Annex

A.1: Mortality rates and the broader health burden

Methodology: Mortality trends. We analysed air pollution data and mortality data from the European Environmental Agency for the period 2007-2021. Data from the year 2020 was excluded as the lockdown measures had an exceptional impact on air pollution emissions. Mortality trends were then estimated using a standard OLS.

Methodology: Air pollution hotspots. We computed the total air pollution mortality for each EU regions, M_i, that is attributable to PM2.5, NO_2, and ground-level one according to the EEA data, during the period 2014-2021. Data from 2020 was excluded due to the disruption caused by COVID-19 lockdowns, so we considered a seven-year period. On the other hand, we considered the population of each of these regions P_i. We then compared $\sum_{i \in H} M_i / \sum_i M_i$ and $\sum_{i \in H} P_i / \sum_i P_i$ where H is the set of selected regions, ie identified hotspots.

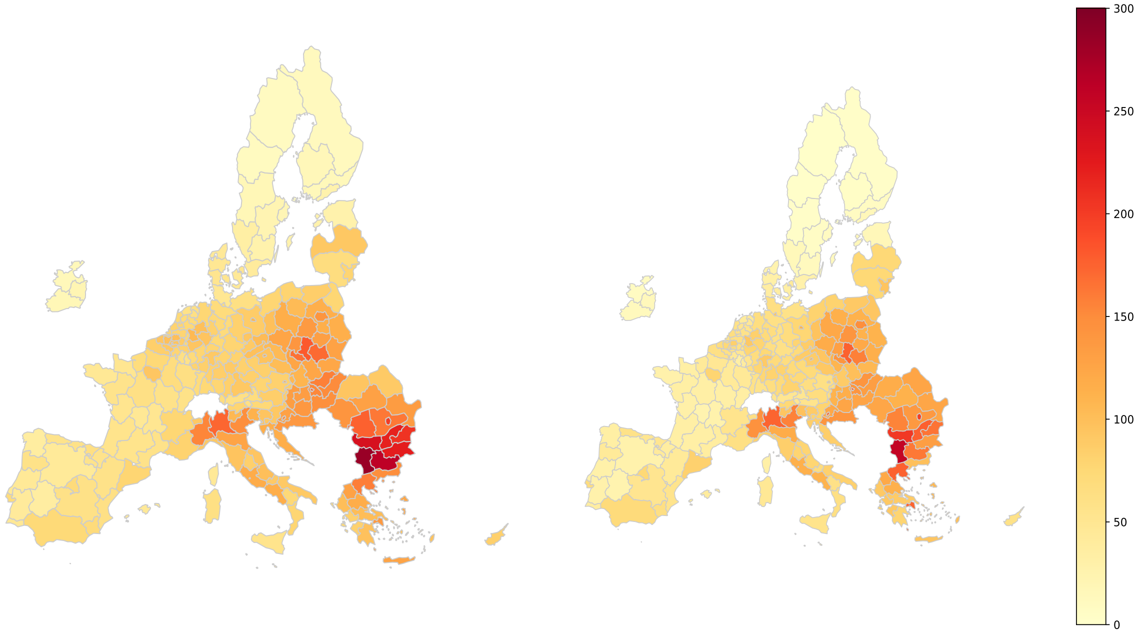
Two different sets of hotspots were identified based on the projected mean annual exposure to PM2.5 by 2030, and on the recorded mortality over the period 2014-2021. Hotspots correspond to the regions where either the former or the latter are highest among the 234 EU regions.

Table A1: EU regions where air pollution mortality rate was highest, expressed in deaths per 1,000 inhabitants.

Region	Air pollution deaths (2014/2021)	Mortality rate
Северозападен (BG)	11 777	15
Северен централен (BG)	10 474	13
Североизточен (BG)	11 021	12
Югоизточен (BG)	11 920	12
Югозападен (BG)	36 580	18
Южен централен (BG)	20 294	15
Moravskoslezsko (CZ)	12 507	10
Κεντρική Μακεδονία (EL)	23 368	12
Grad Zagreb (HR)	9 509	12
Észak-Magyarország (HU)	12 119	10
Małopolskie (PL)	37 200	11
Śląskie (PL)	58 215	13
Łódzkie (PL)	25 877	10
Warszawski stołeczny (PL)	30 457	11
Bucureşti-Ilfov (RO)	30 118	14
Sud-Vest Oltenia (RO)	21 974	11
Total 16 hotspots	363 410	12
Total EU	2 603 357	6

Health burden and low-income households. The health burden of air pollution is not evenly distributed in the EU, namely as both mortality and morbidity are exacerbated by the vulnerability of the population. This led us to analyse the correlation between air pollution mortality and the share of low-income households.

Figure A1: *Air pollution mortality per 100,000 inhabitants over the period 2014-2020 (left) and the share of low-income households in 2021 (right).*



Source: Bruegel calculations based on Eurostat.

A.2: Economics of the impact of air pollution

Methodology from the OECD paper. Air pollution impacts the economy through various channels. On the one hand, it alters the labour force via the population size, absenteeism rates and on-the-job productivity. On the other hand, air pollution affects the productivity of water bodies, crops and forests, and thus the economic output. We follow Dechezlepretre *et al* (2019) who found that a 1 μg/m^3 reduction of annual concentration of PM2.5 leads, in average, to a gain of 0.8 percent of GDP.

A simple conceptual framework. Start with the classical macroeconomic model $Y = A \times F(K, L)$, where Y is the economic output, A is the productivity factor of the economy, K is the amount of capital, and L is the amount of labour. Then, integrate air pollution as an exogenous variable affecting both the productivity factor and labour via three channels: the size of the active population (N), their average working time (h), and their hourly productivity (r). Absent pollution, the labour force is $L = N \times h \times r$. With pollution, it becomes $L(P) = N(P) \times h(P) \times r(P)$, where P stands for the level of air pollution levels. Assuming that F is a classical Cobb-Douglas function leads then to:

$$Y(P) = A(P)\, K^{\alpha} \times\ [N(P) \times h(P) \times r(P)]^{1-\alpha}$$

where α is the elasticity of substitution between capital and labor. The impact of air pollution on economic output is thus explained through four elements: the population size, the average number of working hours, the in-the-job productivity and the productivity factor. All other things being equal, we assume that the latter captures the productivity of the environment, namely forests, crops, and water bodies.

Population size. Air pollution affects the size of the labour force by increasing mortality and morbidity rates (eg the inability to work due to a severe disability) and migration balance. Indeed, according to the European Environmental Agency, more than 300,000 people died in 2021 due to exposure to PM2.5 and NO_2 every year, including more than 1,200 people under 18 years of age and accounting for 2,400,000 years of lives lost. Further, air pollution significantly increases the risk of disease later in life, notably asthma, chronic obstructive pulmonary disease, diabetes, ischemic heart disease, lung cancer and stroke. A recent study found that a 1 percent increase in air pollution led to a decrease in net migration by about 0.28 percent in each county, with these inflows primarily driven by well-educated people at the beginning of their professional careers (Chen *et al,* 2022). These findings were corroborated with survey data from Sofia, Bulgaria, where air pollution was found to impact the career's decisions of the high-skilled workforce: 37 percent of the respondents consider moving elsewhere in Bulgaria and 66 percent consider moving abroad for better air quality.

Working time. Beyond its effect on mortality, disability and migration, air pollution leads to an increased prevalence of many diseases, which in turn translates into sick days or job absenteeism. For example, in Spain, a 10μg/m^3 increase in PM10 concentration in the urban centres was associated with a 1.6 percent increase in job absenteeism; the effects being stronger for workers with pre-existing medical conditions, and weaker for workers with low job security (see Holub *et al,* 2016 and 2020). In Peru, increased levels of air pollution were associated with a substantial reduction of working hours; moreover, a key explaining factor for absenteeism at moderate pollution levels was the presence of dependents in the household, notably children (Aragon *et al*, 2017), thus corroborating the correlation with school absences.

On-the-job productivity. In addition to morbidity, mortality and absenteeism, air pollution is also shown to affect cognitive and physical functions. Hence, there is a clear pathway through which it could impact workplace productivity. The link with air pollution was established by focusing on groups of individuals for which productivity, or some similar measure, is directly observable and for whom tasks cannot easily be delayed or shifted in location. For example, air pollution has been shown to decrease the daily number of pieces harvested by workers at a large farm in California (Graff-Zivin and Neidell, 2012). But importantly, the reduced productivity is not limited to physical workers: analysing worker-level dataset from a Chinese call centre, they find that the number of calls handled by workers falls with increases in the air quality index, due to longer breaks at work taken by workers on polluted days (Chang *et al*, 2016). Estimating the potential effect of pollution on high-skill workers is more challenging, because tasks are typically less repetitive, and can often be shifted in time and space. While the evidence remains thin, several studies suggest that pollution affects productivity in high-skill tasks too, for example in student performance in high-school examinations (Ebenstein *et al*, 2016), in investors performance at the New York Stock Exchange (Heyes *et* *al*, 2016), or in a Chinese manufacturing plant where PM2.5 levels are associated with a significant decrease in productivity.

Environment's productivity. Air pollution harms ecosystems, namely water, crops, and forests, and thus reduces the services they deliver. In forests, for example, air pollutants such as nitrogen oxides and sulphur dioxide damage leaves and inhibit photosynthesis, leading to reduced growth rates and increased susceptibility to diseases and pests. Additionally, air pollution contributes to the formation of acid rain, which exacerbates soil acidification and nutrient depletion. In agricultural landscapes, air pollution – notably ground-level ozone and particulate matter – interferes with plant metabolism and nutrient uptake, leading to decreased crop quality. Yield losses due to ozone exposure were found to be significant, ranging from 3 percent to 16 percent for wheat, soybean, rice and maize (Van Dingenen *et al*, 2009). On the other hand, suspended particulate matter over China's most productive agricultural regions leads to a substantial reduction in solar irradiance and yield (Chameides, 1999). Outside of the agricultural sectors, high levels of PM2.5 in China were associated with large losses in solar photovoltaic output (circa 20 percent), again due to the reduced radiation reaching solar panels (Li *et al*, 2017).

Methodology: mean exposure to PM2.5. Consider some area with total population P. For every region i belonging to this area, let P_i be the size of the population and let C_i be the (annual or daily) average concentration of some fixed pollutant (eg PM2.5). Then, the average exposure (AE) in the area is then computed as a weighted average, as follows:

$$AE = \frac{1}{P}\sum_i C_i \times P_i \,.$$

The mean exposure differs from the mean concentration, obtained by averaging measurements (possibly via satellite) over several locations. The mean exposure confronts the concentration levels in any given area with the population living in this area. To illustrate the differences, consider a hypothetical country with two regions, each of them equipped with a single monitoring station that measures the concentration of PM2.5 once a day, and obtains average annual concentrations of 10 $\mu g/m^3$ and 20 $\mu g/m^3$ respectively. The mean concentration is thus 15 $\mu g/m^3$. By contrast, the mean exposure depends on the population of both locations, P_1 and P_2. If we set $P=P_1+P2$ then the mean exposure is (1/P) ($P_1\times 10+ P_2\times 20$).

Methodology: the economic cost of air pollution. Air pollution is proxied by the mean PM2.5 annual exposure. We assume that the economic impact of air pollution is proportional to the exceedance of annual exposure compared to the WHO 2021 limit value, that is 5 μg/m3, and that the elasticity between annual exposure of PM2.5 and the GDP is the one estimated by the OECD study (Dechezleprêtre *et al*, 2019). That is, to each $\mu g/m^3$ of annual exposure of PM2.5 above 5 $\mu g/m^3$ is attributed an economic loss of 0.8 percent of GDP. Hence, for every region European region i its annual economic cost (EC_i) is given by:

$$EC_i = Max(0, C_i - 5) \times GDP_i \times 0.8\%$$

For any area (region, member country, or the EU) the economic cost of air pollution over several years is obtained by summing over the corresponding regions and years.

Table A2: Economic cost of air pollution by country and by period in three septennial periods, 2014-2020, 2021-2027, and 2024-2030. Costs and GDP correspond to the average and are expressed in € billion.

	2014/2020			**2021/2027**			**2024/2030**		
	AP cost	GDP	Ratio	AP cost	GDP	Ratio	AP cost	GDP	Ratio
BG	7	51	14,4%	7	88	7,7%	5	98	5,6%
PL	60	460	13,0%	76	676	11,3%	81	745	10,9%
EL	22	178	12,3%	21	212	9,8%	21	225	9,4%
HU	13	124	10,3%	13	172	7,7%	13	188	6,9%
RO	18	182	10,0%	19	297	6,3%	16	333	4,8%
HR	5	49	9,9%	5	71	7,7%	5	78	7,0%
SK	8	84	9,8%	8	113	7,1%	7	123	6,1%
IT	165	1 712	9,6%	135	1 954	6,9%	118	2 006	5,9%
CZ	18	189	9,4%	20	276	7,3%	20	296	6,7%
CY	2	20	8,6%	1	29	4,2%	1	32	2,2%
SI	4	42	8,5%	3	59	5,7%	3	64	4,9%
BE	27	439	6,3%	19	563	3,3%	12	590	2,1%
LT	3	42	6,1%	3	68	4,6%	3	74	3,9%
AT	22	364	6,1%	14	445	3,2%	10	463	2,2%
MT	1	11	5,7%	1	19	3,6%	1	22	2,6%
DE	178	3 199	5,5%	122	3 881	3,2%	93	4 009	2,3%
NL	40	730	5,5%	21	956	2,2%	9	1 007	0,9%
LV	1	27	5,1%	1	39	3,4%	1	42	2,7%
FR	110	2 236	4,9%	59	2 630	2,2%	31	2 747	1,1%
ES	53	1 095	4,9%	32	1 339	2,4%	21	1 429	1,5%
LU	3	57	4,4%	1	79	1,1%	0	84	0,3%
DK	11	284	3,9%	9	385	2,3%	7	408	1,8%
PT	6	184	3,4%	3	238	1,2%	2	255	0,7%
IE	6	285	2,0%	7	499	1,3%	5	536	1,0%
EE	0	23	1,2%	0	35	0,1%	-	37	0,0%
SE	4	465	0,9%	1	570	0,2%	1	601	0,1%
FI	2	223	0,7%	0	269	0,1%	-	281	0,0%
EU 27	788	12 757	6,2%	601	15 962	3,8%	487	16 772	2,9%

Colouring rule: Green if <2%, Orange between 2% and 7%, and Red >7%. Source: Bruegel calculations.

Methodology: the economic gains of air pollution reduction. Again, we assume that the economic impact of air pollution is proportional to the exceedance of annual exposure compared to the WHO 2021 limit value, that is 5 µg/m^3, and that the elasticity between annual exposure of PM2.5 and the GDP is the one estimated by the OECD study (Dechezleprêtre *et al*, 2019). That is, to 1 $\mu g/m^3$ of mean annual exposure of PM2.5 above 5 $\mu g/m^3$ is attributed an economic loss of 0.8 percent of GDP. Hence, for every European region *i*, its annual economic gain from reducing air pollution (*EG_i*) is given by:

$$EG_i = [Max(C_i\ ,5)\ -\ Max(C_{i,t-1}\ ,5)]\ \times\ GDP_i \times 0.8\%,$$

Where C_i and $C_{i,t-1}$ are respectively the mean annual exposure to PM2.5 of the considered year and of the previous year. For any area (region, member state, or the EU) the economic gains of air pollution in this area and over several years is obtained by summing over the corresponding regions and years.

Table A3: Economic gains from air pollution reduction in three septennial periods, 2014-2020, 2021-2027, and 2024-2030. Gains and GDP correspond to the entire period and are expressed in € billion.

	2014/2020			2021/2027			2024/2030		
	Gains AP	**Cost AP**	**Ratio**	**Gains AP**	**Cost AP**	**Ratio**	**Gains AP**	**Cost AP**	**Ratio**
AT	15	191	7.7%	13	100	12.8%	12	70	16.8%
BE	23	189	12.1%	16	131	12.5%	16	86	19.0%
BG	3	50	6.8%	4	47	9.2%	5	38	14.3%
CY	0	12	3.6%	2	9	19.0%	2	5	32.5%
CZ	10	122	8.5%	1	140	0.7%	5	139	3.8%
DE	124	1191	10.4%	68	857	7.9%	87	654	13.2%
DK	1	76	0.9%	7	62	10.6%	6	52	10.8%
EE	1	2	26.2%	0	0	74.8%	1	-	100.0%
EL	6	148	3.9%	-1	146	-0.8%	4	148	2.4%
ES	10	365	2.6%	36	221	16.1%	26	146	17.9%
FI	2	10	15.6%	1	1	84.8%	0	-	100.0%
FR	90	753	12.0%	73	410	17.8%	69	219	31.3%
HR	1	34	3.4%	1	38	1.8%	2	38	4.8%
HU	3	88	3.4%	1	93	1.3%	5	91	5.1%
IE	7	41	18.1%	6	46	13.0%	14	37	37.8%
IT	46	1127	4.0%	43	943	4.6%	54	823	6.6%
LT	1	18	3.6%	1	22	5.5%	1	20	5.5%
LU	3	16	20.0%	2	6	32.5%	1	2	75.5%
LV	1	10	6.9%	1	9	6.9%	1	8	9.7%
MT	0	5	0.2%	1	5	11.8%	0	4	11.3%
NL	24	274	8.8%	36	145	24.7%	26	63	41.9%
PL	24	420	5.8%	-3	535	-0.5%	11	566	1.9%
PT	4	41	9.8%	5	20	23.4%	2	13	19.1%
RO	6	129	4.3%	11	131	8.1%	12	113	10.5%
SE	15	29	51.5%	2	10	25.4%	1	5	21.6%
SI	1	25	5.7%	1	24	4.3%	2	22	7.1%
SK	3	57	5.0%	1	56	2.6%	3	52	6.2%
EU 27	423	5 423	7.8%	328	4 208	7.8%	367	3 412	10.7%

Colouring rule: Green if >15 percent, Orange between 5 percent and 10 percent and Red <5 percent. Source: Bruegel calculations based on EEA data

Methodology for estimating EU funds. Different financial instruments exist in both multiannual financial frameworks (MFFs), namely cohesion policy such as the European Regional and Development Fund (ERDF) and the Cohesion Fund (CF), Horizon 2020, Horizon Europe, the European fund for strategic investments

(EFSI), the European Regional Development Fund (EFRD), Life and the Resilience and Recovery Facility (RRF). For each of them, we estimate the amount that is dedicated to tackling clean air as follows.

We focus on cohesion policy (ie ERDF and CF) for the first MFF, and on both cohesion policy and the Recovery and Resilience Facility (RFF) for the second. These funds cover, respectively, nearly 70 percent and more than 90 percent the total pro-clean funds estimated by the European Commission (EU Commission, 2022). For these funds, we provide updated estimates, together with the identification of funds by sector and member state. For this part, we have relied on the methodology set by the OECD (ie Rio markers) which consists in tracking public expenditures across different fields, and determining, for each of them, whether clean air is a primary objective, a secondary, objective, or neither. The allocated amounts are then multiplied by a factor 1, 0.4, or 0, accordingly, and then summed up across sectors and member states. For the other financial instrument, we rely on the estimates of the EU Commission. See section A3 below for more details on our construction of a common database.

On the Revision of the AAQD (February 2024). The reduction of air pollution has proven to be not only feasible and compatible with economic activity, but a driver for economic growth. The revision of the air quality standards, agreed in February 2024, is a strong signal of EU determination to ensure cleaner air for all Europeans. Increased action against air pollution is important for at least five reasons: health, the economy, the environment, justice and cohesion.

Health. Air pollution remains the greatest environmental threat to health and a leading cause of chronic diseases, including stroke, cancer, and diabetes. About 300,000 deaths are attributed each year to air pollution –equal to more than half of the mortality attributed to COVID-19 from 2020-2021 (EEA 2023), accounting for more than 3 million disability-adjusted years of life lost.

The economy. Air pollution has a great impact on the economy, as it reduces the labour force (through mortality, invalidity and migration), the productivity both of workers (on-the-job productivity and absenteeism), and of ecosystems (forests, crops, rivers). Reductions in air pollution between 2000 and 2015 explain 15 percent of the EU's GDP growth (Dechezleprêtre *et al*, 2019).

The environment**.** The environmental impacts of air pollution are vast and varied, for example acid rain, formed by nitrogen and sulphur oxides released during fossil fuel combustion, damages ecosystems by acidifying soils and water; eutrophication, that is high concentration of nutrients accelerated by human activities like nitrogen emissions, stimulates blooms of algae that lead to the death of fish and loss of plant and animal diversity; Haze, caused by pollution particles, obscures visibility and affects ecosystems; ozone depletion, driven by man-made chemicals, increases UV radiation, harming human health and crops. Additionally, global climate change is fuelled by several air pollutants.

Justice. Air pollution disproportionately affects vulnerable groups, including children and the elderly, people with pre-existing conditions and the socioeconomically disadvantaged. Ensuring air quality is thus critical to reducing health inequality. Further, better information regarding the health damage of air pollution (by pollutant, and by type of vulnerability) will allow those who are particularly affected or at risk to make informed choices. Citizens will be informed about symptoms and health risks associated with air pollution – both during pollution peaks, and on average– and will also be able to claim compensation when their health has been damaged resulting from deliberate or negligent breaches of the standards.

Cohesion. While air quality is mainly a local issue – unlike CO_2 emissions, for example – air pollutants travel across borders, resulting in a negative externality from a polluting country to its neighbours. This transboundary aspect of air pollution requires a coordinated response to avoid tensions between EU member countries. It is thus important to have common pollution standards which evolve together with scientific findings, as well as transparent and comparable measuring tools.

The new directive requires that all member states create air-quality roadmaps that set out both long-term strategies to ensure future compliance and short-term emergency measures (such as limiting traffic or suspending construction works) to reduce the immediate risk in areas where air pollution thresholds are exceeded. The EU possesses a large variety of instruments to address the issue, including other policies covering environment, energy, transport, agriculture, industry, research and innovation, along with dedicated funds (see Section 2.3).

However, the agreed directive has several caveats. First, it allows countries and regions with *"specific circumstances"* to postpone compliance with the air quality standards. Justifications for such postponements should be based on sound analysis –for example, objective climatic conditions and landscape features that make achieving air quality standards harder. But some *"specific circumstances"* could be open to interpretation. A notable example is that a postponement can be requested in areas where the new air quality standards can only be met by significantly modifying current domestic heating. While such exceptions were pivotal to seal the agreement before the European elections, they raise significant risks. Systematic postponements will prolong Europe's pollution divide between Western Europe and eastern countries, which tend to be more severely affected by air pollution. In highly polluted areas, action is even more urgent, so instead of postponements, there should be clear prioritisation.

On the other hand, postponements in one country will also hinder the ability of neighbours to comply due to the above-mentioned transboundary effect of air pollution. A country which is not on track to comply with the air-quality standards by 2030 may put forward *"specific circumstances"* to justify their slow progress, even when it is due to insufficient action. If cleaner air is wanted for all Europeans – which according to opinion surveys most Europeans want (EU Barometer 2021) – such specific circumstances need to be managed very carefully.

A3: Database construction for EU clean air funds

The positive funding data comes from EU official sources and policy instruments, mainly the cohesion policy and the recovery and resilience facility (RFF). The negative funding is obtained from IMF data. The following sections explain in detail the data estimation and construction process.

Clean air funding estimation in the EU. For each project with EU funding, a marker ranging between 0 and 100 percent is assigned, indicating the contribution towards clean air objectives (Table A4). The framework shown below is used across the different financial instruments to estimate clean air contributions.

Table A4: European Commission, clean air objectives markers

Description	Example	Marker
Investment categories most relevant to clean air objectives	Air quality measures, cycling infrastructure	100
Categories that partially contribute to clean air	Railways, renewable energy, household waste management, green infrastructure, energy efficiency	40
Any other expenditure		0

Source: authors based on European Commission (2020). Note: in case of uncertainty about the marker choice, the lower bound is chosen.

Cohesion policy 2014/2020. We use European Commission data which includes the projects funded under the cohesion policy instruments [9]. We use the planned amounts of funding for our calculations (eg the 'planned_eu_amount_clean_air' variable in the official dataset). To calculate the clean air funding, we apply the markers foreseen in the legislation (COM (2020) 266 final, Annex 4). These markers are specific for the different intervention fields assigned to the projects funded by the cohesion policy (eg '090 - Cycle tracks and footpaths'). The specific intervention fields can be seen in the legislation previously cited. We perform sanity checks to confirm that the markers foreseen in the dataset are correctly assigned. Following the advice and comments obtained through different meetings with the stakeholders, we filter the observations in the dataset to the 2022 year, aiming at incorporating the latest update of the data.

Cohesion policy 2021/2027. We use the European Commission data for the 2021/2027 MFF related to cohesion policy.[10] We filter the dataset to cover the funding under the ERDF and the CF. For our calculations we use the markers and respective intervention fields contained in the dataset.

Recovery and Resilience Facility (RRF). To the best of our knowledge, no existing database covers the different projects funded by the RRF and the clean air amount associated with each project. Following the advice and comments by the RRF unit of the European Commission, we focused on the Commission Staff Working Documents, analysing the Member States plans submitted by each country. The projects included in the documents are classified across different intervention fields for the climate and digital areas only. Following the advice of stakeholders, we used the intervention field codes of the climate related projects to consistently match them with the clean-air-specific intervention fields. This allows to estimate the clean air funding within RRF projects. The result is a dataset detailing the different projects with the associated clean air funding in the RRF instrument, disaggregated at the country level and by intervention field and description of the projects. Our estimate is around 30 percent higher than the European Commission estimate for the same instrument.[11] Even though we could not get access to the methodology followed by the European Commission, this difference could be explained by a higher execution of the RRF grants by the time we have carried out this analysis.

The following table details the different documents used for each country. The incorporated annexes in the documents detail the projects related to climate and digital areas and the corresponding intervention fields.

Table A5: RRF Member State plans, European Commission documents used to obtain the projects funding clean air.

Country	Document	Country	Document
AT	SWD(2023) 344 final	IE	SWD(2021) 205 final
BE	SWD(2023) 376 final	IT	SWD(2023) 392 final
BG	COM(2023) 746 final	LU	SWD(2021) 159 final
CY	SWD(2023) 377 final	LT	SWD(2023) 347 final
CZ	SWD(2023) 319 final	LV	SWD(2023) 375 final
DE	SWD(2023) 371 final	MT	SWD(2023) 235 final
DK	SWD(2023) 343 final	NL	SWD(2023) 324 final
EE	SWD(2023) 142 final	PL	SWD(2023) 381 final
EL	SWD(2023) 383 final	PT	SWD(2023) 318 final
ES	SWD(2023) 326 final	RO	SWD(2023) 382 final
FI	SWD(2023) 379 final	SE	SWD(2023) 342 final
FR	SWD(2023) 236 final	SI	SWD(2023) 325 final
HR	SWD(2023) 380 final	SK	SWD(2023) 238 final
HU	SWD(2023) 384 final		

Source: authors based on European Commission official documents.

Inflation data. The monetary values are updated from 2014 prices to 2021 prices using Eurostat inflation data. We use the Consumer Prices Index Code 'tec00027'. The latest year available in the dataset is 2023. For the years between 2024 and 2027, an inflation rate of 2 percent is assumed. The relative (per capita) funding is calculated using Eurostat data (demo_pjan).

Geographical information. We use the NUTS geographical information for the EU available on Eurostat[12], namely NUTS1 (country level) and NUTS2 (regional level).

GDP and poverty. Eurostat data is used for both variables. For the GDP variable we used the code 'nama_10r_3gdp' and the unit of measure 'PPS_EU27_2020_HAB', GDP per capita in PPS. For the poverty variable (share of low-income households) we used the code 'ilc_li41'.

Air pollution and health impacts data.

For the levels of air pollution and health impacts across countries/regions we use the EEA health risks assessments dataset. This source of data contains information disaggregated at the different NUTS (nomenclature of territorial units for statistics) levels[13] for the levels of pollution and health impacts of the main pollutants; PM2.5, PM10, NO2 and O3. Within the different health risk scenarios available in the dataset, we use the 'WHO_2021_AQG_Scen_Base'.

The dataset includes data between 2005 and 2021. We exclude the year of 2020 from our analysis due to the influence of lockdowns and travel restrictions derived from the COVID19 pandemic on the data. The years of 2005 and 2006 are also excluded due to poor quality of the data. The dataset also includes population data at the NUTS3 level which is used to compute the relative figures related to the air pollutants. For some observations in the dataset, population values for a given area and year differed among pollutants. In these cases, an average of the population value for all the pollutants for the given year was taken.

Projections. Estimates provided for years between 2022 and 2050 are computed using OLS estimator.