POLAND'S JOURNEY TO CLEAN AIR AND AAQD COMPLIANCE BY 2030

SUMMARY OF THE RESULTS



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The analyses presented in the report were performed in collaboration with:



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THE REPORT WAS CREATED WITH THE SUPPORT OF

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2 | State CLEAN AIR CENTRE

<u>The European Clean Air Centre (ECAC)</u>, is an independent think-tank that promotes air quality and climate protection objectives across different policies at national and EU levels, **presents the latest results on Poland's feasibility to achieve the standards proposed in the revision of the Ambient Air Quality Directive (AAQD).**

Air pollution is Europe's biggest environmental threat to human health and has a significant, negative impact on the environment. Air pollution in the European Union (EU) leads to 300,000 premature deaths every year, as well as it contributes to chronic diseases like asthma, cardiovascular problems, and lung cancer.

In 2021, the World Health Organization (WHO) adopted a new set of guidelines, showing that 96% of urban-dwelling Europeans are exposed to dangerously high levels of air pollution. In light of this, last year, the European Commission published its proposal to revise the AAQD Directive.

This report presents the latest results of the feasibility of reaching the new AAQD threshold in Poland. Air protection activities described in this report should, in the shortest possible time, lead to a reduction in air pollution concentrations to levels not exceeding the proposed standards (IT4¹ by 2030) and, at the same time, prepare a path for further reduction of air pollution levels to enable achieving the levels of the new AAQD.

As part of the project: *Pathways for reaching EU air quality standards in Poland - tackling emissions from buildings and transportation in cities –* the ECAC conducted a scenario analysis of the possibilities of achieving the levels set out in proposed amendments to the Directive. The project aims to develop recommendations regarding:

- >> Air quality management in Poland;
- >> Modelling of air pollution concentrations;
- >> Managing air pollution emissions through public policies;
- >>> Emission and concentration reduction scenarios to achieve the levels of the new AAQD;
- >> Research on actual emissions (emission factors) from solid fuel boilers and heaters.

Contractors of the project include:

- >>> European Clean Air Centre (ECAC),
- >> The National Centre for Emissions Management (KOBiZE),
- >>> University of Wroclaw (UWr),
- >>> Technical University of Ostrava (VSB),
- >> PwC Poland Advisory (PwC),
- >> Clean Air Fund (CAF).

Decisions in the project have been agreed with the Steering Committee, whose members are representatives of the following bodies:

- >> The Ministry of Climate and Environment;
- >> Marshal's (regional) Offices of:
 - > Mazowsze,
 -) Śląsk,
 - > Małopolska;
- >> Municipalities of Warsaw and Cracow;



- >> The National Fund for Environmental Protection and Water Management;
- >> The Polish Smog Alert.

FINDINGS

The study finds that should Poland continue its boiler replacement programme at the same pace as it is currently operating, Poland will meet the revised target proposed by the European Commission² for $PM_{2.5}$ by 2030 (the annual concentration not exceeding 10 μ g/m³). This would result in:

- >> A 15x increase in the number of people breathing clean air (2 million vs 30 million).
- >>> Over 21,000 less premature deaths per year.
- >> Reduction of fuel consumption, in particular coal and biomass.

The analysis within the remainder of this brief focuses on the changes in concentration of $PM_{2.5}$, the primary pollutant that causes health effects. The report presents the results of two scenarios:

- >> baseline current state,
- >> AAQD effective implementation of existing anti-smog policies in the household sector.

>> RESULTS OF AIR QUALITY MODELLING

Picture 1

BASELINE SCENARIO - Current status of compliance with PM_{2.5} standards according to the proposal of the European Commission (October 2022) regarding the revision of the AAQD Directive.

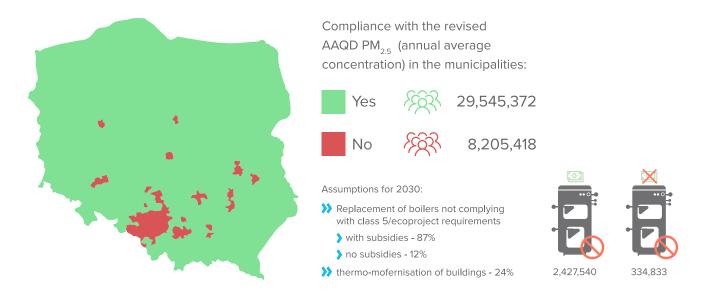


Poland is on the right track to achieve compliance with IT4 by 2030 and has implemented several policies to improve air quality conditions, as described in the methodology sections of this report. There is simply a need to fulfil the existing anti-smog resolutions to phase out outdated solid fuel boilers in households. **The future situation is described in picture 2.**



Picture 2

AAQD scenario - Modelling results of the compliance with PM2.5 standards according to the proposal of the European Commission (October 2022) regarding the revision of the AAQD Directive.



As demonstrated by the modelling conducted within this report, **Poland has the potential to reach the AAQD thresholds** proposed by the European Commission by 2030. Doing so would require the replacement of 2.7 million of existing outdated boilers. As shown in the model assumptions, most will come from the subsidy scheme (2,427,540 replacements) and the rest will be replaced due to natural processes (334,833 replacements).

To achieve this target, it is necessary to replace approx. **6,000 boilers per week, which is presently happening in Poland** (as of 10 October 2023³). After completing these replacements, close to 30 million Poles will be living in areas which meet the AAQD standard air quality levels, compared to 2 million Poles who have this level of air quality today.

Under this scenario, the replacement of all boilers will not lead to 100% compliance with the set path for Poland – in some regions, additional actions will be necessary, including: in the transport and industry sectors.

>> HEALTH EFFECTS

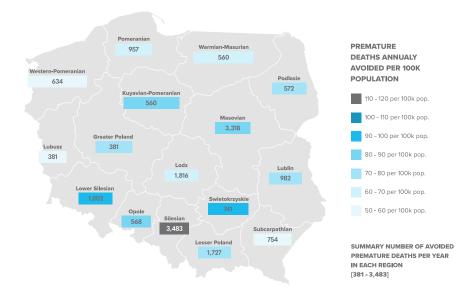
Improvement of Poland's air quality (as in picture 3) results in 21, 247 less premature deaths each year. The presented value shows how many fewer deaths there would be compared to 2022 if the above assumptions were implemented. Please remember that as heating devices are gradually replaced, the air quality will improve each year. Therefore, the total 8-year (from 2022 to 2030) number of premature deaths avoided will be significantly higher. Moreover, the analysis does not take into account the process of ageing of the Polish society, which would lead to a greater share of older people in 2030 as compared with today's situation. Considering that this group is sensitive to the negative effects of exposure to air pollution, emission reduction will potentially be even more important than for a population with an age structure such as today.

Therefore, the analysis result indicating 21,247 less premature deaths every year can be treated as the minimum value for 2030 and subsequent years.



Picture 3

The number of premature deaths annually avoided due to improvement in air quality. The colour scale shows the rate of avoided deaths per 100,000 inhabitants.

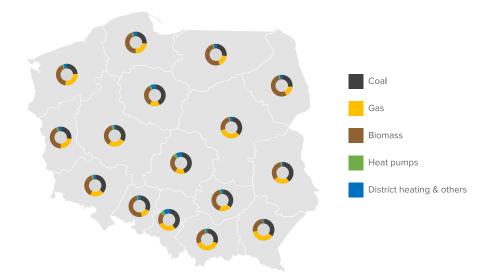


The highest reduction of premature deaths is prognosed for the Silesia (3,483 premature deaths avoided per year, or 110-120 premature deaths per 100,000 inhabitants) and Mazovia (3,318 premature deaths avoided per year, or 80-90 premature deaths per 100,000 inhabitants) regions. This reduction is a result of the high population density and air quality levels in these areas. The positive impacts that the first Polish anti-smog resolution has had on Malopolska, where Cracow is the regional capital, has meant that it is not the highest in this scenario modelling (a significant part of the potential for improvement in this area has already been achieved).

>> ENERGY STRUCTURE

Picture 4

The structure of useful energy for heating households in Poland [%] – baseline scenario.

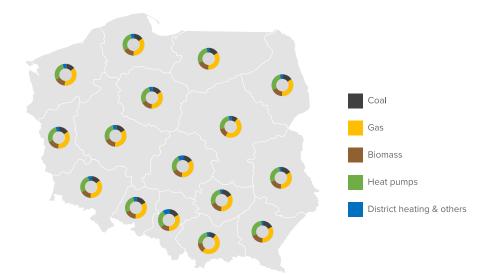


6 CLEAN AIR CENTRE

In 2022, households were the main source of particulate matter (PM) pollution, with the majority being heated with coal and biomass. However, this will need to change by 2030 to meet 2030 targets. Since the AAQD scenario includes the replacement of old heating devices combusting solid fuels, the structure of heating devices in 2030 will be completely different than today.

Picture 5

The structure of useful energy for heating households in Poland [%] – AAQD scenario.



As shown in picture 5, in 2030 the main source of energy will be gas and heat pumps.

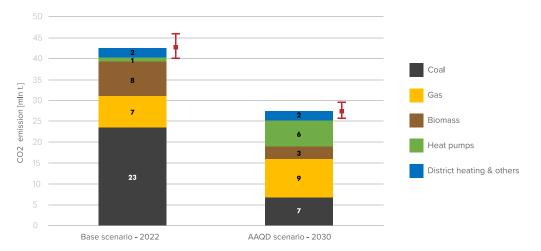
While coal and biomass will still be in use in 5/ecodesign class boilers, they will be used much less than to date.

It must be noted that this report presents the share of heating useful energy, not the share of devices. This approach supports the modelling of emissions and air pollution dispersion. The share of the devices is different due to the energy efficiency of the sources.

CARBON DIOXIDE EMISSIONS

Picture 6

The annual reduction in CO₂ emissions due to implementation of the AAQD scenario compared to the baseline.



An additional benefit of Poland improving its air quality is that there will be a 33% reduction in the household sector's greenhouse gas emissions. This is just one of the many co-benefits of the joint climate and environmental policy.

CONCLUSIONS AND RECOMMENDATIONS

>> Poland can reach the proposed AAQD requirements (for $PM_{2.5}$).

If the current policies are implemented, which fulfil existing anti-smog resolutions.

>> The adopted regulations require implementation.

In particular: anti-smog resolutions, coal and biomass standards and emission standards for low-power combustion devices, further development of the Clean Air Program and other subsidy programs in multi-family housing.

However, in some areas additional measures are necessary.

Work should also begin to reduce the burning of solid fuels (coal and biomass) in as many Polish regions as possible. Moreover, actions towards the reduction of transport emissions, in particular, low emission zones (LEZ) are also necessary. This applies primarily to large urban areas, but we should not forget about industrial emissions in places where they are significant and cause deterioration of air quality.

>> Only a systemic and consistent approach will allow Poland to meet the new AAQD standards.

METHODOLOGY

>> Boiler replacement

The analysis examines whether the implementation of measures in Poland through air protection programs and anti-smog resolutions, including the elimination of devices that do not meet class 5/ecodesign requirements, will enable compliance with the air quality levels set out in the new Directive. Under the scenario accepted by the project's Steering Committee, it has been assumed that by 2030 the following measures will have been taken:

- >> replacement of 87% of devices that do not meet the requirements of anti-smog resolutions using subsidies from the Clean Air Program;
- >> replacement of 12% of devices that do not meet the requirements of anti-smog resolutions without using subsidies (the so-called natural process);
- >> remaining 1% of devices that do not meet the requirements of anti-smog resolutions as non replaced due to, for example, undefined legal status or difficult economic situation of the household.

The data used to categorise device replacement **using subsidies** is based on 2022 data (the latest data from the Clean Air Program at the time of developing the scenarios).

According to the data, 87% of appliances lower than class 5 or ecodesign were replaced (during scenario modelling) with the following structure:

- >> Biomass boilers: 18.9%,
- >> Connection to heating district: 0.2%,
- >>> Electric heating systems: 2.0%,
- >> Oil boilers: 0.1%,
- >> Gas boilers: 25.3%,
- Heat pumps: 53.4%.

In the case of **replacement without subsidies**, it was assumed that coal and biomass boilers would be replaced with newer models of devices burning solid fuels. Therefore, a manually loaded device using coal is replaced by an ecodesign class manually loaded powered by coal. Similarly for biomass and automatic loading appliances. Thus, in addition to the existing household appliances that already meet ecodesign standards, 12% of new solid fuel appliances were added that meet these requirements. This level (12%) was estimated based on the natural rate of replacement of old-generation devices, regardless of the existence of subsidies.

>> Thermomodernization of households

Under this scenario, it was assumed that by 2030, **thermal modernization of 24%** of single-family buildings would be carried out - in line with the Long-Term Building Renovation Strategy. Buildings without a thermal insulation layer were given priority.

9 CLEAN AIR CENTRE

>> Emission factors

In the scenario, to estimate particulate matter (PM) emissions from the household sector, emission factors (EF) that better reflect reality (taking into account the condensing fraction of dust) were used. The values of the adopted EFs came from the analysis carried out by the Institute of Fuel and Energy Technology on behalf of The National Centre for Emissions Management (KOBiZE), as well as from emission tests of the Ostrava University of Technology using the so-called dilution tunnel, allowing condensates to be included in PM emissions - and therefore measuring real emissions 'at the chimney outlet'.

>>Boiler structure

The ECAC created an analytical model enabling the calculation of aggregated emission factors (using the above-mentioned real emission factors) separately for each commune⁴, using local data on the structure of devices from the Central Register Of Emissions Of Buildings database (CEEB). This approach to the design of the aggregate emission factors also made it possible to take into account the current (2022 data) progress in the implementation of the anti-smog resolutions.

KOBiZE prepared emission data for the 2030 scenario air quality modelling, taking into account the above-mentioned emission factors developed by ECAC. The use of the fuel mix (the share of fuels burned in the so-called low-stack emission sector) from KOBiZE, together with the use of emission factors specific to each municipality, allowed for a significant improvement in the spatial representativeness of emission data, compared to the standard approach.

In addition, a change in transboundary emissions, in line with the levels required by the National Emission Ceiling (NEC) Directive, has been addressed.

>> Air quality modelling

Modelling of air quality concentrations predicted for 2030 was performed by the University of Wrocław using the EMEP4PL model created for Poland. This is the EMEP (European Monitoring and Evaluation Program) MSC-W (Meteorological Synthesis Center-West) chemical transport model for Poland. A single mesh (the smallest area for which the model determines the air pollution concentration value) under this model is 4x4 km.

Modelling at this stage did not focus on the impact of short-term (e.g. hourly, daily) emissions on air quality, e.g. from fireplaces. This aspect will be analysed in further stages of work.

The resulting map (picture 2) shows the modelling of the average annual $PM_{2.5}$ concentration for 2030 in Poland. The scenario assumes compliance with the assumptions described earlier.

>> Limitations

It is necessary to take into account, that all, even the best modelling, has a built-in error. Therefore, even more areas (in the resulting map) could be "green" and meet the levels of the updated AAQD. The opposite situation is also possible, i.e. the occurrence of an error of overestimation of the effects of planned emission reductions. Thus, in order to ensure that the requirements of the updated AAQD are met over the largest possible area of the country, taking into account the limit of the estimation error, additional measures - apart from the replacement of heating equipment - should be recommended not only in the areas marked as "red". In addition, data sources also have limitations in terms of correct spatial representation of actual emissions, so in reality, the boundaries of "green" and "red" areas may be different. Nevertheless, the authors of the analyses have made every effort to achieve the best possible precision.