Frequently Asked Questions:
Chronic Coal Pollution Turkey

1. ABOUT THE REPORT

Q: Why is coal power generation a health concern in Turkey and other countries?

A: Coal combustion, the burning of coal for electricity generation, emits tons of hazardous air pollutants as well as CO2. Coal power generation therefore contributes to poor air quality, and fuels climate change, both of which in turn threatens our health.

The body of evidence on how air pollution harms health keeps on growing, and more and more researchers now discuss the need to move towards zero pollution.

In addition, in Turkey and elsewhere the detrimental effects of climate change are increasingly being felt, and the need to limit fossil fuel consumption, including in the energy sector, is evident.

Q: Why have you published this report now?

A: Health professionals in Turkey have long been concerned about the health impacts from coal power generation. Already in 2014, the Turkish Medical Association issued a call for a coal phase out. In 2015, HEAL published the first ever assessment on the health cost of coal power generation[1]. Since then, more coal power plants have been built and the government has plans for a significant increase in coal capacity, with 30 new coal plants in the pipeline (more than doubling the 19 gigawatt (GW) fleet at the end of 2019).
This is contrary to the direction the European Union has taken, where coal power is playing an increasingly diminished role in the electricity market, which is reinforced by political decisions on phase outs across the region, and the implementation of the Paris Climate Agreement.

[1] HEAL. (2015). Ödenmeyen Sağlık Faturası. https://www.env-health.org/IMG/pdf/heal_report_the_unpaid_health_bill_how_coal_power_plants_make_us_sick_final.pdf

Q: Why do you call the report Chronic coal pollution?

A: The title has two meanings: first, it refers to the decades coal power plants are in operation, which is on average 40 years. Building new coal power plants in Turkey would mean locking in health-harming emissions for decades (even with the best filter technology).

Second, many of the health effects of coal power generation are chronic, long-term impacts, on people's respiratory and cardiovascular systems. Children that breathe in harmful air pollutants can experience the consequences only much later in life.

Q: What is the current share of coal in electricity generation in Turkey?

A: As of the end of 2019, 56% of Turkey's annual electricity was generated by burning fossil fuels, and coal accounted for 37%.Over the last three years, the share of lignite coal, which is a domestic resource, has increased as a result of Turkey's energy policy. As of December 2020, Turkey had 29 large coal power plants that have a total installed capacity of 19,122 Megawatt (MW) or 19,12 Gigawatt (GW).

Q: How did you choose the pollution hotspots presented in the report?

A: The areas selected - Çanakkale, Adana and Hatay, Eskişehir and Muğla - are areas where there has been great concern about pollution (from existing coal plants or industrial activities) or areas where there has been high health and local engagement to prevent new coal power plants.

For example, Çanakkale is the region with the highest planned increase in coal capacity, with five new plants in the pipeline, threatening to lock Turkey into highly polluting activities for decades. Adana and Hatay are located in Iskenderun Bay, where people's health has been threatened from industrial pollution for decades. But other areas with high pollution still exist.

For further details see:
https://www.env-health.org/wp-content/uploads/2018/06/toolkit_turkey_coal_power_plants_health_izmir_canakkale_tekirdag.pdf
https://www.env-health.org/wp-content/uploads/2018/06/heal_toolkit_iskenderun_bay.pdf

Q: According to the Lancet Countdown, climate change is considered the greatest health challenge of the 21st century. What is the Turkish government doing to tackle this health threat?

A: In 2015, the Paris Climate Agreement was adopted, which aims to limit global warming to well below 2 degrees C, preferably to 1.5 degrees C, compared to pre-industrial levels.

Unfortunately, Turkey is now one of only 7 remaining parties, out of 197, that have not ratified the Agreement. The government has also set insufficient goals to cut CO2 emissions for 2030.

2. HEALTH IMPACTS FROM COAL POWER GENERATION AND AIR POLLUTION

Q: Why is air pollution a problem for health?

A: According to the World Health Organization (WHO), air pollution is the largest environmental threat to people's health across the globe, in Europe and also in Turkey. Worldwide, air pollution, both ambient (outdoor) and indoor, leads to 7 million premature deaths each year. Drawing on the results of a large number of epidemiological evidence from the peer reviewed literature, the WHO says that no level of air pollution can be considered 'safe', and the link between air pollution and respiratory and cardiovascular diseases is well established.

Breathing in particulate matter (emitted when burning fossil fuels in transport or energy production), even at low levels, can lead to physiological changes in the body that damage health. Poor air quality is also linked to chronic and acute respiratory diseases, which significantly degrades quality of life, such as bronchitis and the aggravation of asthma. Scientists continue to identify new ways that air pollution can harm our health. For example, there is increasing evidence linking air pollution to dementia and new evidence has shown that particles of air pollution travel through the lungs of pregnant women and lodge in their placentas, harming babies before they are born.

Q: Which groups are particularly vulnerable to air pollution?

A: While everyone is affected by air pollution, some groups are more at risk than others. This includes pregnant women and children, those already ill, the elderly or those suffering from disease, for example asthma or heart disease. For children, air pollution is a particular concern as their bodies are still developing. Exposure to air pollutants may increase their risk to develop disease much later in life.

The report quantifies many of the health impacts associated with air pollution, for example hospital admissions, work days lost due to illness, new cases of chronic bronchitis in children and adults and even premature deaths.

For some health impacts it is not possible to quantify them, for example the risk of a child to develop a disease in adulthood as a consequence of harm in early years[2]. The quantifications in this report can be considered biased with a greater focus on impacts on the elderly, via mortality, hospital admissions and COPD.

[2] Royal College of Physicians. (2016). Every breath we take: the lifelong impact of air pollution. Report of a working party. London: RCP, https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

That means that the impacts and cost presented in this report can therefore be considered an underestimation.

Q: How are people exposed to mercury from coal power plants?

A: Coal power plants are the second largest source of mercury emissions globally.

The health costs of total mercury exposure in Europe have recently been estimated at over 9 billion EUR per year. Mercury is mainly released in gaseous form because it is not captured by the standard filters, and it is later deposited by precipitation. Thus the mercury enters the water cycle, where it is taken up by bacteria and algae and travels up the food chain. Thereby the concentration of mercury increases, it is highest in long-living fish species. The main exposure of Europeans to mercury in its neurologically damaging form methylmercury is happening through fish consumption. Exposure to contaminated fish is especially worrying for pregnant women and small children, as the developing brain of children can be damaged by methylmercury, leading to impaired cognitive development. Mercury from coal power plants can thus contaminate fish in regions where no coal is being burned, because mercury can be transported very far by air and water.

The report estimates that coal power generation in Turkey in 2019 led to 352 premature deaths and 8,850 IQ points loss.

Q: What are the health impacts considered in this report?

A: The report is based on the methodology of the World Health Organization (as detailed in: Health risks of air pollution in Europe – HRAPIE project, published in 2013), with the addition of a 2016 study of Trasande et al[3] and a 2016 study of Nedellec et al[4], to include further health impacts.

Health impacts considered are:

- Premature death in adults (short and long-term mortality)
- Death of children of up to 1 year
- Preterm birth
- Bronchitis in children
- Days with asthmatic and bronchitis symptoms in asthmatic children
- New cases of chronic bronchitis in adults

---

[3] Trasande, L. Malecha, P. Attina, T.M. (2016). Particulate Matter Exposure and Preterm Birth: Estimates of U.S. Attributable Burden and Economic Costs. Environmental Health Perspectives 124:12. https://doi.org/10.1289/ehp.1510810

[4] Nedellec, V. and Rabl, A. (2016). Costs of Health Damage from Atmospheric Emissions of Toxic Metals: Part 2-Analysis for Mercury and Lead. Risk Analysis. 36(11):2096-2104. https://dx.doi.org/10.1111/risa.12598.

- Hospital admissions for respiratory and cardiovascular reasons,
- Work days lost: days lost due to illness for the population of working age(20-65 years),
- Sickness days for the non-working population
- Neurological damage (lost IQ points) from mercury exposure

Q: What are the sources for the data on emissions used in this report?

A: Air pollutant and greenhouse gas emissions from large combustion plants in Turkey, including coal power plants, are not shared with the public at utility level. Regarding this lack of transparency, emissions at plant level are calculated in this report.
The emissions used for the health impact and cost calculations of the coal plants operating in were retrieved through research from several open sources including data from previous EU twinning projects, operators' reports, websites and presentations, and official requests for plant specific information from Directorates of the Ministry of Environment and Urbanisation at city levels.

A large dataset was thus generated, with information on calorie, moisture, dust and sulfur content of the coal used, electricity generation for 2019, boiler type, filtrations for dust and removal technologies for SOx and NOx (for 2019) as well as stack dimensions which defines the distribution of the pollutant.

Q: How is it possible to quantify health impacts from coal plants and put a price tag to them?

A: The methodology used in this report can be summarised in four steps.

1. Identify the emission from coal power plants operating in Turkey in 2019.
2. Model the pollutant exposure resulting from the stack emissions.
3. Calculate the health impacts associated with modelled pollutant exposure.
4. Calculate the cost of the modelled health impacts.

Once the emission data was calculated, the European Monitoring Programme Meteorological Synthesizing Centre - West (EMEP MSC-W) was used for atmospheric modelling to be able to consider the pollution dispersion and background emissions. 2020 update of EMEP WSC-W is used where data is based on CLRTAP reporting of each country, including Turkey.

Q: Why is this report an underestimation of the true health impacts and cost?

A: The report is likely to be an underestimate for the following reasons:

- We assume that the filtration systems installed in the plants are operated regularly to meet emission limits of the relevant Turkish laws, but regularity is not proven. We also

assumed a 95% efficiency for DeSOx, and 99% efficiency for DeNOx filters, when experience has shown that efficiency drops with age and use. For plants installed after 2010 we assume that the pollutant concentrations in flue gas meet the national regulation, while this is not proven.

- Recent health studies and impacts linked to air pollution are not considered. This report is based on the 2013 WHO HRAPIE methodology. Since then, new studies have been published that show higher health impacts both for premature death[5] as well as for disease impacts (morbidity).[6] [7] For NO2, new evidence is also available pointing to a greater health damage.[8]
- This report also does not consider further health impacts, such as dementia or obesity, for which some studies show a link to air pollution.
- Exposure to air pollution in utero or early years can increase the risk of falling ill much later in life. However there is currently no methodology to quantify the health impacts or costs from air pollution over a lifetime.

Q: What is the difference between "health effects and cost in Turkey and the region" and "health effects and cost in Turkey only"?

A: Air pollution knows no borders and everyone is at risk from its health-harm.

The results of atmospheric modelling show that air pollution from coal power plants in Turkey can disperse thousands of kilometres and reach overseas. This is also the case for coal power plants in other countries.

With a view to an informed policy debate on the costs of coal power generation, we then distinguished between health costs and impacts in Turkey itself, and then in other regions.

---

[5] Jie Chen, Gerard Hoek. (2020). Long-term exposure to PM and all-cause and cause-specific mortality: A systematic review and meta-analysis. Environment International.
Volume 143, ISSN 0160-4120, https://doi.org/10.1016/j.envint.2020.105974.

[6] European Commission Directorate General Environment. (2021, January). Support to the development of the second Clean Air Outlook- Annex. Page 44. Figure 1.9.
https://ec.europa.eu/environment/air/pdf/CAO2-ANNEX-final-21Dec20.pdf

[7] European Commission Directorate General Environment. (2021, January). Support to the development of the second Clean Air Outlook- Annex. Page 46. Figure 1.10.
https://ec.europa.eu/environment/air/pdf/CAO2-ANNEX-final-21Dec20.pdf

[8] Huangfu, P. & Atkinson, R.(2020). Long-term exposure to NO2 and O3 and all-cause and respiratory mortality: A systematic review and meta-analysis. Environment International, https://doi.org/10.1016/j.envint.2020.105998.

Due to methodological limitations, the effects of mercury (premature deaths, IQ point loss) can not be limited to Turkey's border, thus the health results and cost for Turkey excludes these health effects, which is another underestimation.

3. HEALTH COSTS

Q: What do the cost figures in the report include?

A: The report aims to do a comprehensive calculation of the costs from coal power pollution in Turkey, based on methodology from the World Health Organization.

Monetizations for the following health impacts are included:

- Premature death in adults (short and long-term mortality)
- Death of children of up to 1 year
- Preterm birth
- Bronchitis in children
- Days with asthmatic and bronchitis symptoms in asthmatic children
- New cases of chronic bronchitis in adults
- Hospital admissions for respiratory and cardiovascular reasons,
- Days with asthmatic and bronchitis symptoms in asthmatic children
- Work days lost: days lost due to illness for the population of working age (20-65 years),
- Sickness days for the non-working population)
- Neurological damage (lost IQ points) from mercury exposure

Q: How does the adjustment of the prices work?

A: The steps in adjustment were as follows: the initial valuations for the health impacts are based on the European Environment Agency's 2014 report[9] which estimates a valuation for the given health effects (except for preterm births which is based on another research).
Then, these values were converted into 2019 prices by using EU inflation rates.
These updated 2019 valuations were then adjusted for different levels of gross domestic product (GDP) per capita and costs by using purchase power parity (PPP) and GDP levels of each affected country, in order to reflect the difference in economical status of countries.
If this adjustment had not been included, the health costs calculated would only be based on a currency conversion and thus be too high.

[9] European Environment Agency (EEA). (2014). Costs of air pollution from European industrial facilities 2008–2012 — an updated assessment. EEA Technical report No 20/2014. https://www.eea.europa.eu/publications/costs-of-air-pollution-2008-2012

Q: Are your cost numbers an overestimate or an underestimate?

A: Given that the health impacts are already an underestimate (see above), the report is likely an underestimate of the cost. In addition, there has been no update of the valuation given in the EEA's 2014 report.

Q: Does the report calculate the health costs from climate change?

A: No, the estimate that air pollution from coal power plants in Turkey caused health damage of 47.41 - 99.37 billion Turkish Lira (5.20 - 10.90 billion EUR) in 2019 does not include any health damage related to greenhouse gas emissions and climate change, it focuses on the following air pollutants: particulate matter, sulphur dioxide, nitrous oxides, and mercury.

4. EMISSIONS AND EMISSION CONTROL TECHNOLOGIES

Q: Is the data on emissions used for the calculations retrieved from plant operators or relevant Turkish ministries?

A: The report is a major endeavour to fill data gaps on emissions of existing coal plants. While EU member states are legally required to report emissions at plant level to a publicly accessible database (E-PRTR), Turkey does not share power plant or sectoral emission data. Instead, it reports merged data for electricity generation and the heating sector, under international commitments.

This makes it challenging to pinpoint emissions coming only from coal powered energy sources, or even from the electricity sector as a whole. Furthermore, there is a lack of studies and data about the effects of air pollution on health in Turkey.

To overcome data limitations, this report is based on extensive research and collaboration. The technical details of the coal plants which influence air pollution levels were studied, alongside real time electricity generation. Filtration systems, which can reduce but not eliminate pollution, were also studied.

Q: Are coal plant operators legally required to have pollution filters installed? Don't filters solve the air pollution problem?
A: Even the best filtration systems are not a solution to chronic air pollution since they can only limit air pollutants emitted from stacks to a certain point, and there are concerns around the efficiency of old filters. Filters also do not prevent the release of CO2, meaning that they do not reduce coal power's role in driving climate change.

Q: In 2020, some coal power plants have invested in (new) filtration systems. Isn't this an improvement and does this not mean your numbers on health impacts and costs are outdated?

A: It is important to note that the coal power plants in question have been operating without any filtration systems for years. However, air pollution control systems on their own are not enough, the extent of the pollution depends on several factors, including the coal quality, to the dispersion from the stacks.