

The Suffocating Grip Of Coal

Report on the effects of coal burning on human health



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GREENPEACE

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Summary and key messages

Air pollution is a key cause of a number of diseases in Europe and Bulgaria. This report of Greenpeace Bulgaria on the impact of coal burning on human health demonstrates the close link between human health and the energy policy and strategy of Bulgaria.

Reliance on coal and new nuclear capacities on the part of the Bulgarian government is ill-advised from both economically and environmentally wise. Most importantly, it implies an unacceptably high price, measured in human health and human lives. As a result, thermal power plants benefit at the cost of human life and health.

Key messages

Air pollution with sulphur dioxide and particulate matter (PM) per generated kilowatt-hour (kWh) of electricity in thermal power plants (TPP) in Bulgaria is one of the highest in Europe.

Most TPP in Bulgaria have installed filters for capturing of sulphur dioxide and nitrogen oxides. Even so, as estimated by Greenpeace Bulgaria, air pollution from TPP in Bulgaria in 2012 alone has lead to:



2000

premature deaths – four times the death toll of road accidents in Bulgaria in the same year



These facts, as well as the current economic crisis, require a comprehensive restructuring of the production of electricity in Bulgaria. In particular, they require reduced use of fossil fuels, increased measures for energy efficiency and increased share of alternative energy sources.

approximately 2000 sick leave days



2600 cases of respiratory disease in children and over **3000** cases for adults per day and restricted working ability for **3700** adults per day



¹ HEAL (2013). The Unpaid Health Bill – How coal power plants make us sick. <http://www.env-health.org/resources/projects/unpaid-health-bill>. ² Greenpeace (2013). Silent Killers – Why Europe must replace coal power with green energy. <http://www.greenpeace.org/slovenia/Global/international/publications/climate/2013/Silent-Killers.pdf>.

Coal-fired electricity generation: (no) prospects

From an economic perspective

While the market cost of electricity from coal seems relatively low, it does not account for environmental damages (contaminated water and farmland) and the damages done to human health. We are, however, all paying this price.

According to the Directive on industrial emissions, electricity generation from coal is subject to quotas for the emission of sulphur dioxide, nitrogen oxides and particulate matter (PM). In the period 2008 – 2011 Bulgaria permanently exceeded the quotas for PM and nitrogen oxides. A potential penalty by the European Commission would substantially raise the cost of coal-fired electricity generation.

From an ecological perspective

Coal burning is one of the main causes of climate change. In 2010, 43% of all global carbon dioxide (CO₂) emissions were associated with the use of coal; the trend is for this share to increase. In addition to causing climate change, coal mining and burning take up thousands of acres of farmland and pollute millions m³ of water.

From a social perspective

The coal industry positions its workers in an artificially produced conflict between serving their material needs and the desire for good health and clean environment. The conflict between communities who bear the brunt of pollution and the people who earn their living by working at TPPs is often muted.

Coal burning is not a deal for one more reason: **the damage done to human health.**

When we talk about air pollution, we often picture the old industrial days, chimneys with black smoke and smog that permeates the entire city. Contrary to this, the most common air pollutants are quite invisible. They are microscopic particles, which enter deep into our lungs and blood, causing inflammation, respiratory problems, blood coagulation, toxic effects in many internal organs, lung cancer and increase the risk of ischemic stroke.

This report considers primarily the health risks associated with coal burning. While the report does not consider nuclear energy and related problems, **we consider nuclear power production as equally outdated and irresponsible from economic, social, health and environmental perspective.**^{5,6}

While the focus of this publication is on coal burning, the effects of coal-fired electricity generation go beyond this. The entire process of coal mining, transport, handling and storage – from burning to disposal and reclamation – has a direct impact on the environment, human health and communities living in (immediate) proximity to mines. It has a significant impact on ecosystems and waters and it generates greenhouse gases, including methane. Furthermore, coal mining and burning require enormous amounts of water, which makes coal the most water-consuming source of electricity.



³ Directive 2010/75/EU of the European Parliament and of the Council of 24 Nov 2010 on industrial emissions. <http://ec.europa.eu/environment/air/pollutants/stationary/ied/legislation.htm>. ⁴ IAE (2012). CO₂ Emissions from Fuel Combustion. Highlights. <http://www.iea.org/publications/freepublications/publication/CO2emissionfromfuelcombustionHIGHLIGHTS.pdf>.

⁵ EJOLT Report No 14 (2013): Expanded Nuclear Power Capacity, Impact of Uranium Mining and Alternatives. ⁶ Greenpeace, "End the nuclear age." <http://www.greenpeace.org/international/en/campaigns/nuclear>.

Coal-fired power plants in Bulgaria

Before we discuss the health risks of coal-fired electricity generation in Bulgaria, let us review the energy sector in Bulgaria and the largest thermal power plants.

43% of Bulgaria's electricity is produced from coal (Figure 1). Nearly 40% of this falls on Maritsa East 2.

TPP Maritsa East 2 is located near the town of Radnevo over nearly 512 ha. The plant is state-owned (Bulgarian Energy Holding – BEH JSC). It has 1587 MW installed capacity and is the largest TPP on the Balkan Peninsula. It works on lignite coal obtained locally in the mines of Maritsa East Mines JSC. According to the Ministry of Economy and Energy (MEE), its eight generating units have filters for capturing sulphur oxides with efficiency above 94%, extending the lifetime of the equipment with 25 years.⁸

TPP Varna, has an installed capacity of 1260 MW and is the second largest TPP on the Balkan Peninsula. The plant works on highly calorific anthracite coal supplied entirely by import at a special port. The plant has six mono-blocks of 210 MW installed capacity each. TPP Varna JSC is 100% owned by CEZ (Czech Republic). Its regulated market quota equals approximately one month of operation at full capacity, which effectively means that the plant serves primarily as cold reserve.⁹

TPP ContourGlobal Operations Bulgaria – the former **Maritsa East 3** – has an 908 MW of installed capacity. It is located near the town of Galabovo. Since 2011 it is jointly owned by the ContourGlobal (USA) and the National Electric Company (NEC). The plant works on lignite coal extracted at Maritsa East Mines. The plant has been modernised and according to data from its owners, it is an “ecological leader” in the region.¹⁰

⁸ TPP Maritsa East 2 company website. <http://www.tpp2.com>.

⁹ TPP Varna EAD company website. <http://www.cez.bg/bg/za-nas/kompaniite-v-balgariya/tets-varna.html>.

¹⁰ ContourGlobal company website – Maritsa East 3. <http://www.contourglobal.com/portfolio/?id=17>.

Thermal power plants in Bulgaria: overview

TPP AES Maritsa East 1 is newly constructed (2006–2011) and has a 670 MW installed capacity. The plant is owned by AES (USA). Similarly to TPP ContourGlobal, TPP AES Maritsa East 1 is located near the town of Galabovo and uses lignite extracted from the Maritsa basin. According to the company website, the plant is equipped with the most modern filters and technologies for treatment of fine particles.¹¹

Brikel JSC is the fourth TPP in the Maritsa East energy complex. It is owned by the Bulgarian businessman Hristo Kovachki. With a total output of 200 MW, it brings together the oldest power plant in the region – TPP Maritsa East 1 – with the Briquette Factory. The plant is located at about 5 km from the town of Galabovo and it is powered by lignite coal. The plant exhausted its quota of operational hours in 2010 but continues to operate. It has sulphur and nitrogen oxide filters of dubious effectiveness. When the license of Brikel JSC expired in 2011, the Ministry of Economy and Energy expanded it for another 10 years. The latest comprehensive pollution permit of the plant from the Ministry of Environment and Water is as of April 2013.¹²

TPP Maritsa 3 is located in the eastern industrial zone of Dimitrovgrad and has 120 MW installed capacity. It works on lignite coal from the mines of Maritsa Basin JSC. Together with Maritsa East 2 JSC, TPP Maritsa 3 is a state-owned subsidiary of BEH EAD.¹³

TPP Bobov Dol is located near the village Golyamo Selo, Kyustendil District. It has 630 MW installed capacity and works on brown coal extracted from the mines Bobov Dol. The electricity generation licence of the plant expires in 2021, and only one of the generating units was operational in 2013, according to reports in the popular press.¹⁴

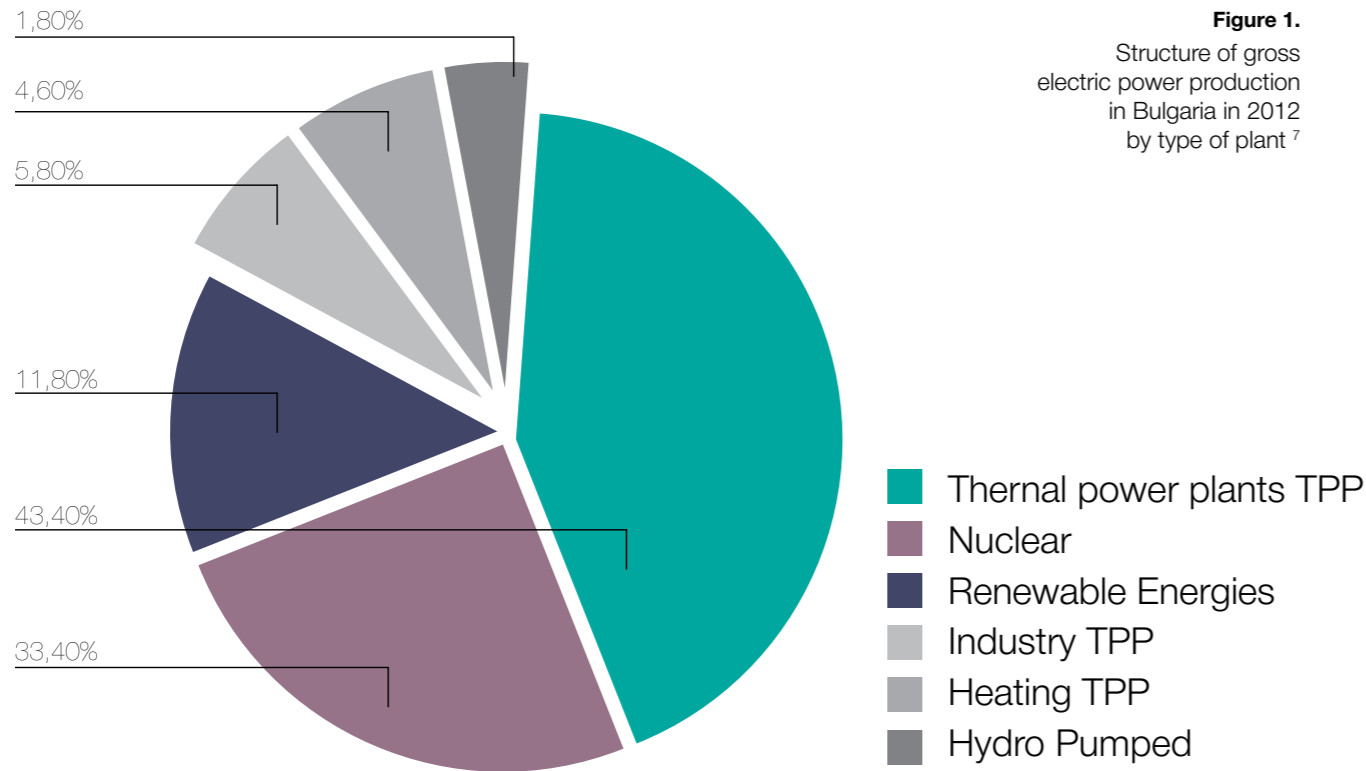
TPP Rousse has an installed capacity of 400 MW. In 2013 Toplofikacia Rousse JCS was acquired by Toplofikacia Pleven JSC – owned by Hristo Kovachki. The plant works on imported anthracite coal.¹⁵

¹¹ AES company website. <http://www-origin.aes.com/Business/Generation.aspx> ¹² Energoproekt AD company website. <http://www.energoproekt.bg>. ¹³ TPP Maritsa 3 company website. <http://tec-marica3.com>

¹⁴ State Energy and Water Regulatory Commission – TPP licences, <http://www.dker.bg/page3bg.php?P3=40&SP3=98&OID=70>. Trud (15 June 2013), “Spryaha TEC Bobov dol” [TPP Bobov Dol was stopped], <http://www.trud.bg/Article.asp?ArticleId=2062053>.

¹⁵ Toplofikacia Rousse JSC company website. <http://www.toplo-ruse.com/about.php>.

Energy production and energy consumption in Bulgaria: plans and reality



The National strategy for development of the electricity transmission network projects a reduction of the installed capacity for coal-fired electricity generation by approximately 43% from the current 5775 MW.¹⁶ According to media statements of the Minister of Energy from July and October 2013, by 2018 Bulgaria's energy system will dispense with approximately 2500 MW of TPP capacities – including TPP Varna, TPP Bobov Dol, TPP Brickel and TPP Maritsa 3.^{17,18}

Nevertheless, this promise remains dubious, as each of the listed TPP has received licence to extend its operating hours upon installation of sulphur dioxide filters and has managed to renew its Complex Permit with

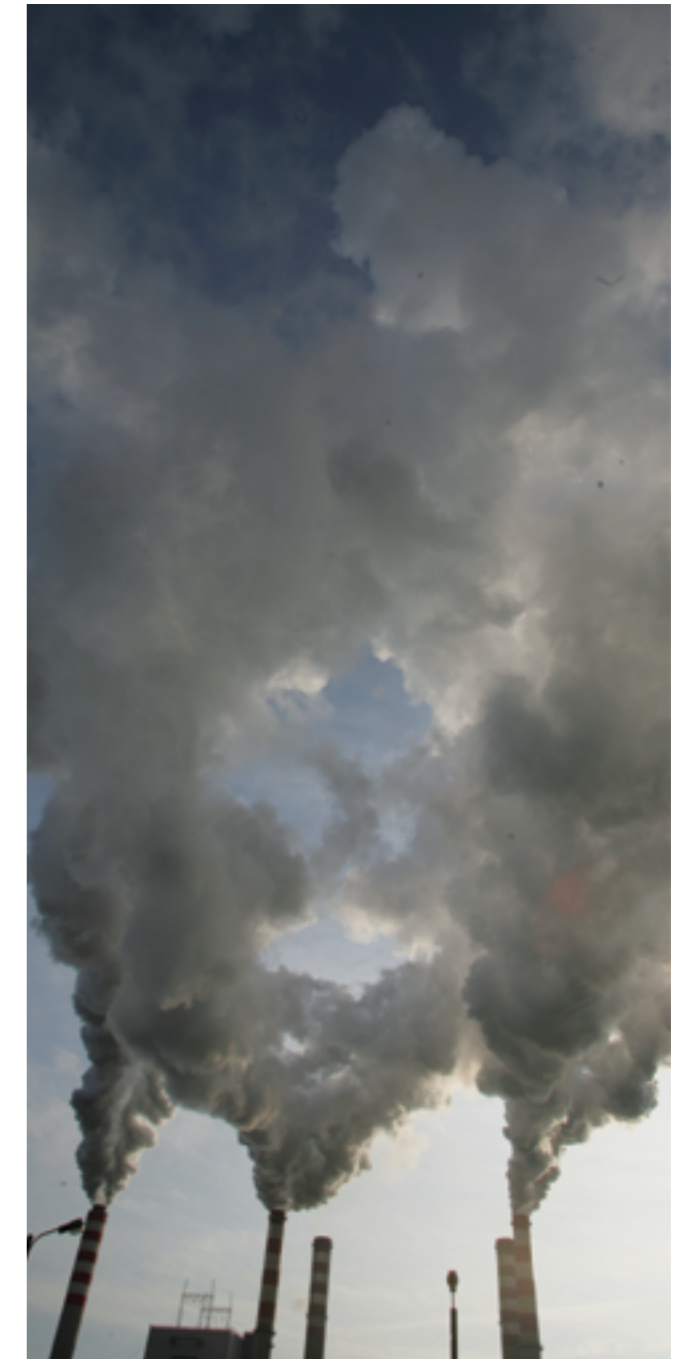
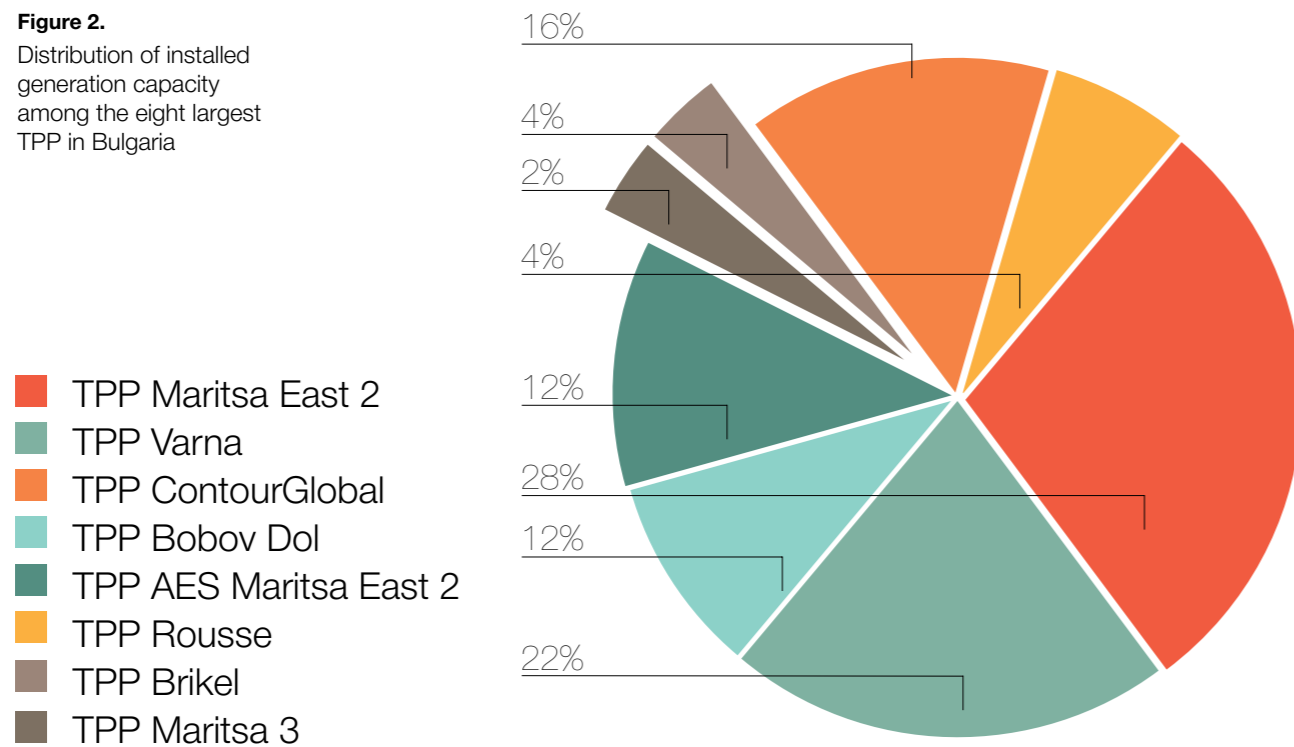


Figure 2.
Distribution of installed generation capacity among the eight largest TPP in Bulgaria



- TPP Maritsa East 2
- TPP Varna
- TPP ContourGlobal
- TPP Bobov Dol
- TPP AES Maritsa East 2
- TPP Rousse
- TPP Brikel
- TPP Maritsa 3

⁷ Ministry of Economics and Environment (2013). Byuletin za sostoyaniето i razvitiето na energetikata na Republika Bulgaria [Bulletin on the state and development of the energy sector of Bulgaria]. http://www.mi.government.bg/files/useruploads/files/epsp/buletin_energy_2012&annex.pdf

¹⁶ Ministry of Economy and Energy (2010). Plan za razvitie na prenosnata elektricheska mrezha na Bylgaria za perioda 2010 – 2020 [Plan for the development of the electricity transmission network of Bulgaria for 2010-2020]. http://tso.bg/uploads/file/bg/10_Year_Net_Dev_Plan_BG_2010-2020.pdf. ¹⁷ Monitor (11 July 2013). "Pensionirat 2500 MW ot TEC-ovete" [2500 TPP MW to be retired]. <http://www.monitor.bg/article?id=391868>. ¹⁸ Novinar (9 Oct 2013). "Zatvoryat TEC Varna" [TPP Varna is being closed]. http://novinar.bg/news/zatvariat-tetc-varna_NDQyOTs0OQ==.html

The energy strategy of Bulgaria assumes an increase in electricity consumption by 8% and 23% respectively in 2020 and 2030 compared to 2005. Nevertheless, the average annual consumption of electricity in Bulgaria has steadily declined after 2005 (Figure 3).

Figure 3.
Consumption of electricity
in Bulgaria, GWh ¹⁹



● production

Despite declining electricity consumption, the Energy strategy projects an increase in the production of electricity by 13% and 32% respectively in 2020 and 2030 as compared to 2005.²⁰ In the last few years the difference between production and consumption (and exports) has reached an entire 30% (Figure 4). In other words, production seriously outcompetes consumption.

Figure 4.
Production and consumption of electricity in
Bulgaria, GWh ²²

What is more, the energy strategy leans primarily on new nuclear and “clean” coal capacities although this technology has failed all scientific and technological tests.²¹



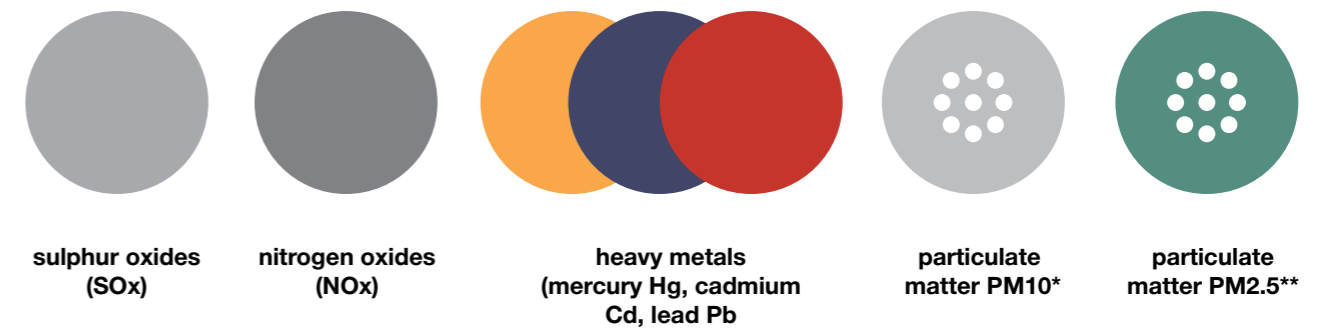
● production
● consumption

¹⁹ ENTSO-E. <https://www.entsoe.eu>
²⁰ Ministry of Economy and Energy (2011). Energiina strategiya na Republika Bulgaria do 2020. Za nadezhdna, efektivna i po-chista energetika [Energy strategy of Bulgaria till 2020. For a reliable, effective and cleaner energy sector]. http://www.mi.government.bg/files/useruploads/files/epsp/22_energy_strategy2020_.pdf.

²¹ Greenpeace (2008). False hope. Why carbon capture and storage won't save the climate. <http://www.greenpeace.org/international/Global/international/planet-2/report/2008/5/false-hope.pdf>. ²² ENTSO-E

Air pollution from coal burning in Bulgaria: myths and reality

The key pollutants emitted from coal burning of coal in TPP and homes are:



* PM10 are respirable suspended particles with $d \leq 10 \mu\text{m}$. They are rougher and released during coal burning, road traffic and various industrial processes.
 **PM2.5 are fine particles with $d \leq 2.5 \mu\text{m}$. They are smaller and generally toxic organic compounds and heavy metals.

Once emitted high in the atmosphere, sulphur and nitrogen oxides react with other substances and create new ones, such as secondary ozone.

Table 1 shows the annual levels of key pollutants emitted by all TPP in Bulgaria.

Table 1.
Emissions of sulphur dioxide, nitrogen oxides and particulate matter – all TPP in Bulgaria, 2012²³

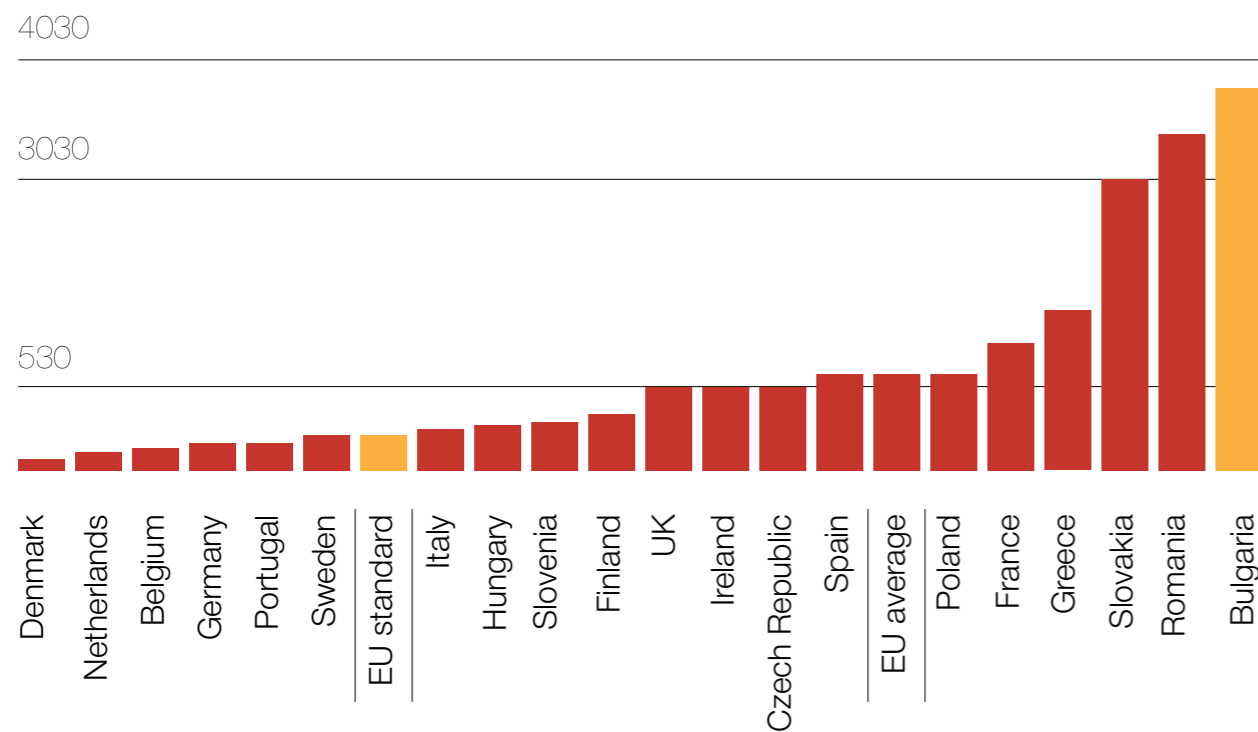
	SO2	NOx	particulate matter PM10
Emissions in 2012 (t)	238213	46394	6315

²³ Data are available through the Ministry of Environment and Water and available on the website of the European Environment Information and Observation Network. <http://www.eionet.europa.eu>

Understanding these values

In Bulgaria, air pollution with sulphur dioxide and PM10 per kWh electricity produced at thermal plants is highest in Europe (Figures 5–6).^{24,25}

Figure 5.
Emissions of sulphur dioxide per 1 kWh of TPP-produced electricity – EU countries, 2010

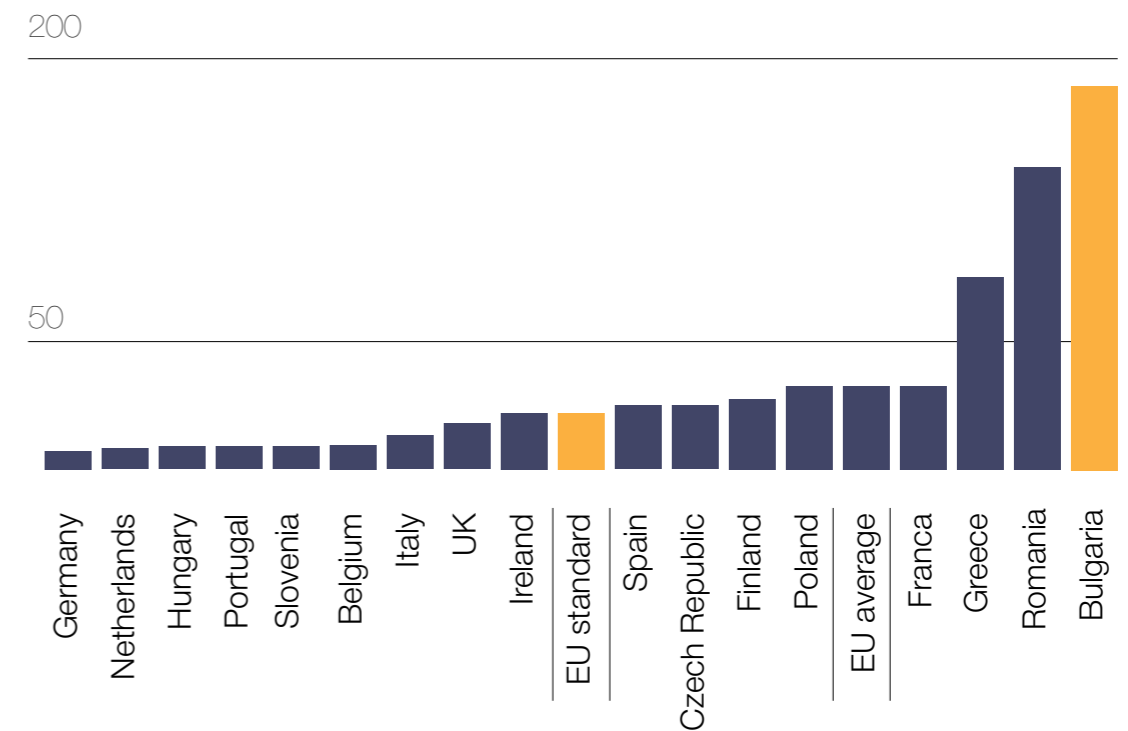


The amount of sulphur dioxide released per 1 kWh of TPP-generated electricity in Bulgaria exceeds the European (health) standard nearly 20 times (Figure 5).



Furthermore, although air pollution per kWh has been on the decrease in Europe as well as in Bulgaria, coal-based electricity production continues growing which cancels out the gains in air quality achieved.

Figure 6.
Emissions of particulate matter per 1 kWh of TPP-produced electricity – EU countries, 2010



On the other hand, the fine particle PM 10 released per 1 kWh TPP-generated electricity in Bulgaria exceed the European (health) standard nearly 10 times (Figure 6).



Even though most thermal power plants in Bulgaria have filters for sulphur dioxide:

- 84% of sulfur dioxide emissions , 39% of nitrogen oxide emissions and 19% of fine particles measured in Bulgaria come from TPP.²⁶
- Atmospheric pollution in the region of Stara Zagora region, particularly in the city of Galabovo, continued in 2013.²⁷
- Most TPP do not have equipment for capturing PM2.5 and nitrogen oxides.
- In the period 2008–2011 Bulgaria exceeded the quotas for emissions of particulate matter and nitrogen oxides set out in the Directive on large combustion plants. It is very likely that these quotas will not be met in the next period.²⁸
- TPP continue to be a major source of atmospheric emissions of arsenic and mercury.²⁹

For these reasons, air pollution continues to be a major factor for a number of diseases in Europe and Bulgaria. ^{30,31}

Settlements located near TPP are most highly affected by certain atmospheric pollutants . However, the negative effects of coal burning on human health are not limited to the areas located close to TPP. The substances released from TPP smokestacks may be transported hundreds of kilometres . How far pollution spreads depends mainly on the height of the TPPs chimneys and the direction of the wind.



Local (within 10 km radius):

fine particles (PM10), nitrogen oxides, sulfur dioxide, acid gases, heavy metals, dioxins

Trans-boundary (within 10–1000 km radius):

серен диоксид, азотни оксиди, тежки метали, диоксини, фини прахови частици (ФПЧ 2,5).

Global (beyond 1000 km radius):

fine particles (PM2.5), mercury, dioxins



Figure 7. Scale fo dispersion of air pollutants from TPP and associated effects on human health

²⁶ MOCB Ministry of Environment and Water – Executive Environment Agency (2013). Nacionalen доклад za systoqnieto i opazvaneto na okolnata sreda [National report on the state and protection of the environment]. <http://eea.government.bg/bg/soer/2011/soer-bg-2011.pdf>. ²⁷ Standart (13 Oct 2013), “Obgazyavane paralizira Galabovo” [Gassing paralyzed Galabovo]. http://www.standartnews.com/regionalni/obgazyavane_paralizira_galabovo-208926.html. ²⁸ Investor (14 Aug 2013), “MOSV predlaga izpolzvaneto na vuglishta s po-malko syara MOCB predlaga izpolzvaneto na vuglishta s po-malko syara” [MEW suggests using coal with less sulphur]. <http://www.investor.bg/ikonomika-i-politika/332/a/mosv-predlaga-izpolzvaneto-na-vyglishta-s-po-malko-siara,156011> ²⁹ EEA (see note 25). The European Pollutant Release and Transfer Register E-PRTR, <http://prtr.ec.europa.eu/FacilityLevels.aspx>.

³⁰ HEAL (2013). The unpaid health bill. How coal power plants make us sick.

³¹ HEAL estimate that air pollution in Europe is responsible for an average reduction in life expectancy of 8.6 months – or, in other words, 492 000 premature deaths every year.

Coal burning: effects on human health

Continuous exposure to air pollution considerably increases the risk of chronic diseases of the cardiovascular system and the respiratory tract, as well as the risk of cancer. Recent evidence shows that the negative effects of air pollution on human health occur at lower levels than previously thought.^{32,33}

The most common diseases associated with coal burning affect the cardiovascular, respiratory and nervous systems.

Respiratory system effects

Nitrogen and sulfur oxides, particulate matter and secondary ozone considerably increase the risk of breathing difficulty, asthma and chronic respiratory diseases. Continuous exposures to certain levels of particulate matter can lead to chronic bronchitis, emphysema and decreased lung functioning. They can also adversely affect the lung development. Children are particularly susceptible to air pollution as they breathe more air in relation to their body weight due to their immature immune systems.

Cardio-vascular system effects

There is a direct link between the level of outdoor air pollution and the levels of cardiovascular diseases, as well as deaths caused by these. The relationship is strongest with respect to fine particles (PM2.5). Even short term exposure to fine particles can cause a heart attack, symptoms of coronary heart disease, ischemic stroke, cardiac arrhythmias, as well as death. These dust particles are smaller than 2.5 µm in diameter – sufficiently small to penetrate into the tissue of the lung and enter the blood stream. A recent review of the medical literature shows that these particles can cause inflammation of cardiovascular tissue and blood coagulation. Thus, air pollution can cause arterial blockage and heart attacks.

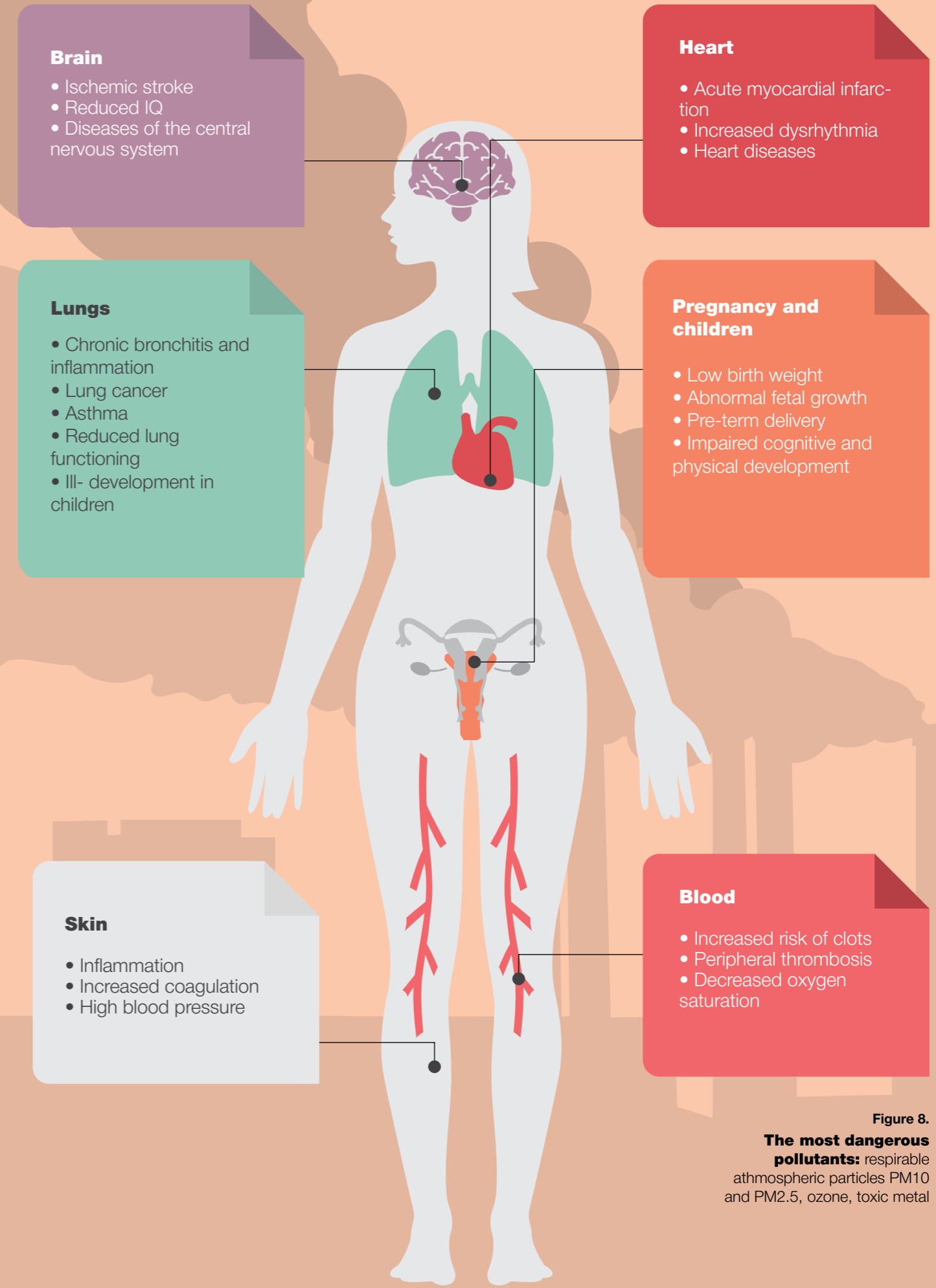
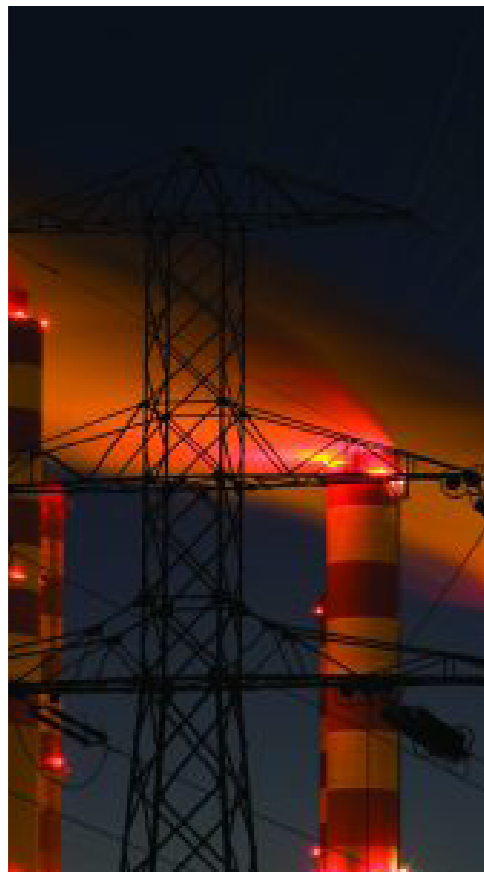


Figure 8.
The most dangerous pollutants: respirable atmospheric particles PM10 and PM2.5, ozone, toxic metal

³² Grandjean P, Weihe P, White RF, et al. (1997): Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury. *Neurotoxicology and Teratology*, 19:417–428.
³³ Bellanger M. et al. (2013). "Economic benefits of methylmercury exposure control in Europe: Monetary value of neurotoxicity prevention." *Environmental Health*, 12, 3

TPP in Bulgaria: impacts on human health

Methodology

In this Greenpeace Bulgaria report, calculations of health damage from coal burning are based on the EcoSense model, developed by the Institute of Energy Economics and the Rational Use of Energy at the University of Stuttgart (IER). The model quantifying the damage from coal burning at TPP on human health is highly complex in terms of technical data and scope. It uses: data on the incidence of diseases related to coal burning at TPP compiled among 500 000 people in the USA³⁴; detailed geographical information; statistics on the levels of various atmospheric pollutants; and modeling of local weather conditions (e.g. wind direction).³⁵

When applied to the atmospheric pollution of all coal power plants in Europe in 2010, the model shows that their operation leads to thousands of premature deaths and a combined loss of life of almost 240 000 years.³⁶



Results:

When applied to all TPP in Bulgaria, the model shows striking results. In 2012 alone, air pollution from TTP in Bulgaria has resulted in the following:



Table 2.
Health damage caused by TTPs in Bulgaria (for 2012)*

Number of adults with asthma attack (per day)	456
New cases of chronic bronchitis (per year)	641
Cases of respiratory illness with adults (per day)	3101
Cases of respiratory illness with children (per day)	2650
Number of people on sick leave (per day)	1824
Number of people with restricted activity (per day)	3725
Cummulative years of life shortened due to PM2.5 pollution	21341
Premature deaths	2049

** Results are calculated using the emissions of sulphur dioxide, nitrogen oxides and particulate matters recorded at the automated measuring stations of the Ministry of Environment and Waters, and modelling of the climate conditions and the population density.*

³⁴ Pope et al (2002). "Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution." Journal of the American Medical Association. 2002 Mar 6;287(9):1132-41. http://www.epw.senate.gov/107th/Levy_1.pdf. ³⁵ Preiss P. and V. Klotz (2007), "Description of updated and extended draft tools for the detailed site-dependent assessment of external costs." NEEDS, Technical Paper No 7.4 - RS 1b, http://www.needs-project.org/RS1b/NEEDS_RS1b_TP7.4.pdf. ³⁶ Preiss P., J. Roos and R. Friedrich (2013). Assessment of Health Impacts of Coal Fired Power Stations in Europe. Report commissioned by Greenpeace Germany. Institute for Energy Economics and the Rational Use of Energy (IER), University of Stuttgart, Germany.

³⁷ 599 in 2012.



The high mortality rate (over 2000 people) is probably highly influenced by the contamination with fine particles (PM10 and PM2.5), released in the form of the dust and soot. The largest part of the PM2.5 is formed when sulphur and nitrogen oxides react high in the atmosphere. Point sources of PM10 are also the mines, which facilitate the re-suspension of the particles and thus leading to their high concentrations.³⁸

The level of particulate matter in Bulgaria is particularly high as most TPP do not filter for PM10 and PM2.5 for reasons of economic efficiency. In other words, power plants profit on the cost of human lives.

³⁸ EKOGB GMBH (2010). "Dispersionno modelirane na zamursyavaneto na atmosferiya vuzduh s FPCH10 i SO2 za teritoriyata na Radnevo" [Atmospheric dispersion modeling of PM10 and SO2 pollution in the territory of Radnevo].

TPP in the Maritsa basin: impacts on human health

The Bulgarian government defines Stara Zagora, Galabovo and Radnevo as regions of increased health risk, due to air pollution. A report of the Council of Ministers for 2008-2009 finds that the risk of respiratory, bronchopulmonary and allergic diseases for children in pre-school age in Stara Zagora is twice as high as in comparison with nearby regions. This is caused by a continuous exposure to an array of air pollutants.³⁹

The report adds that the main cause of death in the district of Stara Zagora in 2005 were blood-vascular diseases and respiratory diseases.

At the same time, the bulk of the emissions of sulphur dioxide and fine particles in Bulgaria come from the thermo electrical plants in the Maritsa basin (TPP Maritsa

East 2, TPP Contour Global Operations Bulgaria, TPP AES Maritsa East 1, TPP Brikel and TPP Maritsa 3).⁴⁰

Radnevo

According to data from dispersion modelling of atmospheric pollution in Radnevo Municipality in 2011, excessive pollution with PM10 is registered in immediate proximity to Maritsa East Mines.⁴³ Affected are the settlements of Radnevo, Trayanovo and Kovachevo. Excessive pollution is registered in a radius of 120 km² from the point source, approximately 90 km² of which on the territory of Radnevo Municipality.

Stara Zagora

Stara Zagora is among the cities with the highest concentration of PM10 in Europe: limit values are exceeded 76 days per year. According to an independent expert analysis, however, air pollution in the city has an additional source, which is the Zmeyovo military test field and Baritna Mina (baryte mine).⁴²

Galabova

In 2011, automated measuring station "Galabovo" recorded 73 exceedances of the maximum allowable 1-hour average value for sulphur dioxide.



Dr Valchanova,
allergist, Stara Zagora

In the last ten years we have seen a progressive increase, five- to ten-fold, in diseases of the upper and lower respiratory tract: infections, allergic rhinitis, bronchial asthma, chronic respiratory deficiency, cough syndrome of unknown etiology. There has been an increase in skin diseases: dermatitis, eczema, skin rashes of unknown etiology. More and more people come with oncological problems. Disease among children has increased too: virus infections, frequent respiratory diseases

According to data provided by the National Center of Public Health and Analyses, in the period 2003-2012, newly diagnosed cancers in Stara Zagora Region significantly and consistently exceed the average for Bulgaria. For example, in 2010 and 2011 the incidence of cancer is respectively 11% and 18% higher than the average for the country.⁴⁴ Given that air pollution in Stara Zagora Region is also related to the burning of missiles near the city, it is difficult to precisely estimate what part of these are related to coal burning.

If we apply the EcoSense model to the air pollutants emitted by local TPPs, we can estimate the damage to health done by for each of them (Table 3). Results are in line with reports on the high percentage of cancer and respiratory diseases quoted earlier.

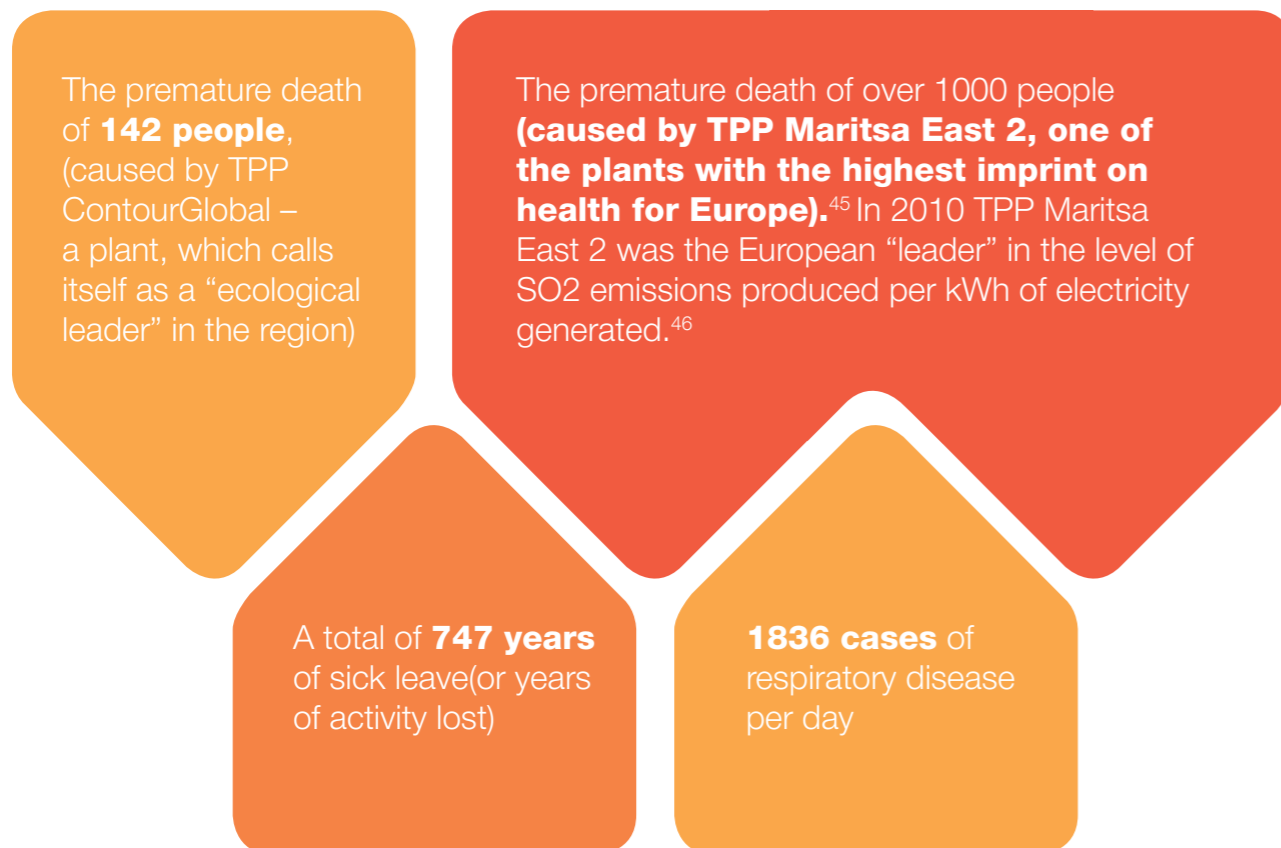
³⁹ Council of Ministers, 29 Dec 2008. Programa za opazvane na naselenieto ot zamursyavaneto na okolnata sreda v rayona na oblast Stara Zagora [Programme for population protection from environmental pollution in the region of Stara Zagora Region]. <http://www.strategy.bg/FileHandler.ashx?fileId=722>. ⁴⁰ 66% of all SO₂ emissions, 36% of all NO_x emissions and 56% of all PM emissions in Bulgaria. ⁴¹ EEA/EEA Report No 9/2013. Air quality in Europe – 2013 report. <http://www.eea.europa.eu/publications/air-quality-in-europe-2013/download>

⁴² Ass. Prof., PhD in chemistry, Eng. Dobrinka Lolova (2010). Analiz na kachestvoto na atmosferniya vazduh v oblast Stara Zagora za perioda 2006-2009 [Analysis of air quality in Stara Zagora Region, 2006-2009]. <http://www.chambersz.com/news/3117-качеството-на-атмосферния-въздух-Стара-Загора>. ⁴³ Radnevo Municipality (2011). Programa za namalyavane na nivata na zamursitelite i za dostigane na utvurdenite normi za nalichie na vredni veshtestva v atmosferniya vazduh na Obshtina Radnevo za perioda 2011-2013 [Programme for reducing air pollution levels and complying with air pollutant norms, 2011-2013]. http://radnevo.acstre.com/assets/Proekti_Programi_Strategii/Programi_na_obshtina_Radnevo/PKAV%20Radnevo%202011.pdf. ⁴⁴ Hospitalisation due to respiratory disease exceeds the country average until 2006 and again in 2011.

Table 3.
The health damage caused by four TPPs operating in the Maritsa basin (for 2012)

TTP	AES Maritsa East 1	Maritsa East 2	Contour-Global	Brikel JSC
Premature deaths	44	1008	142	24
Years of life lost	437	10646	1465	243
Years of work capability lost	25	622	86	14
Cases of respiratory illness in adults (per day)	67	1519	214	37

In 2012 alone, air pollution from coal-fired power plants in the Maritsa East complex was associated with:



Distribution of health risks

Some of these effects are limited to the region of Stara Zagora. According to a report by the Bulgarian government, mortality rates from diseases of the respiratory system in the region is significantly higher than in neighbouring ones and the national average.⁴⁷

Large portion of the fine particles, however, disperse over thousands of kilometres and their toll on health affect the entire country as well as its near and far neighbours.

⁴⁵ EEA Technical Report No 15/2011. “Revealing the costs of air pollution from industrial facilities in Europe.” <http://www.eea.europa.eu/publications/cost-of-air-pollution>.

⁴⁶ Acid News No 2 (2012), “Europe’s most polluting power plants.” <http://www.airclim.org/acidnews/europe%E2%80%99s-most-polluting-power-plants>.

⁴⁷ Council of Ministers, 29 Dec 2008. Programa za opazvane na naselenieto ot zamursyavaneto na okolnata sreda v rayona na oblast Stara Zagora [Programme for population protection from environmental pollution in the region of Stara Zagora Region]. <http://www.strategy.bg/FileHandler.ashx?fileId=722>.

Alternatives

There is no clean coal. Even the most modern European power plants fail to capture 100% of the emissions and have an unacceptably high negative impact on human health, as shown above. Recently, the World Organisation for Economic Cooperation and Development (OECD) warned that premature deaths from air pollution will become more frequent, even if control over air quality is increased.⁴⁸

The only way to prevent the irreversible and deadly effects of coal burning on human health is to phase out coal replacing it with renewable energy sources (RES). For Bulgaria, the first step in this direction would be a four-fold increase in energy efficiency and use of renewable energy sources for heating and electricity

– as suggested in the Alternative Energy Scenario of Za Zemiata.⁴⁹

Certainly, phasing-out coal in electricity and heat generation will have social repercussions. These can be compensated for by transforming existing jobs and creating new ones in the renewable energy sector. New jobs may be related to TPP/mine recultivation and biomass/biogas installations for highly efficient combined heat and power production (CHP).

The recommendations of the Alternative Energy Scenario are as follows:



increase in the electricity produced by wind by 1700 MWh until 2020 for onshore generators – and combined increase of 3000 MWh by 2030 for onshore and off-shore wind power capacities

an increase in electricity generation from biomass

combined heat and power production (co-generation); increase in solar heating – up to 1 M m2 in 2020 and 7.5 M m2 in 2050;

increasing in solar PV generation – by 49 M m2 installed capacity by 2050.

⁴⁸ OECD (2012). OECD Environmental Outlook to 2050: The Consequences of Inaction, p 28. <http://www.oecd.org/environment/indicators-modelling-outlooks/oecdenvironmentaloutlookto2050theconsequencesofinaction.htm>.

⁴⁹ Za Zemiata (2008). Alternative Energy Scenario for Bulgaria till 2050.

Conclusions and recommendations

The current report demonstrates that Bulgaria's energy policy is destroying not only the global climate, but also - human health.

Greenpeace Bulgaria welcomes the commitment of the Bulgarian Government to phase out 2500 MW of coal capacities by 2018 – including TPP Varna, Bobov Dol, Brickel and Maritsa 3 – and insists that this commitment is respected.

The impact of TPP Maritsa East 2 on public health needs public recognition and discussion– not only on part of the local authorities and community. In square monetary terms, the cost of the health damage incurred by the plant significantly exceeds the value of the electricity its produces.⁵⁰ . Much of the health damages, however, cannot be expressed in monetary units, and their cost is borne by those, who do not gain from the operation of the plant, nor are they in any way compensated.

The same holds for the modern TPPs in Bulgaria – AES Maritsa East 1 and ContourGlobal Maritsa East 3. Their operation, too, has a heavy toll on human health and lives, and required political consideration.

The cost of coal burning in Bulgaria has an unacceptably high price, expressed in irreversible health damage and numbers of lives lost.

Greenpeace Bulgaria believes that the single strategy which can guarantee clean air and



health for the people in the region of Stara Zagora (and for Bulgaria as a whole) is the gradual phasing out of the thermoelectric plants in of Maritsa East energy complex, as well as the introduction of a ban the burning of missiles.

If the European and Bulgarian governments do not take due measures, the current economic crisis could further tighten the suffocating grip of coal, destroying yet more lives. There is a real danger of locking-in our energy infrastructure with technology that leaves an irreversible scar on human health and the environment. The first step towards reducing dependence on such schemes in Bulgaria and worldwide is a gradual phase out of coal-fired power plants without replacing these with new nuclear capacities.

European governments, including Bulgaria, can choose. Natural resources are being depleted while the carrying capacity of the planet is pushed beyond its limit.⁵¹ Renewable energy sources and energy efficiency measures can do the job. Electricity consumption in Bulgaria is, furthermore, decreasing. Coal-fired and nuclear electricity is thus neither necessary, nor advisable.

⁵⁰ HEAL (2013). The unpaid health bill. How coal power plants make us sick.

⁵¹ Schneider, F., G. Kallis, J. Martinez-Alier, "Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue." *Journal of Cleaner Production*, Issue 18 (2010) 511–518. http://degrowth.org/wp-content/uploads/2011/05/Schneider_Crisis-or-opportunity.pdf.

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