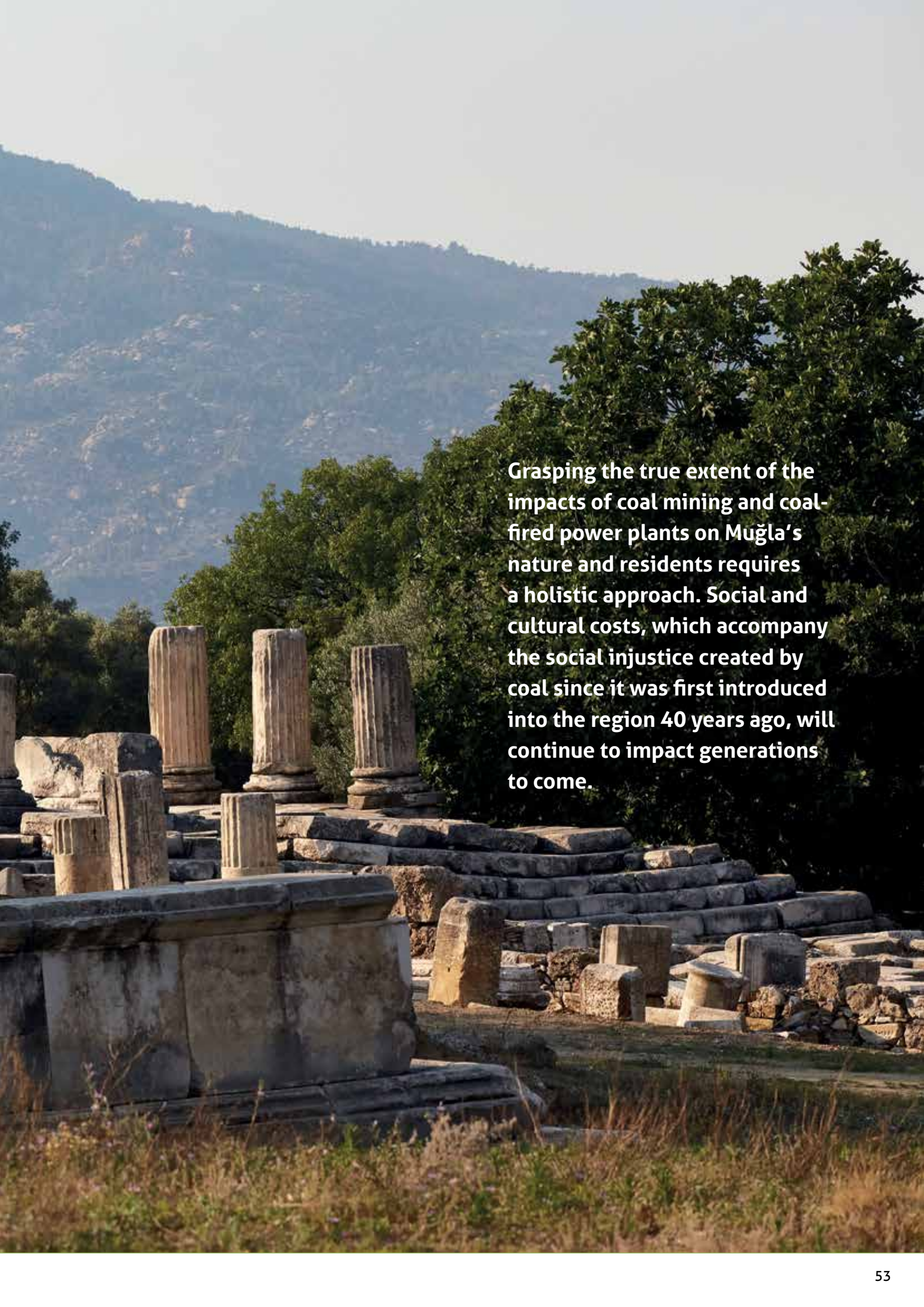


PART 4:

# SOCIAL AND CULTURAL COSTS OF COAL IN MUĞLA





A photograph of ancient stone ruins, including several tall, fluted columns and a large, low wall, situated in a valley. In the background, there are lush green trees and a range of mountains under a clear sky. The scene is bathed in warm, golden light, suggesting late afternoon or early morning.

**Grasping the true extent of the impacts of coal mining and coal-fired power plants on Muğla's nature and residents requires a holistic approach. Social and cultural costs, which accompany the social injustice created by coal since it was first introduced into the region 40 years ago, will continue to impact generations to come.**





“**Coal-fired power plants offered employment opportunities to the unemployed. In the beginning, salaries were low and workers used to quit their jobs and leave. People from other regions come here to work. Those who worked at the power plants quit their jobs, tobacco production paid better. Now, tobacco production is dead. Olive production is about to disappear. People are going to work, even if it means working for the power plan. They have no other way out.**” — **Nizamettin Gökgedik, Yatağan**

Muğla's coal-fired power plants and mines took away traditional production and employment opportunities, forcing residents to work in the coal sector or to migrate. Forced demographic transformations resulted in significant changes and deteriorations in the social and cultural fabric.

Until the introduction of coal in the late 70s, traditional livelihood in Muğla consisted of family farming, beekeeping, weaving, fishing, etc. It took only ten years for the three coal-fired power plants and mines to dominate life in Muğla. Today, almost all male villagers say that they worked in a coal mine or in a coal-fired power plant during some time in their lives. Residents who retired from these facilities can compare life before coal, when power plants and mines were state-operated and after they were privatized. Other changes frequently mentioned are displacements of villages, the decrease in agricultural yield and the demographic, cultural and social transformations in the region.

Over the past 40 years, eight villages have been forced to relocate -some more than once- because of coal mining operations. If these plants capacities are increased, their lifespans extended as planned and more coal mining-licensed areas become operational, 40 additional villages will be forced to entirely relocate or their res-

“**That year I was doing my military service in Ankara. I wrote six letters to my father. My family did not receive any of them. I also wrote a letter to the owner of the coffeehouse, who was in charge of these things in the village. All the letters were returned to me at the same time. I did not understand what was happening and I was very worried. I learned later on that our village had been displaced.**”

— **Durmuş, Yeşilbağcılar, Yatağan**



“ The Yeşilbağcılar village was expropriated and abandoned. First, they put money in everyone’s bank accounts, and they said you can take it or leave it. People did not want to go, but they could not resist. What could they do? People went to the bank and took out the money that was deposited into their accounts. But now they regret it. Some of them moved to Yatağan, Marmaris and Aydın. I mean, they had to. They lost their fields and olive groves together with their houses. Now they say that “they are yearning for a basket of olives”. ”

— Şerifan, Turgut, Yatağan

idents will be forced to leave their homes because the olive groves and agricultural forest areas on which they rely on for income will be expropriated. This would entail the direct or indirect displacement of approximately 30,000 people: 8,300 people in Milas and 20,400 people in Yatağan and Menteşe.

Mining-induced displacements not only violate basic rights such as right to life, right to property, but also cause severe trauma to the more vulnerable, such as the elderly, children and women in rural areas.

The relocation of the eight villages, the promises made versus what ensued after the relocations raise legit-

imate concerns for the people living in and near the mining licensed areas that are not yet operational. In 2012, residents of the 4500-year-old Yeşilbağcılar village were forced to relocate because of the expansion of the open-pit mine that supplies coal to the Yatağan power plant. Even though residents were notified of the evacuation decision back when the coal reserve was discovered in the 1980s, there had been no developments until the privatization process was completed in 2007. In the five years following 2007, evacuation accelerated when the open-pit mine reached the entrance of the village, damaging houses and exposing the village to the risk of landslides. In 2012, the entire village was evacuated.





“They paid us 85,000 TL for 13 lots of olive groves and one house. Then we took a bank loan and bought a house in Milas for 140,000 TL. I used to produce 300kg of olive oil a year. Currently a liter of olive oil sells for 15TL. Never mind the bank loan, losing my olive oil income alone has cost me 4,500 TL this year. ”

**Süleyman**, Ekizköy, Milas







At that time the Turkish Coal Enterprises (TKİ), which operates the coal reserves, promised to move the whole village as well as the 109-year old historical Yeşilbağcılar Mosque to another site, but never kept the promise. The new settlement was located at 2 kilometers from the old village and the Housing Development Administration (TOKİ) built only 127 residences to accommodate the entire village. The rest of the villagers were scattered to different residences that were built in plots allocated by the municipality. The village, as a unit of social life, was scattered. Hundreds of villagers chose to migrate to other provinces and districts to join their relatives. The historical village mosque was never moved and still stands, damaged, at the old Yeşilbağcılar village site near the Yatağan Power Plant coal mine. Recently, villagers who moved to the TOKİ residences have been facing the threat of another forced relocation on the basis that new coal deposits were discovered under the site.

At the beginning of the evacuation, the Yeşilbağcılar residents were told that all the land they left behind would be expropriated and that they would be compensated for their land. However, villagers were only compensated for lands containing coal deposits. According to the neighborhood representative of the new Yeşilbağcılar village, initially villagers received some expropriation compensations during the first evacuation, but not for all the expropriated lands. Then, expropriation was stopped on the basis that coal deposits were exhausted.

The Yeşilbağcılar village is not an exception; in Muğla, all villagers who were displaced because of coal went through similar experiences. Villagers are reeling under heavy debts, not only because they received below-the-market compensation for the expropriation of their agricultural fields but also because their sources of fixed income were taken away from them. Interviews with villagers whose olive groves were expropriated indicate that the options they were given to maintain their welfare were neither real nor fair and that almost all of them sustained losses after the expropriations.

In previous years, farmers, and particularly those who produce citrus, olive and tobacco in the vicinity of the Yatağan coal-fired power plant, were frequently going to court on the grounds that the pollution from the power plant caused decreases in yield and therefore financial loss. At the end of the 1990s-early 2000s, courts ruled that farmers should receive financial compensation. Court decisions determined that pollution from the coal-fired power plant was harmful to agriculture, damaged plants by preventing leaf development and decreased yield. As noted previously, present-day academic studies reveal the extent of the impact of the dust particles emitted by the three coal-fired power plants and open coal mines on two important and traditional sources of employment in Muğla, namely beekeeping and olive cultivation. Agricultural income loss from coal pollution eliminates all employment options other than daily employment in the coal sector.



# AGRICULTURAL PRODUCTION AND COAL

**“ I used to produce 8 tons of olive oil and 150 tobacco bales before the coal-fired power plant was built. 8 tons dropped to 5 tons, then to 3 tons and now I barely produce 2 tons. Also, olives are drying up. Before, olives used to be green and juicy. Now, they are yellowish because they are constantly exposed to the poison in the air. ”**

— **Mustafa, Turgut, Yatağan**

## Unprotected by the Olive Law

Olive is cultivated in many regions in Turkey and is not only a source of income but also a part of this land's traditions and culture, so much so that a 1939 law provided special protection to olive groves. Law No. 3573 on Olive Improvement and Grafting of Wild Species contains provisions to encourage the increase and development of olive cultivation and to protect olive groves from industrial and other polluting activities. In recent years, the government has tried a few times to amend the “Olive Law” to pave the way for industrial infrastructure, mining and power generation projects and was prevented each time by widespread public reaction and legal battles. The most critical article, Article 20 states *“Facilities that produce chemical waste and emit dust and smoke that could hinder the vegetative and generative development of olive trees, with the exception of olive oil facilities, shall not be built nor operated in or within a three-kilometer-radius of olive fields.”* The same article further states *“Olive cultivation surface area shall not be decreased. However, in the event olive groves within municipality boundaries fall within zoning boundaries, the total construction area, including infrastructure and social facilities, shall not exceed 10 percent of olive grove area. The removal of olive trees is subject to the justified permission of the Ministry of Agriculture and Rural Affairs. This permit requires the assent of the research institutes under the Ministry of Agriculture and Rural Affairs and of the local chamber of agriculture, where present. Even in these instances, an olive tree, cannot be cut down or uprooted unless it is absolutely necessary. Anyone who cuts or uproots olive trees without permission will face a fine of two to five million TL per tree. The trees that have been cut down and uprooted will be confiscated.”*

Although the government did not succeed to amend Article 20, which prohibits industrial and infrastructure

projects in olive cultivation areas, this article is very often violated. Currently, this article is frequently (almost every week) violated in the villages of Yatağan where olive trees are uprooted to expand the coal mine that lies within the boundaries of the licensed area.

In the past two years, thousands of olive trees have been cut down and uprooted in the village of Turgut in Yatağan by the company that operates the coal mine. Knowing that olive trees are protected by a special law and cannot be cut down even by the landowner, Turgut residents filed complaints for each incident. Filing complaints ensured that the incidents were documented by the authorities and the company was fined. Excavations were frequently stopped because of the criminal sanctions brought against the mining company. However, according to local residents, the company waited a while after paying the fines and continued to excavate in the same area.

Today, the mine that supplies coal to the Yatağan power plant has expanded and reached the limits of Turgut village. The expansion threatens not only the villagers's olive groves, but also the thousand-year-old village itself. There is no expropriation decision for the village yet, however the olive trees in the 93 parcels located on the slope between the village and the coal mine sit on top of the village's water source. Excavating this area for mining creates the risk of destroying the olive groves and water resources of Turgutlu residents as well creating potential landslides. This leaves the villagers, who are stripped of their vital resources and whose living spaces are at physical risk, no choice but to eventually migrate. However, Turgut residents are continuing their struggle to protect their homes and olives.





**“I want to live in my village where my ancestors are buried and with my olive trees, the olive trees that I have planted and taken care of. I want to die here. The money that the company gives us will last only two years, whereas my olive trees enabled me to raise my children, send them to school and marry them off.”**

**— Tayyibe, Turgut, Yatağan**

One of the biggest traumas experienced by village residents who migrate is losing the sense of belonging that comes with leaving one's ancestral land. The land that was left behind by the younger generations of families who have lived here for hundreds of years is now used for open-pit coal mining and looks nothing like the village where they were born and raised. Mining-induced migrations not only violate fundamental rights, such as the right to life and property, but also cause serious traumas on the more vulnerable population, particularly the elderly, children and women. In addition to mining-induced displacements, the decrease in agricultural production as a result of the pollution from coal-fired power plants disrupts local residents' livelihoods. Coal-induced air pollution directly impacts not only public health by causing respiratory and cardiovascular diseases, but also the yield and quality of agricultural production in the region.



## Abdullah Aysu, Çiftçi-Sen President , *Opinion*

In Muğla, the upper soil levels are richer and much more fertile than the deeper levels. The underground contains difficult to extract, dirty and low-calorific lignite reserves, whereas favorable climatic conditions provide diverse and rich traditional agricultural production. More than 60 percent of Muğla residents earn their living from agricultural production. More than 3 percent of gross agricultural production in Turkey comes from Muğla. Olive cultivation, citrus production, fruit and vegetable cultivation, greenhouse cultivation, animal husbandry, beekeeping, tourism and fisheries constitute the main sources of income in the region. Many of these economic activities are long-standing and have shaped the local culture and lifestyles.

In recent years, companies began to seize private lands and immovable properties through the "immediate expropriation" procedure in accordance with the provisions of Article 27 of Law No. 2942, Article 27 of Law No. 3634 and Article 1 of Law No. 3634. The Expropriation Law grants the Energy Market Regulatory Authority's (EMRA) power to exercise immediate expropriation and enables companies to expropriate the homes and lands of individuals to build power plants, processing facilities and conduct mining activities. Peasants and lawyers, scientists and environmental groups reacted to the law and joined forces. Today, we are witnessing a new form of struggle in rural Turkey and the Muğla countryside is one of the regions where this struggle can be observed.

Olive cultivation in Muğla dates back 3,000 years. Currently, approximately 22,000 farmers earn their living from olive cultivation. 13 percent of the olives and 8 percent of the olive oil produced in Turkey comes from Muğla. Olives and olive products are healthy products. As long as they are processed with the right methods, they do not produce any harmful waste. Olives are always green. The government wants to open olive groves to mining explorations but the Olive Law No. 3573 is preventing them. The government is trying to flout the law with new regulations, but the average size of olive groves in Turkey is 12 decares and they have the potential to generate substantial income for olive growers.

Muğla plays a leading role in Turkish beekeeping (apiculture). Muğla boasts approximately 6,000 beekeeper families and about 983,000 bee colonies in about 360 neighborhoods. Muğla has been Turkey's apiculture center for centuries. The region's main product is pine honey and pine honey cultivation is a profession and a craft. Muğla



alone accounts for a large part of Calabrian pine honey production and nearly all of the imported Turkish honey is pine honey. Muğla's mild climate has the potential to provide bees with unlimited floral resources throughout the year. Citrus, almond and sweetgum trees, which are the dominant tree species in the region, provide many benefits to beekeepers.

Another agricultural product that puts Muğla on the map is sesame. Muğla is the third largest sesame producing region in Turkey. Muğla's sesame is very valuable and is renowned for being produced with traditional methods and without any chemicals. This agricultural potential should have been protected, developed and translated into environmentally compatible production and habitats. However, sesame production has been decreasing for the last 35 years because of the bad decisions to invest in coal-fired power plants. Coal has taken hold of the region, whereby decreasing employment opportunities in agriculture.

The agricultural model of production in rural Muğla is hundreds of years old and could have been continued for thousands of years to come, but coal has taken hold of the region and is spreading, posing a risk to all living and non-living entities. Coal has already impacted almost everyone whose traditional livelihoods consist of agricultural production and forest, sea and tourism-related activities. If the sovereignty of coal is not stopped and continues to expand, the ecological damage as well as the social and cultural damage in Muğla will be irreversible.



## A total of 880 protected sites lie within the pollution impact zone of the Yatağan, Yeniköy and Kemerköy coal-fired power plants, **833** of which are archaeological sites.

Associate Professor Semra Purkis from the Department of Economics at Muğla Sıtkı Koçman University states that investing in coal mining and coal-fired power plants instead of making use of Muğla's rich non-coal sectoral potentials is not only an issue of energy demand, but also an economic choice. In her published paper "Development possibilities in Muğla in the framework of a good and high-quality life: another Muğla is possible", Professor Purkis uses data from the Turkish Statistical Institute and the South Aegean Development Agency to reveal non-coal sectors that stand out in the short-term and those that can provide high value-added activities in medium term. The paper highlights Muğla's potential for a significant number of very high value-added industries in the framework of a high-quality life and different approach to economic development. Some of the sectors that can stand out with necessary investments and subsidies are: renewable energy, organic agriculture, agriculture-based industry, ecotourism, and medicinal and aromatic plant production (Purkis, 2019)

Coal-fired power plants and coal mines come with a cost not only for people, but also for our common cultural heritage. The region that was referred to as Caria in Antiquity, currently includes present-day Aydın and Muğla provinces and the western tip of Denizli, and is located at the intersection of coal-fired power plants, coal mining licensed areas and air pollution dispersion area. Caria is a mountainous region with a long indented coastline and inland fertile plains formed by alluvial deposits carried by streams flowing to the sea. Caria boasts many ancient settlements and was also home to the Seljoukides, Byzantines, Ottomans before the Turkish Republic.

A study on coal's impact on the archaeological heritage in Muğla, conducted by Yiğit Ozar, Head of the Istanbul Branch of the Archaeologists Association for the The Real Cost of Coal - Muğla, indicates that the lignite mines, coal-fired power plants and other coal production facilities in the region pose a threat to the 4000-year-old archaeological heritage. Ozar analyzes the impacts on archaeological entities in two parts: excavation activities in lignite mines and air pollution caused by thermal power plants.

According to archaeologists, the sites between Stratonikeia and Lagina will be most affected by the expansion of mines that supply coal to the coal-fired power plant. Explorations are currently being conducted in these two ancient settlements and important cultural heritage sites in Yatağan.

The ancient city of Stratonikeia is on the tentative list of UNESCO world heritage sites. However, the "Sacred Road" between the ancient city of Stratonikeia and the Lagina Hekate Sanctuary has been completely destroyed for coal mining and the construction of highways connecting the mines. Ozar indicates that coal mining licenses granted to areas within archaeological sites impede holistic conservation approaches and he underlines that the destruction of the Sacred Road negatively impacted the holistic approach to the conservation of the ancient city of Stratonikeia and the Lagina Hekate Sanctuary, resulting in the destruction of an important landscape.

According to Ozar, the erosion of archaeological structures from coal-fired power plant pollution constitutes another significant threat. An air pollution dispersion model of Muğla's heritage sites was carried out for The Real Cost of Coal – Muğla report.

The model measures the impact dispersion area of a number of pollutants and particularly sulfur dioxide and nitrogen dioxide, which damage organic and inorganic matter and are high-risk gases for cultural sites. The Coal's Impact on Muğla's Archaeological Heritage report states that these gases not only damage outdoor monuments, but also they find their way indoors and have adverse effects on objects stored in museums or archives.

The report also highlights that nitrogen converts into nitric acid and damages marble. This is particularly important in the context of the ongoing archaeological excavations because marble is the main construction material in Muğla's ancient sites. As a matter of fact, the ancient city of Stratonikeia is on the tentative list of UNESCO World Heritage because it is one of the largest ancient sites built entirely from marble.





# PART 5: MUĞLA COAL'S BURDEN ON THE ECONOMY









**The social and ecological costs of coal-fired power generation were addressed in previous chapters. For the past few years, the adverse impacts of state-subsidized coal-fired power generation on the Turkish economy, as well as on the economy of other developing and emerging countries, have become more noticeable.**

The Yatağan, Yeniköy and Kemerköy coal-fired power plants in Muğla, which had already reached retirement age when their lifespans were extended through privatization, have a certain cost to the economy that is unfortunately not entirely quantifiable with a simple profit and loss analysis. Consumers or tax-payers, whose welfare is directly affected, are left to bear the financial burden.

The Yatağan, Yeniköy and Kemerköy coal-fired power plants were initially operated by Elektrik Üretim A.Ş. and they were privatized as part of the liberalization of the electricity market in accordance with the IMF program and with the technical support of the World Bank.

The state provided the private operators of these aging coal-fired power plants two important privileges regarding mandatory environmental and efficiency investments:

- The cost of massive investments such as flue gas filtration, desulphurization units and boiler technology improvements were funded by public investment programs (ie. from the state budget) before the coal-fired power plants were privatized.
- An amendment to the Electricity Market Law exempted privatized power generation facilities from environmental legislation, postponing environmental investments.





# Beyond external costs

*The case of the Yatağan coal-fired power plant* ———



The Yatağan power plant's first unit began operating in 1982 and two additional units were added later on. The estimated installation cost of the 630 MW Yatağan power plant is approximately 1,260 million Turkish liras in 2016 figures. Soon after it became operational, the power plant was regarded as a "wrong" investment by many experts, institutions and organizations- including the political parties that were in favor of the investments- because of the plant's environmental impacts as well as its distance to the coal-supplying mines and industrial zones that needed power. The power plant began operating before the flue gas treatment system was installed in 2007, which means it operated without a desulfurization unit for 22 years.

Prior to 2007, the power plant was frequently shut down by the governorship on days when it emitted high levels of sulfur dioxide as well as for maintenance and repairs. According to 2001 data obtained from Water and Gas Workers' Union(TES-İŞ) Yatağan Branch, the Muğla governorship shut down the power plant on eight occasions for maintenance and around 50 times for pollution from January 2000 to December 2001.

A troubling clause in the privatization agreement stated that the power plant would receive capacity payment even when it was shut down, directly putting the burden on the public budget. Despite the signed transfer agreement, the privatization that was planned for 2000 was

delayed thanks to protests by labor unions and local residents as well as economic circumstances and the court decision against the transfer of operating rights. Local and foreign companies that formed the consortium applied to the International Chamber of Commerce (ICC) for arbitration and Turkey paid a compensation of 90.2 million USD, including accrued interest..

The power plant was privatized in 2014 and expensive technology upgrade projects aimed at increasing production and profitability have currently resurfaced. Furthermore, faced with decreasing open-pit coal reserves in Yatağan, the operator developed an underground mining operation project, which is quite costly and unusual for the region.

On the other hand, in July 2018 an accident in Yatağan power plant killed two workers and injured eleven. According to trade associations and unions, the coal belt system feeding the boilers collapsed because of negligent maintenance, repair and rehabilitation. Prioritizing projects aimed at increasing the production and therefore the profitability of a power plant that has reached retirement age brings to mind the Soma coal mine disaster of a few years ago. Perhaps one the most important lessons to be learned from the Soma disaster is that the cost-benefit principle should not be applied to social policies such as job security and can lead to immeasurable social cost.



# The constant need for rehabilitation and its cost to the economy\*

*The case of the Yeniköy coal-fired power plant* —

## Private sector's license to pollute

The provisional clause 8 of the Electricity Market Law No. 6446, which entered into force on 14 March 2013 and was revoked by the Constitutional Court in 2014 upon objections from many institutions and organizations, exempted companies that had won privatization tenders from environmental legislation for 5 years as of 2013. Clause 8 granted companies the privilege to continue to pollute the environment without interrupting production even when they caused increased environmental damage and exempted them from all criminal sanctions.

With the Constitutional Court's decision to annul Clause 8, completing the required environmental investments became an urgent matter, especially for the old and dirty coal-fired power plants. However, inquiries made by NGOs reveal that investments were not made during this period. Despite strong objections from professional associations, political parties, unions and NGOs, and the Constitutional Court's 2014 decision to annul on grounds of "violation of the constitutional principle of environmental protec-

tion", the provisional Clause 8 was reinserted through an amendment to the Electricity Market Law in 2016. The significant changes to the article consisted of extending the 2013 permission deadline for completing environmental investments by one year, from the end of 2018 to the end of 2019, and including power plants that were privatized before 2016 and those that would be privatized after 2016, the date when the amendment came into effect.

Therefore, all winners of past and future privatization tenders were granted the privilege to pollute and were exempted from criminal sanctions until the end of 2019. In February 2019, Article 45 of an omnibus bill introduced in the Turkish Grand National Assembly proposed extending the deadline to 2021. The enactment of this article would have granted the operators of 12 old and dirty coal-fired power plants, including Yatağan, Yeniköy and Kemerkoç, exemption from environmental investments for a total of 8 years. However, NGOs, trade associations and healthcare professionals who realized the gravity of the situation, quickly launched a petition. The petition,







which was signed by 70,000 people in the course of only a few days and was forwarded to political parties, prevented the parliament from passing the article. Consequently, these twelve coal-fired power plants will either make the necessary costly rehabilitation investments by the end of 2019 or they will be shut down.

The Yeniköy coal-fired power plant's estimated installation cost is 840,000,000 TL in 2016 figures and the winning bid in the 2013 privatization tender was 1,602,600,000 TL. However, between 2008 and 2014, in other words just before it was privatized we see that over 800,000,000 TL was allocated from annual public investment programs for the power plant's rehabilitation and flue gas filtering system. The 28-year-old Yeniköy power plant was privatized in 2014 following the state-funded rehabilitation investments. The Yeniköy power plant was close to the average age of retirement (35), but instead of being shut down, it was rehabilitated so that the company that won the privatization tender could operate it for decades to come. In 2015 YK Energy, the operator of the

Yeniköy and Kemerköy coal-fired power plants, applied to the investment incentive program to obtain VAT exemption for the rehabilitation investments.

There is no information on whether the company benefited from VAT exemption because information on whether the company ever made these investments for either or both power plants was not made available to the public. However, in 2017 the company announced that a 260 million USD agreement was signed for the modernization projects of Yeniköy and Kemerköy coal-fired power plants. If the company goes ahead with this project that is planned to begin in 2019, the health, socio-economic, cultural and ecological costs of these two power plants will continue to build up even if their environmental performances relatively improve. The coal-fired power plants CO<sub>2</sub> emissions cannot be reduced with these rehabilitation investments and they will continue to contribute to climate change.

**\* All figures are expressed in terms of the current value of TL, without comparison to any base year.**

Recent economic analyses reveal that as of 2013 the state budget allocated approximately 730 million USD worth of incentives to the coal industry in Turkey. This figure includes the most up-to-date coal industry data available in 2015 such as coal R&D, mineral exploration incentives, treasury incentives, rehabilitations during the privatization process and new reserve exploration studies. However, the coal industry investment incentive figure does not include power purchase agreements, customs duty and value-added tax (VAT) exemptions, social security premium support, capacity allowances, land allocation and below-market interest rates. This figure shows public incentives provided to the entire coal industry and not the incentives provided to each power plant. Therefore, only up-to-date and reliable data that could be accessed for each of the three coal-fired power plants in Muğla were used in this report.

The amounts and types of subsidies provided to Muğla coal-fired power plants according to available data are:

- **Regional subsidies**

Coal projects are subsidized within the framework of the 2012 New Investment Incentive Program, under the Regional Investment Incentive Plan and are classified

as "priority. Coal investments throughout Turkey benefit from privileges such as VAT exemption, customs duty exemption, tax deduction, support for employer share of social security premiums, land allocation and interest support.

The Regional Investment Incentive plan classifies Muğla as a First Region province, thereby making it eligible for lower subsidies. Investments in coal exploration and production and coal-fired power plants are subsidized under the Regional Investment Incentive Plan and are classified as "priority investments". They benefit from the Fifth Region subsidies, in other words they are eligible for bigger subsidies.

Information on subsidy requests made by companies and whether investments were made are not accessible by the public. Therefore, it is not possible to confirm if these investments were realized and whether the requested subsidies were granted. However, the Investment Subsidy documents that were published in November 2016 reveal that the Yatağan power plant operator asked for VAT exemption, custom tax exemption and tax deduction for its 390 million TL modernization investment.



**In 2017, the Yatağan, Yeniköy and Kemerköy coal-fired power plants sold 1.10 billion TL worth of electricity, which accounted for 30 percent of the total electricity purchased through power purchase subsidies provided to power companies who produce electricity from domestic resources.**

The Investment Subsidy documents published in April 2015, reveal that the company who operates the Yeniköy and Kemerköy power plants asked VAT exemption for its 3.5 million TL steam boiler rehabilitation investment .

Although it is not possible to determine and quantify the Regional Investment Incentive Plan subsidies that were provided, such as tax exemption, it is clear that the fact that companies do not pay taxes on their large-scale strategic investments puts a significant burden on the country's economy.

• **Fixed-price power purchase agreement for power generation from domestic coal**

In 2016, the Electricity Market Law was amended by a Council of Ministers decree. The amendment was brought forth in the policy framework on "including domestic and renewable energy resources in power generation" and introduced power purchase agreements for electricity produced with domestic coal, with fixed price and amounts to be determined by the Council of Ministers. The fixed tariff privilege provided to coal is at odds with the recent talks to liberalize the electricity market, but more impor-





tantly it can obstruct renewable energy resources –which will become increasingly cheaper in coming years –, and poses significant risks to the country's economy.

At the end of 2017, another Council of Ministers decree amendment introduced adjustment of purchase price for annual inflation. For example, in 2017 the fixed purchase price for all domestic coal-fired power plants was 186 TL per megawatt hour (TL/MWh). In the first quarter of 2018, it was adjusted according to common inflation expectations and was set at 201.35 TL/MWh. As for the purchase amount, the previous amendment had authorized the Council of Ministers to set the purchase amount on an annual basis. With the new amendment, the amount of energy that would be purchased by the state from domestic coal-fired power plants the following year was set at half the power plants' projected output, in other words the purchase amount would be determined by the operators' expectations instead of energy demand.

The purchase price for the first quarter of 2019, which was adjusted for inflation, was set at of 285 TL/MWh, significantly higher than 2017 and 2018 prices. Furthermore, this price was also higher than the 2018 weighted average market clearing price of 233.09TL. Power purchase agreements provided to coal have a cost to the country economy, and this cost is directly or indirectly borne by consumers. According to an analysis, the cost of power purchase agreements, which is approximately 150 million USD annually, would increase 2018 consumer bills by 0.0019 TL per kilowatt-hour (TL/kWh), excluding taxes. This analysis assumed that the 2018 average exchange rate and electricity prices on day-ahead markets would be close to the averages of 2016 and 2017. However, the high inflation rate, exchange rate fluctuations and the significant increases in electricity prices in 2018 lead us to believe that the cost that was reflected in electricity bills was higher (Sitti, 2018).

**Table 11: Subsidies available to Yatağan, Yeniköy and Kemerköy Coal-Fired Power Plants**

	Regional Subsidies	Fixed Power Purchase Agreement	Capacity Mechanism Payments
<b>Yatağan PP</b>	VAT exemption	In 2017, 11.5 percent of the total purchases from coal-fired power plants: <b>422,5 million TL*</b>	Total monthly capacity mechanism payments received from January to December 2018: <b>70 million TL</b>
	Customs duty exemption		
	Tax deduction		
	Support for employer share of social security premiums		
	Land allocation		
	interest support		
	Regional Subsidies	Fixed Power Purchase Agreement	Capacity Mechanism Payments
<b>Yeniköy PP</b>	VAT exemption	In 2017, 7.4 percent of the total purchases from coal-fired power plants: <b>273 million TL**</b>	Total monthly capacity mechanism payments received from January to December 2018: <b>48 million TL</b>
	Customs duty exemption		
	Tax deduction		
	Support for employer share of social security premiums		
	Land allocation		
	Interest support		
	Regional Subsidies	Fixed Power Purchase Agreement	Capacity Mechanism Payments
<b>Kemerköy PP</b>	VAT exemption	In 2017, 7.4 percent of the total purchases from coal-fired power plants: <b>409,5 million TL**</b>	Total monthly capacity mechanism payments received from January to December 2018: <b>68 million TL</b>
	Customs duty exemption		
	Tax deduction		
	Support for employer share of social security premiums		
	Land allocation		
	Interest support		

\* Calculated using the 2017 fixed purchase price of 186 TL/MWh and the TETAŞ 2017 purchase data. The 2018 data for the amount of electricity purchased from each power plant was not available..

\*\* Assuming that the purchase guarantee was provided to the investor and thereby in proportion to the total capacity of both Yeniköy and Kemerköy coal-fired power plants.



**In 2018, capacity mechanism payments to enable Yatağan, Yeniköy and Kemerköy coal-fired power plants maintain a certain operational capacity cost the state 187 million TL.**

• **Capacity mechanisms**

The Capacity Mechanism Regulation that came into effect on January 1, 2018 granted further privileges to companies who produced electricity from domestic coal. Capacity mechanisms are implemented in some European Union countries and they are measures that enable power plant availability to generate a certain amount of electricity –that they would not normally produce - to meet excess demand. The justification provided by the Turkish government for introducing this regulation was not based on electricity demand but on excess electricity supply. The government announced that capacity payments would be provided to power plants- which were facing high installation and operating costs, as well as decreasing electricity prices due to excess electricity supply- to prevent them from shutting down

Capacity mechanisms are expected to cost the public budget an additional annual total cost of around 1.4 billion TL. These capacity mechanism payments show that the existing incentives and subsidies are not enough to enable fossil fuel power plants with relatively high installation and operation costs to compete with solar and wind energy, which costs are rapidly declining. Furthermore, European cost analyses indicate that these measures increase the profits of the companies who qualify for capacity mechanism payments and the electricity bills of consumers.

In 2018, private operators of coal-fired power plants faced financial risks despite benefiting from significant subsidies such as power purchase agreements, capacity allowances, and tax exemptions. The unexpected rapid fall of renewable energy prices and the emission restrictions imposed within the framework of climate change and air pollution measures in various countries are some of the risks that will be added to the list of troubles that investors currently experience in maintaining the profitability of the coal-fired power plants.

If an investment loses its value prior to the end of its economic life, it becomes a stranded asset. Recent financial analyses indicate that coal-fired power plants that are privatized close to retirement age expose their new operators to the risk of stranded assets. According to a 2016





**According to a 2016 analysis, the Yeniköy coal-fired power plant is one of the five power plants that bear the highest risk of becoming a stranded asset in 2026.**

report, companies that invest in privatized coal-fired power plants will be adversely impacted if the power plants become unprofitable before the investment costs are recovered. The new operators' efforts to compensate for the stranded asset risks of these coal-fired power plants, which were privatized in 2014, through various subsidies shift the economic risk from private companies onto the state, hence onto the taxpayers, electricity consumers and the economy.

Calculating the costs of tax privileges, power purchase agreements and capacity mechanism payments and how much they reflect on consumer bills is very important in understanding the burden they impose on the country's economy. Assessing the macroeconomic burden imposed by the subsidies provided to coal-fired power plants with inefficient production capacity and high operating costs and who can no longer maintain their competitive edge in current market conditions, and comparing this burden with power plant retirement costs is also very important.

Many countries, and notably EU countries and the United States of America, have begun to retire coal-fired power plants that need subsidies to maintain profitability, and impose additional health and environmental burdens on the economy, and those that require further investments to increase production efficiency, keep up with new environmental regulations and extend their lifetime.

EU countries retired 22 coal-fired power plants in January 2016-September 2018 (Europe Beyond Coal, 2018).

Twenty power plants are expected to be shut down in the coming months. The USA decided to shut down some

relatively younger coal-fired power plants in line with their emission reduction policies and because the environmental, economic and social costs these power plants will impose during their operational lifetime exceeds retirement costs.

However, the province of Muğla has a very important agricultural production potential. Currently, Muğla is the top national aquaculture producer and almond, pine honey, beeswax, kidney bean and fresh cowpea producer; ranks second in olive oil acreage and pomegranate cultivation; and third in sesame, lemon, thyme, dried cowpea and anise production. Muğla is also one of the top five tomato, grapefruit, carob, celery, lettuce, chard, arugula, citrus, loquat and orange producers in Turkey.

Furthermore, Muğla's 982,601 beehives account for about 15 percent of Turkey's beehives. In 2016, Muğla produced around 15,875 tons of honey. There are approximately 4,900 beekeepers registered with the Muğla Beekeepers Association (MAYBİR). Around 30,000-35,000 people, including beekeepers' family members and people from subsectors, earn their living from honey. (GEKA, 2017).

Muğla's 1,479 km coastline accounts for about one-seventh of Turkey's total coastal area. Summer tourism in Muğla is important to Turkey's economy and has great potential for further development.

Muğla accounts for 65 percent of Turkey's fisheries production and 2.05 percent of Muğla residents (about 19,000 people) depend on aquaculture for their income.

According to calculations using Turkish Statistical Institute data regarding the number of people entering and leaving Muğla and average expenditure per person, Muğla's tourism income contributed around 1.3 billion USD to Turkish economy. This figure reflects domestic and foreign tourists arriving by air or sea and does not include land travel. With its sheltered coves, green landscapes and historical and cultural heritage, Muğla has great potential for yacht tourism and ecotourism.

**Muğla's 982,601 beehives account for 15 percent of Turkey's total beehives. Muğla produced about 15,875 tons of honey in 2016. Muğla Beekeepers Association (MAYBİR) has 4,900 registered members.**



# JUST TRANSITION INTO A LOW-CARBON FUTURE

Recent NASA studies reveal that the solar energy potential of some of the leading European solar energy power plants- which are located to the north of Turkey- is comparable to some regions of Spain, Italy and Greece. However, compared to other European countries Turkey uses only a very small part of this solar potential.

Muğla is located in one of the regions with the highest solar energy potential in Europe; Turkey's southwest coast's daily solar radiation is 7 kilowatt per hour per square meter (kWh/m<sup>2</sup>), only comparable to Cadiz, the solar power plant region in Southwest Spain. Furthermore, residents in Muğla and the southwestern coastline began to use solar water heating a long time ago to save on bills.

On the other hand, the local coal is low-quality lignite with high dust and sulfur content. Extracting and burning this limited and dirty resource is labor-intensive, expensive and brings about high costs.

Moving away from fossil fuel-fired power generation—and particularly coal-fired power generation and transitioning to a low-carbon economy is a matter of great importance to the world and to Muğla. This transition is not an option, but rather an urgent necessity; on local scale to end social inequities, to prevent permanent environmental damage and restore damages, and on global scale to prevent irreversible climate change and ensure that the planet remains habitable for human beings. However, moving away from fossil fuel resources requires planning a just and equitable transition process for the workers and their families who depend on coal-fired power generation and on subsidiary industries for their income, as well as for the local residents who are affected by the social injustice brought about by coal. It is of great importance that the transition is planned to ensure not only economic but also social justice, and includes policies that focus on structural changes.

The 2018 Intergovernmental Panel on Climate Change (IPCC) 1.5°C Special Report revealed that coal is the first fossil fuel we need to abandon to limit global warming to 1.5°C. Global decision makers, municipalities, consumers and companies began to take action. On the other hand,

labor unions, international workers' organizations and mining communities, who support transition to a low-carbon economy, began to consider the impacts that this transition will have on their jobs and to voice out their concerns. Some progressive countries who are redesigning their climate and energy policies for a zero-carbon future in line with the Paris Agreement emphasized the necessity to include social and economic equity. The necessity to tackle climate change impacts and to ensure a just transition to a low-carbon future "without leaving anyone behind" came forth during and after the Paris agreement. The concept of "Just Transition" was inserted in the Paris Agreement in line with the calls of the International Trade Union Confederation (ITUC) and its members with the phrase "Taking into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities."



Turkey Solar Potential Atlas, Ministry of Forestry and Water Affairs

*If Turkey revises its climate and energy policies to meet the "100 percent renewable energy by 2050" target in line with limiting global warming to no more than 2°C and perhaps even 1.5°C, it can decrease its fossil fuel dependency by at least 54 Mtoe/year by 2030, thereby saving 23 million USD/year, preventing 35,000 premature deaths and creating 64,000 new jobs in the renewable energy sector. (CAN Europe, New Climate Institute, 2016).*



**While employment in the renewable energy sector in the European Union alone reached 1.5 million in 2017, global renewable energy employment increased by 5.3%, compared to the previous year, and reached 10.3 million worldwide. The social, environmental and economic benefits of the transition to renewable energy are most evident in countries that have implemented policies that support the renewable energy sector (IRENA, 2018).**

A low-carbon future is technically and economically feasible and brings about significant benefits for sustainable development. Unlike a carbon-intensive pathway that brings about high economic, social and ecological costs, a renewable energy -centered development pathway and its low-carbon generation models can provide many benefits such as independence in energy supply, reduction of health costs, and high-quality green job opportunities. A 2016 study reveals that policies in line with the Paris Agreement target of limiting global temperature increase to 1.5°C above pre-industrial levels may not only save lives, but also increase global gross national product by 10 percent by 2050. According to this study published by Climate Vulnerable Forum and Climate Analytics, the development scenarios in line with the 1.5°C target will:

- Ensure food security by limiting the irreversible impacts of climate change;
- Significantly reduce the economic costs of air pollution by reducing emissions;
- If quickly implemented, cause rapid drops in the market prices of renewable energy and energy efficiency technologies, thereby accelerating the transition process;
- Enable the allocation of incentives and capital -which are provided to destructive high-carbon technologies- to citizen-centered energy systems or climate change adaptation;
- Prevent countries with diminishing or no fossil fuel resources from being dependent on countries rich in oil, natural gas and coal, by improving energy independence;
- Reduce current budget deficits.

Trade union confederations, international labor organization and national trade unions state that the right policies can prevent endangering the future of coal workers and their families. Furthermore, using the opportunities offered by this transition can increase the welfare and quality of life of working families.

A study conducted specifically for Southeast Europe reveals that the coal sector exaggerates the employment opportunities that planned coal projects will offer, and makes empty promises to local residents, thus delaying the low-carbon just transition. The study shows that the employment figures associated with nearly all the newly planned coal projects in the region were exaggerated and that the size of the existing coal workforce was actually declining (Bankwatch, 2018).

If governments do not spend as much effort and money on the planning and implementation of a just transition as they spend on protecting the coal sector, they will not be able to prevent workforce loss and they will leave behind families who are forced to work in the coal sector.

According to a 2018 study, the one-year total cost of the Eskişehir Alpu coal-fired power plant power purchase agreement is about 2 billion TL. The report reveals that the power purchase agreement provided to a coal-fired power plant is equivalent to the monthly living cost of 1,143,275 undernourished families, the cost of an 11,700-bed hospital, and 257 elementary schools. The same report indicates that the cost of a power purchase agreement awarded to a single coal-fired power plant can increase Turkey's current solar energy capacity by 2.15 (Greenpeace, 2018).



# CONCLUSION AND RECOMMENDATIONS

The coal that is extracted and burned in the Muğla region is a low-quality lignite with a high content of dust and sulphur. The extraction and burning of this lignite, and the disposal of the combustion ash and waste that result from this process, come with a serious cost for both people and the environment. However, outside of the coal sector, Muğla has many opportunities for a different kind of economic growth that would offer a higher quality of life, giving it great potential for high-value-added regional development. If policies to break Turkey's dependence on coal were to be implemented, Muğla would be well-suited for a social transformation, and just transition, that would enable non-coal employment and development. According to the analysis of current official data carried out in the preparation of this report, Muğla's agricultural production, aquaculture and tourism are among the priority sectors in the short term. Renewable energy, organic agriculture, ecologic tourism and medical and aromatic plant production are all sectors with as yet undeveloped potential for growth.

Muğla's coal-fired power plants are at a turning point. In addition to their heavy ecological and social costs, including their contributions to the global climate crisis, they are near retirement age and cannot function properly without government subsidies that burden the economy. Moving away from extracting and burning coal, and transitioning to a low-carbon development model would have noticeable benefits on the local, regional, national and international level. It is possible for Turkey to immediately abandon its plans to build dozens of additional coal-fired power plants, and to shut down its operational facilities in a planned fashion, starting with the oldest plants. Though the ecological and social damage that has been done by coal cannot be fully remedied, further damage can be avoided by transitioning to a real sustainable development model based on the region's broader potential and taking into account the community's preferences and the local way of life. Successful planning for a post-coal future requires prioritizing the following steps:

- Presenting regional and national plans that will enable transition in energy production from coal to sustainable, citizen-centered renewable energy resources;
- Ensuring this transition to be equitable for all communities: The approximately 5,000 existing coal workers, and their families, in Aydın, Denizli and Muğla must be rehabilitated, retrained, and provisions made to meet the needs of their families.
- Sharing the true extent of the pollution that has been accumulating in the region for the past 40 years (the total pollution load) with the public, starting from health experts and local communities;
- Continuous monitoring of the environmental performance indicators of existing coal mines and coal-fired power plants, by the supervising state institutions, ensuring that these facilities abide by all regulations until they are closed down; and making sure the monitoring reports are publicly accessible -as it is defined by law;
- Promoting public-health monitoring studies in this region, which has been significantly impacted by industrial pollution;
- Incorporating coal transportation facilities, power-plant waste facilities, and other facilities related to the coal infrastructure, in the Environmental Impact Assessment (EIA) processes for Muğla's coal mines and coal-fired power plants -adopting a holistic approach;
- Immediately ending further expansion of new coal mines, in the designated license areas;
- Planning a gradual closure of Yatağan, Yeniköy and Kemerköy power plants at their retirement age, and a transformation of the coal regions with their inhabitants, instead of costly renovation investments;
- Shifting the public budget, allocated for coal exploration and production subsidies, to citizen-centered renewable energy projects and adaptation to climate change impacts in the region.

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### **Contact Us**

#### **CAN Europe Headquarters**

Mundo B  
Rue d'Edimbourg 26  
1050, Brussels  
Belgium

**Tel: +32 (0) 28944670**  
[info@caneurope.org](mailto:info@caneurope.org)