

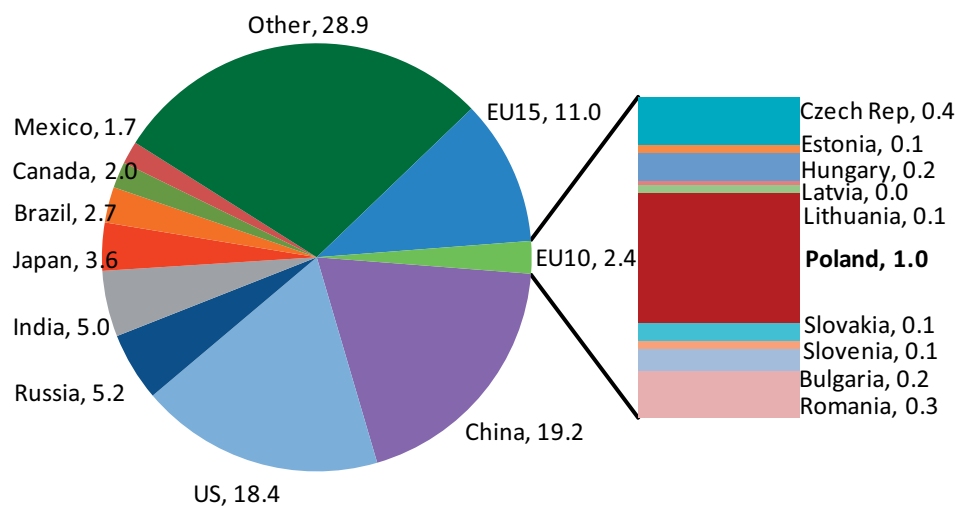
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# **POLAND'S GREENHOUSE GAS EMISSIONS**

Poland is not among the largest emitters of greenhouse gases globally, but its economy is among the least carbon-efficient in the EU. Poland's global share in GHG emissions is just 1 percent; and its per capita emissions are about the average for the EU. Poland cut its emissions considerably as a side effect of the restructuring of transition to a market economy, but the link between growth and emissions has re-emerged in recent years. A critical difference in the make-up of Poland's emissions is the dominance of the power sector and its extraordinary dependence on coal. Apart from energy sector, Poland's transport sector has experienced very high rates of emission growth, and energy efficiency, although improving, remains below EU averages.

Poland contributes marginally to the global carbon footprint, with a share in global GHG emissions equal to about 1 percent. The EU as a whole is responsible for about 13 percent of global emissions, while China and the US, the largest emitters, are responsible for almost 40 percent of global emissions between them. (Figure 2). On a per capita basis, Poland emits about 10 metric tons of CO<sub>2</sub>e (tCO<sub>2</sub>e) each year, which is the average across the EU (with most countries at between 7 and 15 tCO<sub>2</sub>e per capita). On average, Europeans emit less than half the greenhouse gases of North American or Australian citizens. Nonetheless, this level remains well above the global average of 7 tCO<sub>2</sub>e as well as the benchmark of 2, the average global per capita emissions consistent with a 2°C rise in temperature.<sup>14</sup>

Figure 2. World's largest greenhouse gas emitters, 2005, in percent



Source: World Resources Institute, World Bank staff calculations.

Despite unremarkable overall emissions levels, Poland's economy remains among the least carbon-efficient in the EU. In 2007, around 1.3 metric tons of CO<sub>2</sub>e were required to produce €1 million in GDP, while the EU average was less than 0.5 tCO<sub>2</sub>e. This high emissions-intensity of the economy is due partly to high amounts of CO<sub>2</sub> generated by the energy consumed but also to the high energy intensity of production in Poland. While in the EU on average, consumption of energy equal to one ton of oil equivalent<sup>15</sup> generates 2.5 metric tons of CO<sub>2</sub>, in Poland the same ratio is around 3.4 (Figure 3), despite the downward trend of carbon intensity in Poland over the last two decades. At the same time, energy used per million euros of GDP, at 400 tons of oil equivalent, greatly exceeds the EU-wide average of 169 (Figure 11) and stands at about the world average (Figure 4). Among transition economies, Poland's performance appears better: its carbon intensity on a per capita basis is situated in about the middle of the countries of Eastern and Central Europe and Central Asia (see Figure 5).

14 The Contraction and Convergence model developed by the Global Commons Institute estimates that to contain global warming to 2°C increase, which is typically associated in climate models with a CO<sub>2</sub>e concentration of 400-500 ppm, emissions per capita must come down to 2 tCO<sub>2</sub>e per capita by 2050. The Institute has advocated for an egalitarian sharing of emissions abatement costs under which every country brings emissions per capita to the same level.

15 Toe (ton of oil equivalent) is the amount of energy released by burning one ton of crude oil, approximately 42 GJ or 11.63 MWh (according to the IEA and OECD).

Figure 3. CO<sub>2</sub> intensity of energy use in Poland and EU27

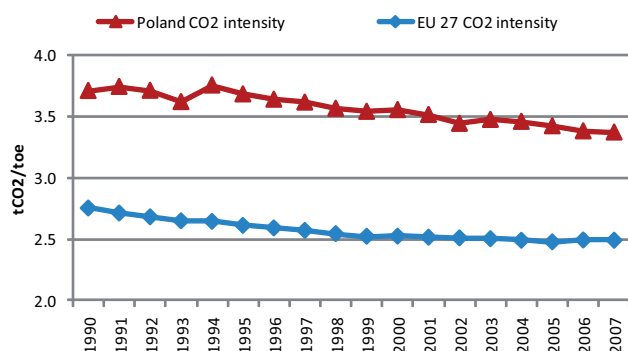
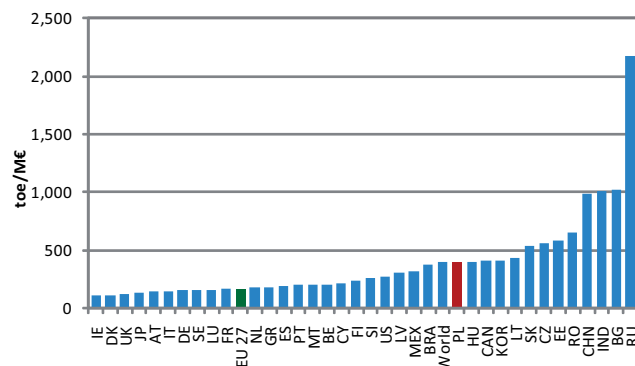
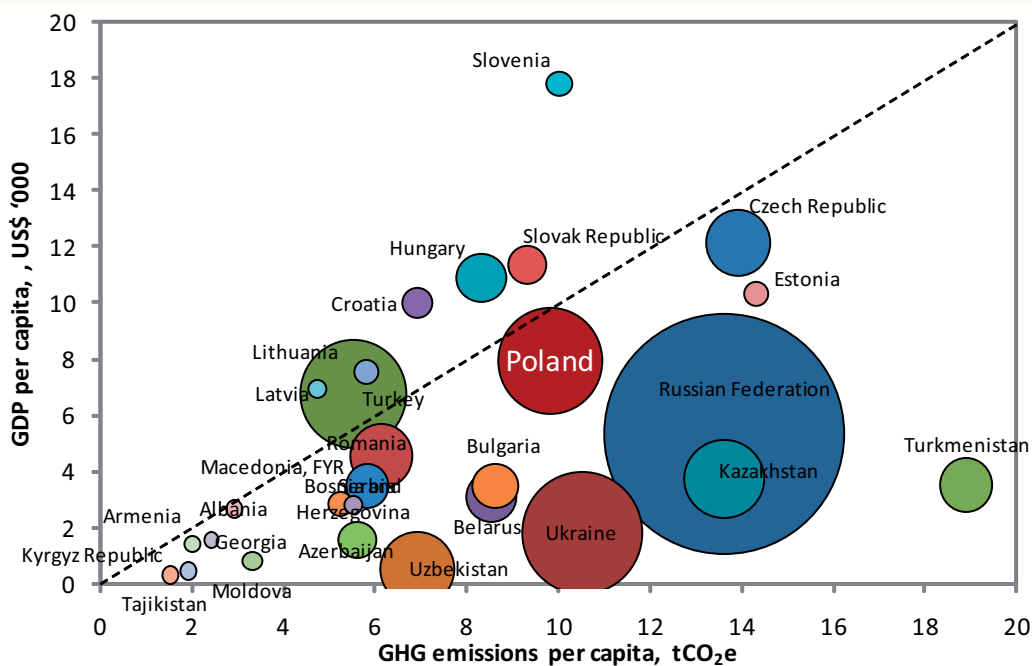


Figure 4. Energy intensity across countries, 2007 (toe/M€)



Note: CO<sub>2</sub> intensity is measure in metric tons of CO<sub>2</sub> per tons of oil equivalent consumed. Energy intensity is the ratio of gross inland consumption of energy (in toe, tons of oil equivalent) to GDP (in million euros at 2000 prices).  
 Source: European Commission, World Bank staff calculations.

Figure 5. Carbon intensity in Central and Eastern Europe and Central Asia, 2005



Note: Size of circle indicates total CO<sub>2</sub>e emissions for each country.  
 Source: World Bank staff calculations.

Poland's transition to a market economy had a co-benefit of sharply reduced carbon emissions. From 564 million metric tons of CO<sub>2</sub>e in 1988, greenhouse gas emissions collapsed along with output through 1990 (declining 20 percent), as inefficient, often highly energy-intensive plants shut down during the early years of transition. The period of 1996 to 2002 witnessed another 17 percent decline in emissions but while GDP expanded. Overall, although Poland's GDP near doubled during 1988 to 2008, its GHG emissions were reduced by about 30 percent. Nevertheless, during the last half decade or so, a more traditional positive correlation between GDP growth and GHG emissions has re-established itself. (See Table 1 and Figure 6).<sup>16</sup>

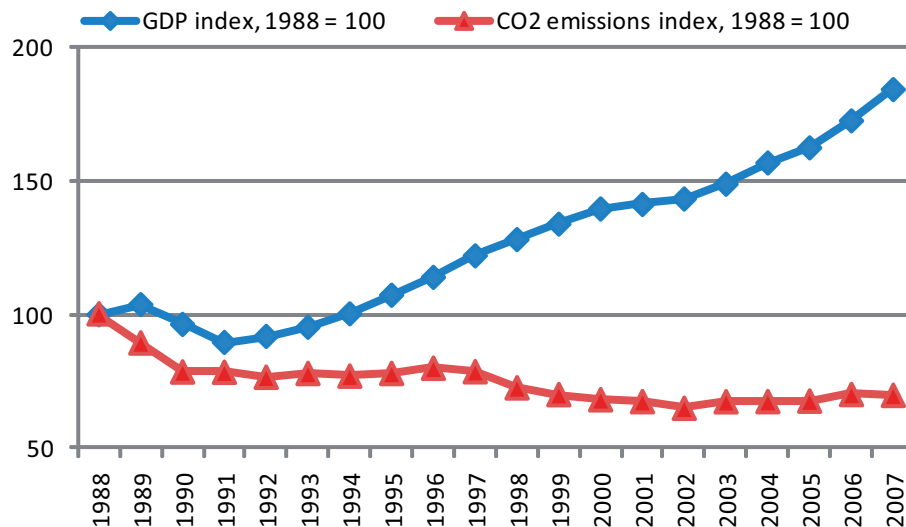
Table 1. Poland's greenhouse gas emissions, 1988, 2000, and 2008

Emissions, in MtCO <sub>2</sub> e	1988	2000	2008
GHG emissions (without LULUCF)	564.0	390.2	395.6
Net emissions/removals by LULUCF	-28.7	-24.5	-39.2
GHG net emissions with LULUCF	535.3	365.7	356.4
GHG emissions (without LULUCF)	1988 to 2000	2000 to 2008	1988 to 2008
Changes in emissions, %	-30.8	1.4	-29.9
Average annual growth rates, %	-3.0	0.2	-1.8

Notes: LULUCF is land use, land use change, and forestry.

Source: Fourth National Communication under the UNFCCC.

Figure 6. Economic growth and GHG emissions in Poland, 1988-2008



Source: World Resources Institute, UNFCCC, Central Statistical Office, World Bank staff calculations.

Poland's types and sources of greenhouse gas emissions resemble those for the rest of the EU except for the electricity sector. The breakdown of Poland's greenhouse gas emissions by type of gas show that its emissions are predominantly CO<sub>2</sub> (with a more than 80 percent share), with the EU overall at about the same level. Compared with the rest of the world, emissions from agriculture are less important in the EU and in Poland. One point of departure from the EU and even from the EU10<sup>17</sup> is Poland's greater emissions from the electricity and heat sector (Figure 7 and Figure 8).

<sup>16</sup> Net emissions removals by land use, land use change, and forestry (LULUCF) are shown in Table 1. Because they are not a central issue for Poland and because consistent cross-country measurement of LULUCF remains under discussion, the remainder of this report considers emissions without LULUCF.

<sup>17</sup> The EU10 consists of Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

Figure 7. GHG emissions by gas, 2007

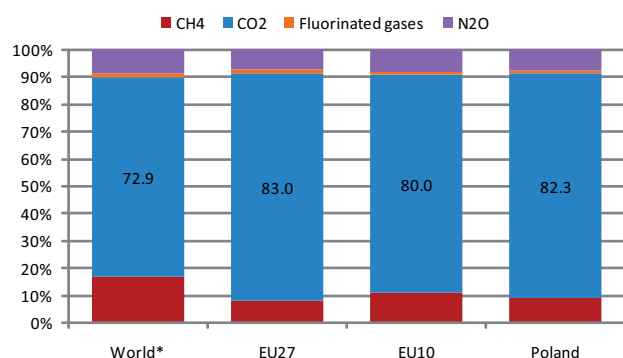
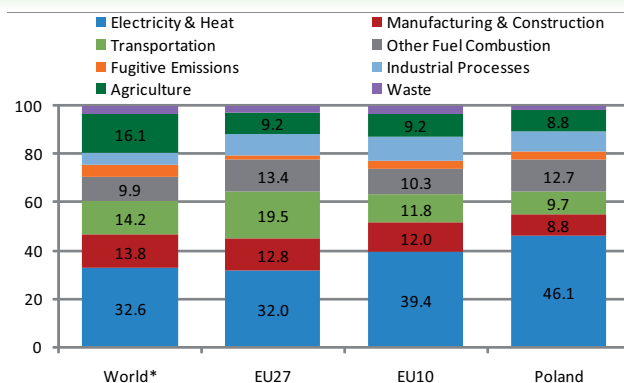


Figure 8. GHG emissions by sector, 2007



Note: \*world data from 2005.

Source: World Resources Institute, European Commission, World Bank staff calculations.

Poland's energy mix is dominated by coal to such an extent that it is an outlier in both Europe and globally. In contrast to the EU overall or even to the EU10, in Poland solid fuels (coal and lignite) constitute 57 percent of gross inland energy consumption (Figure 9). The share of natural gas (13 percent) and renewable energy (5 percent) are significantly below the EU15 and EU10. Also, Poland is one of 11 countries in the EU and one of 3 countries in the EU10 with no energy generated by nuclear power plants. Poland's dependence on domestically available coal is one of the highest in the world. Over 90 percent of electricity in Poland is generated from coal and lignite (Figure 10), which is the highest share in the EU.

Figure 9. Energy consumption by fuel, 2007

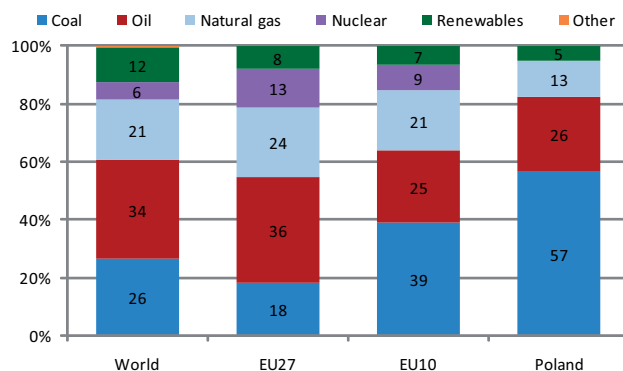
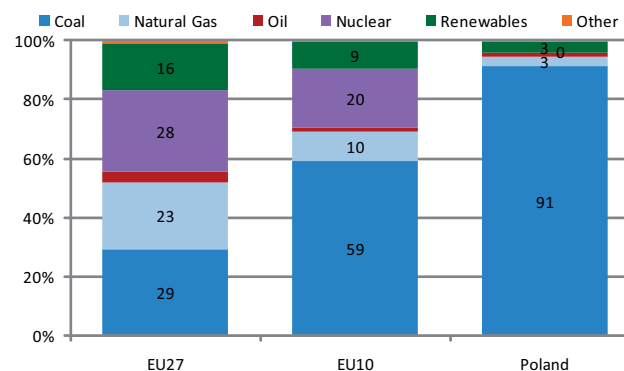


Figure 10. Electricity generation by fuel, 2007



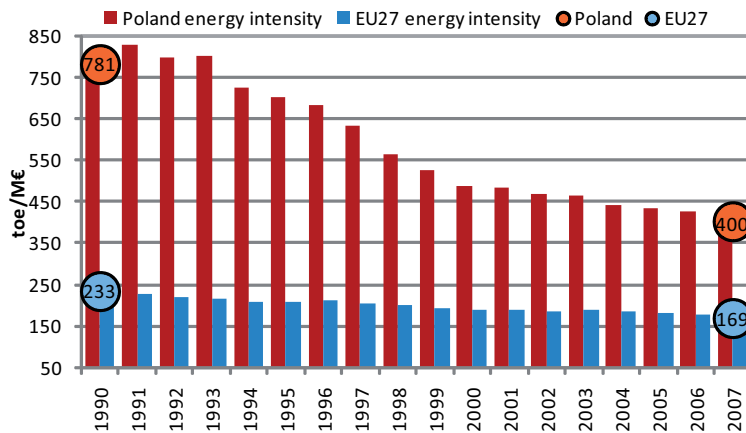
Note: Energy consumption is gross inland consumption of energy.

Source: European Commission, World Bank staff calculations.

Poland has made considerable advances in energy efficiency in the past 20 years; yet further efforts are required to bring it to Western European standards. Per unit of GDP, Poland's economy is still more than twice as energy intensive as the EU average.<sup>18</sup> Advances in energy efficiency, which were dramatic during 1988 to 2000, have slowed during the most recent decade (see Figure 11). Consumption of energy per € of GDP has fallen by half during 1990 to 2007, from 781 tons of oil equivalent required for every hundred million euros of output to 400. From a level of energy intensity 3.4 times higher than the EU average, Poland as of 2007 stands 2.4 times above the EU.

18 Alternative statistics, using GDP adjusted for purchasing power parity, as reported by the IEA, suggest a smaller gap between Poland's and Western European energy intensity of about 30 percent.

Figure 11. Energy intensity in EU27 and Poland, in toe/M€

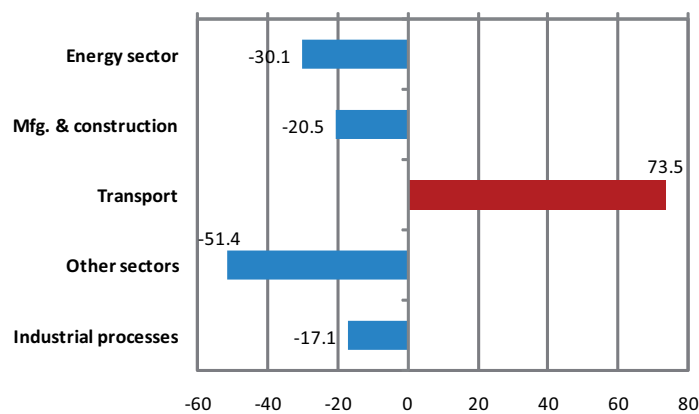


Note: Energy intensity is the ratio of gross inland consumption of energy (in toe, tons of oil equivalent) to GDP (in millions of euros at 2000 prices).

Source: European Commission, World Bank staff calculations.

While the energy sector currently dominates Poland's emissions profile, emissions from the transport sector have been growing at a high rate. Energy sector emissions have fallen by one-third since 1988, although the sector still produces near half of the country's greenhouse gases. Transport, on the other hand, while constituting about 10 percent of overall GHG emissions has grown by almost three-quarters since transition. Moreover, Poland still has relatively low rates of motorization, which argues that the growth of road transport will likely be high going forward. Further complicating the picture is the very high share of used vehicles, which tend to be much more fuel inefficient and polluting (see Figure 12).

Figure 12. Change in GHG emissions by key sector, 1988 to 2006, in percent



Note: Industrial processes emissions consist of by-product or fugitive emissions of greenhouse gases, excluding emissions from fuel combustion.

Source: UNFCCC, Greenhouse Gas Inventory, 2006.

The level and structure of Poland's greenhouse emissions will be important as the next sections lay out the challenges of moving towards a lower carbon growth path. Poland's overall carbon intensity of GDP, the sectoral composition of emissions, its dependence on coal, and its progress to date will all be important factors in assessing the economic costs of abatement. The combination of large energy and carbon efficiency gaps in Poland and huge investment requirements in energy, infrastructure, and housing suggests there is a substantial scope for climate-smart policy choices that would likely yield benefits regardless of climate developments.