AGH

UCZELNIA BADAWCZA
INICJATYWA DOSKONAŁOŚCI

Poland in the light of global methane emissions

Poland ICE-CMM
Operating under auspices of the UNECE Group of Experts on Coal Mine Methane

UNECE

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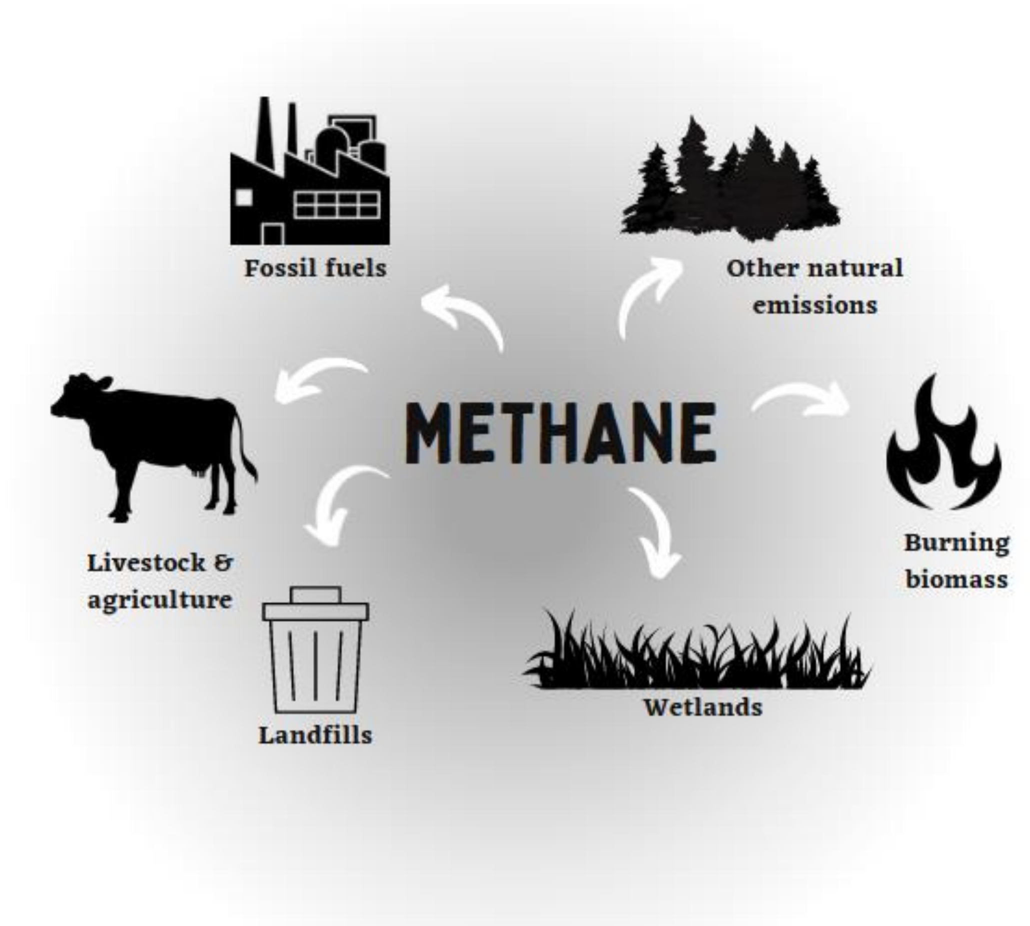
Introduction

- Methane (CH_4) is one of the most dangerous anthropogenic GHG besides carbon dioxide.
- The GWP factor is about 84 (in a 20-year perspective).
- Reducing methane emissions may be the fastest solution to slow down the rate of global warming.



Total methane emissions in the world

- Methane sources can be divided into natural, such as wetlands and peat bogs, and those associated with human activity.
- Most global anthropogenic emissions come from agriculture, the fossil fuel industry, and waste management.

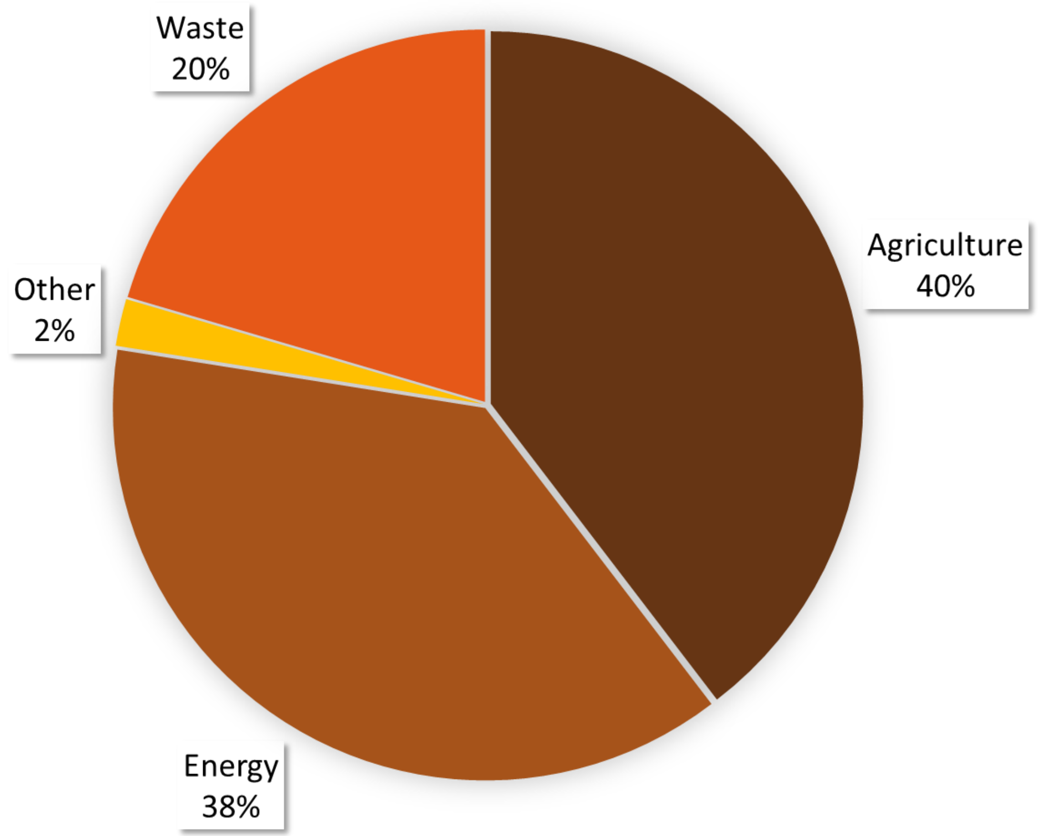
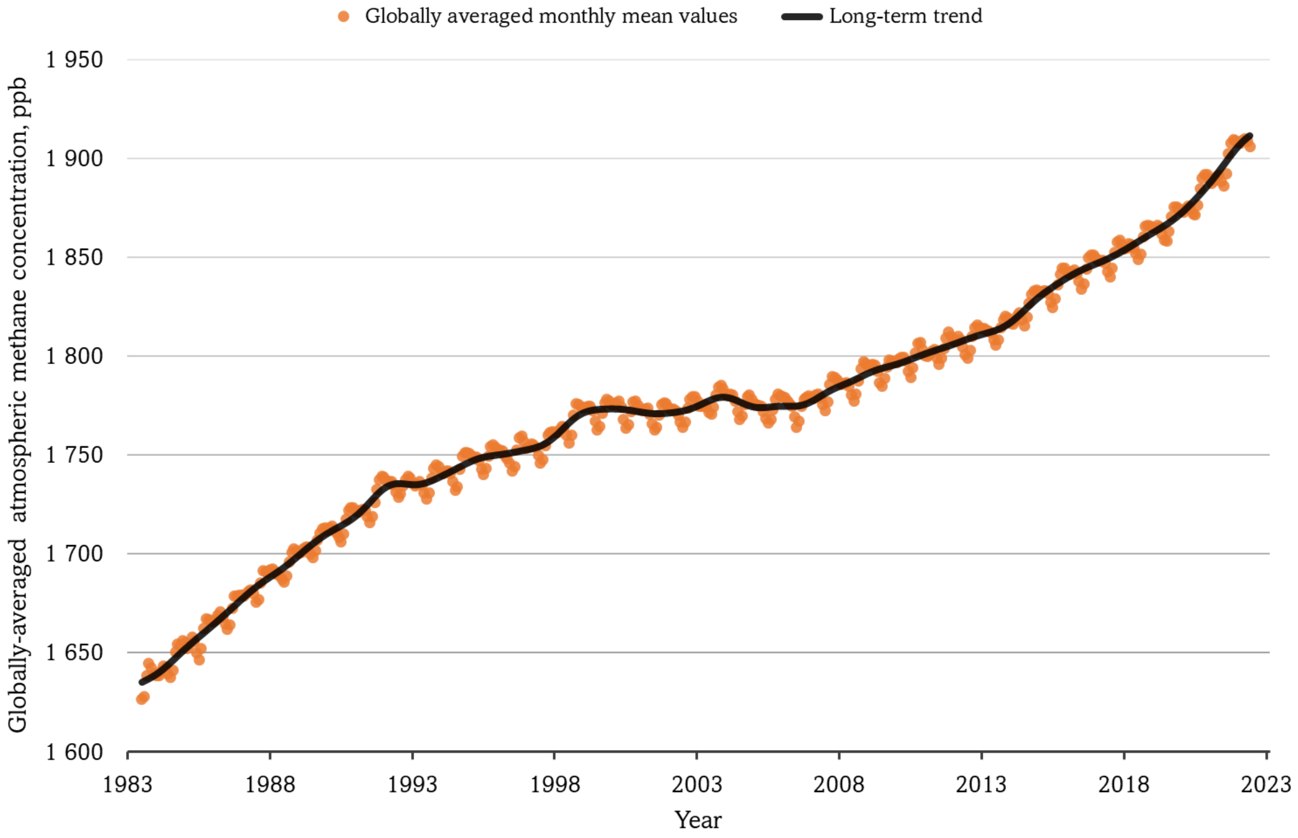


Figure 1. Summary of methane emissions from anthropogenic sources by main sectors for 2020. Based on data from the International Energy Agency (2022) Methane Tracker Database – IEA.

Total methane emissions in the world

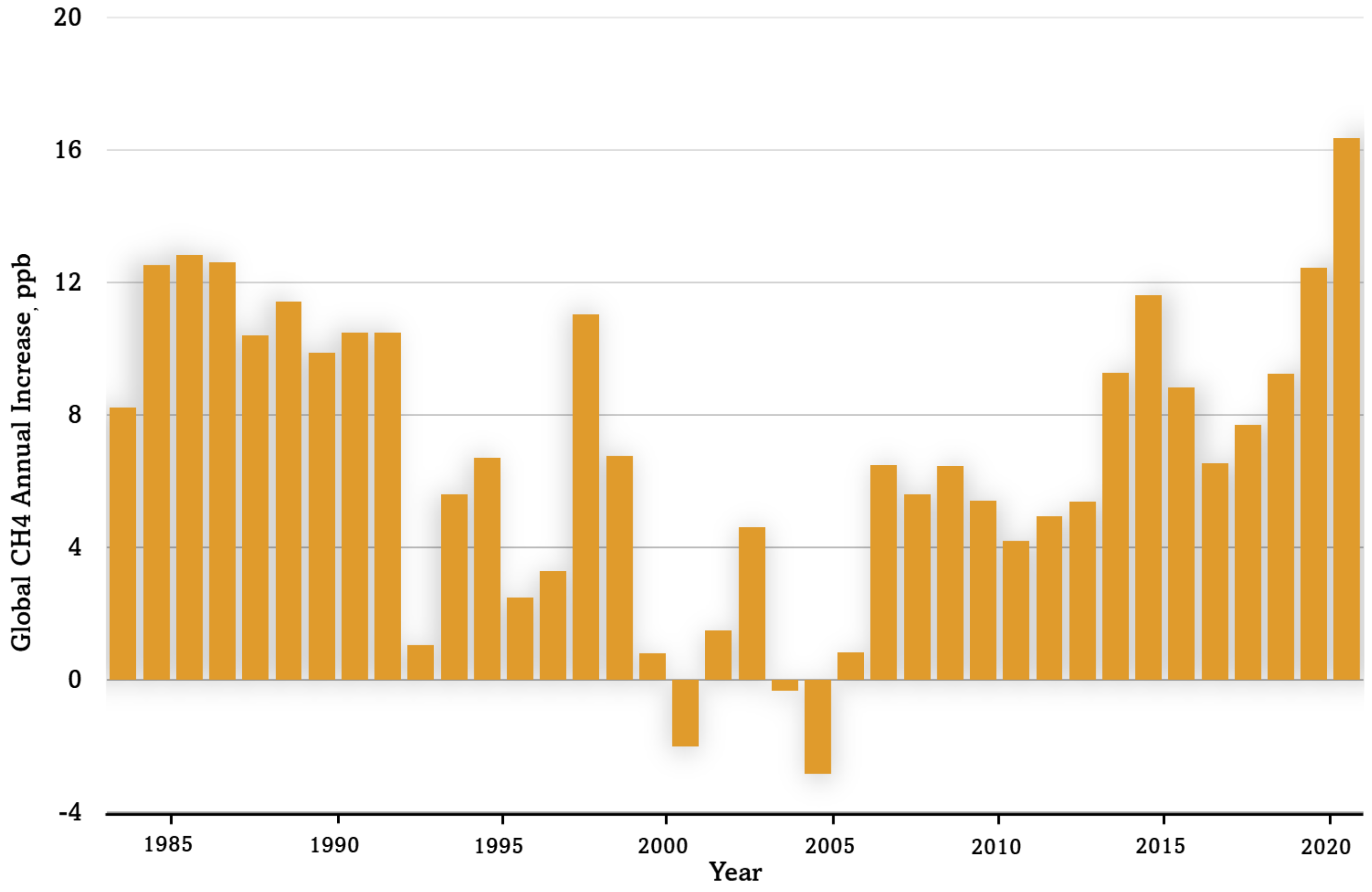


Wykres 2. Wykres 2. Globally-averaged, monthly mean atmospheric methane abundance determined from marine surface sites in 1983-2022, ppb (parts per billion). Based on data from NOAA/ESRL.

- After stagnating in 1998-2008, atmospheric methane concentrations are rising again.
- According to data from NOAA, emissions of this gas from the beginning of the industrial revolution to today have increased by about 160%.

Total methane emissions in the world

- According to the WMO and NOAA, the methane concentration in the atmosphere in 2021 recorded the highest year-on-year increase since measurements began forty years ago.



Wykres 3. Annual increases in atmospheric CH4 based on globally averaged marine surface data. Based on data from NOAA/ESRL.

Total methane emissions in the world

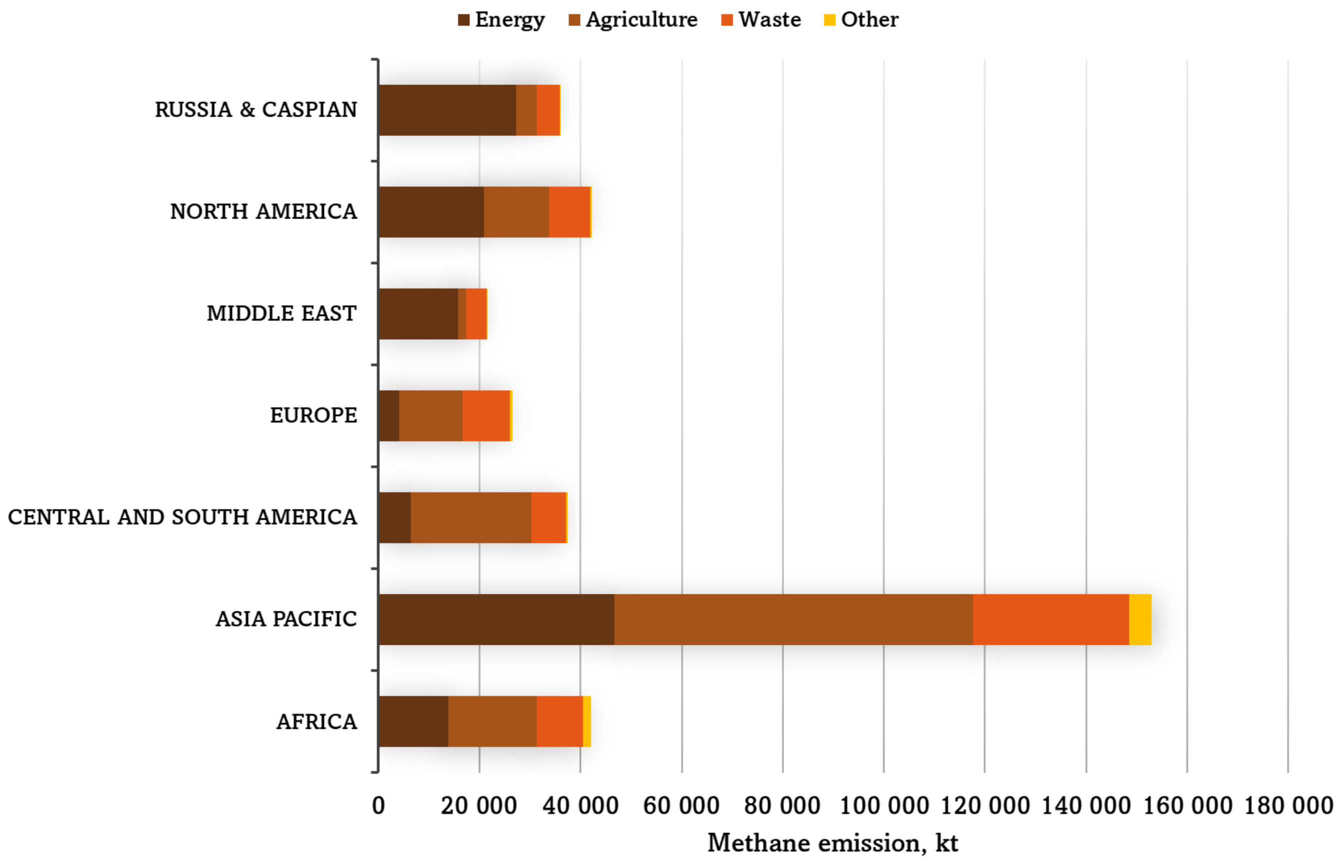
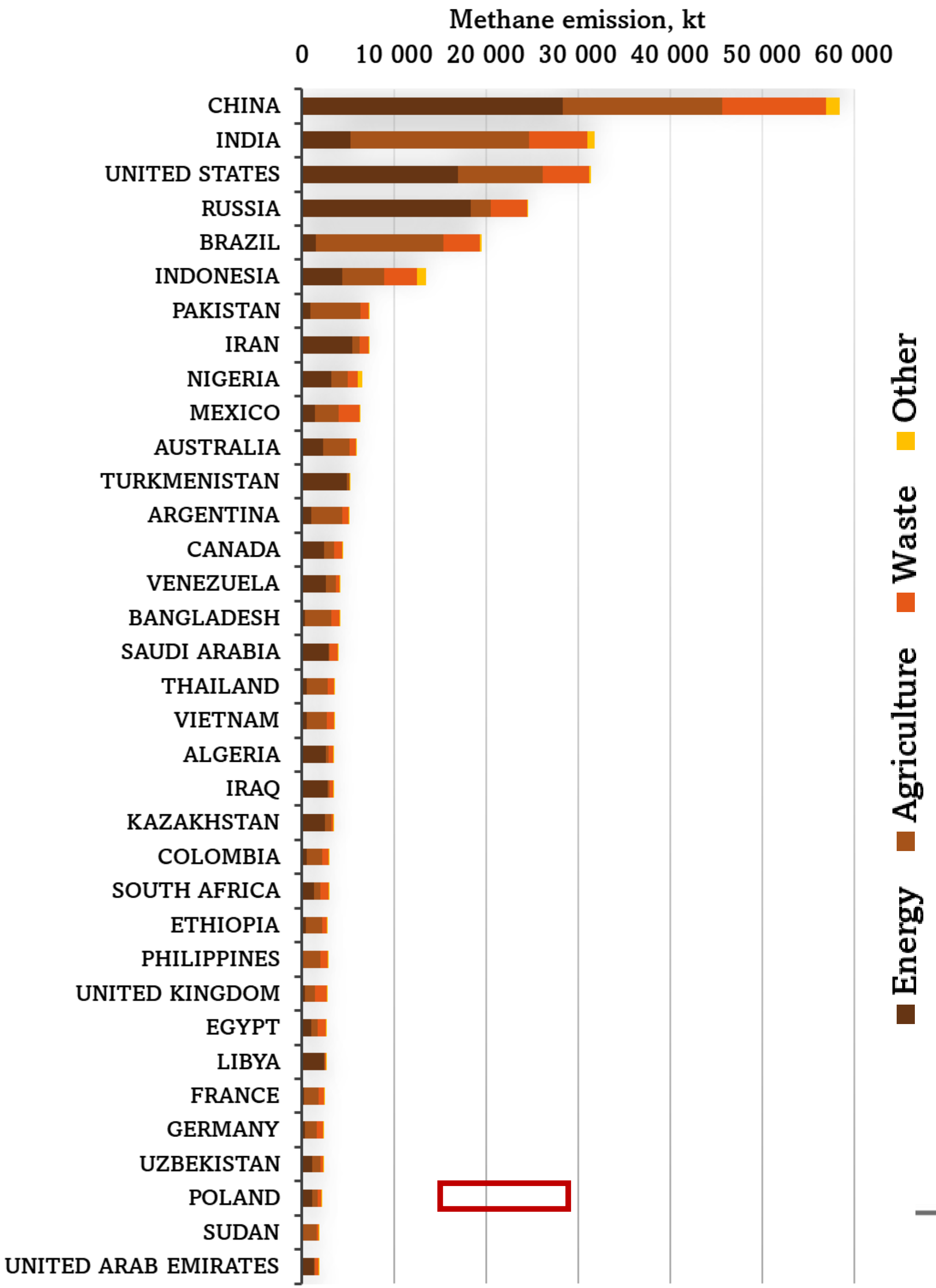


Figure 4. Methane emissions by region, broken down by sector. Based on data from the Methane Tracker Database – IEA (2022).

- The highest emission level among the analyzed areas was recorded in the Asia-Pacific region.
- Less than 50% of agricultural methane emissions come from the Asia-Pacific region.

Total methane emissions in the world

Figure 5. Countries with the highest methane emissions. Based on data from the International Energy Agency (2022) Methane Tracker Database – IEA.



Total methane emissions in the world

- The world's top five methane emitters (of all types of sources) are China, India, the United States, Russia, and Brazil. Together, they account for almost half of all methane emissions worldwide.

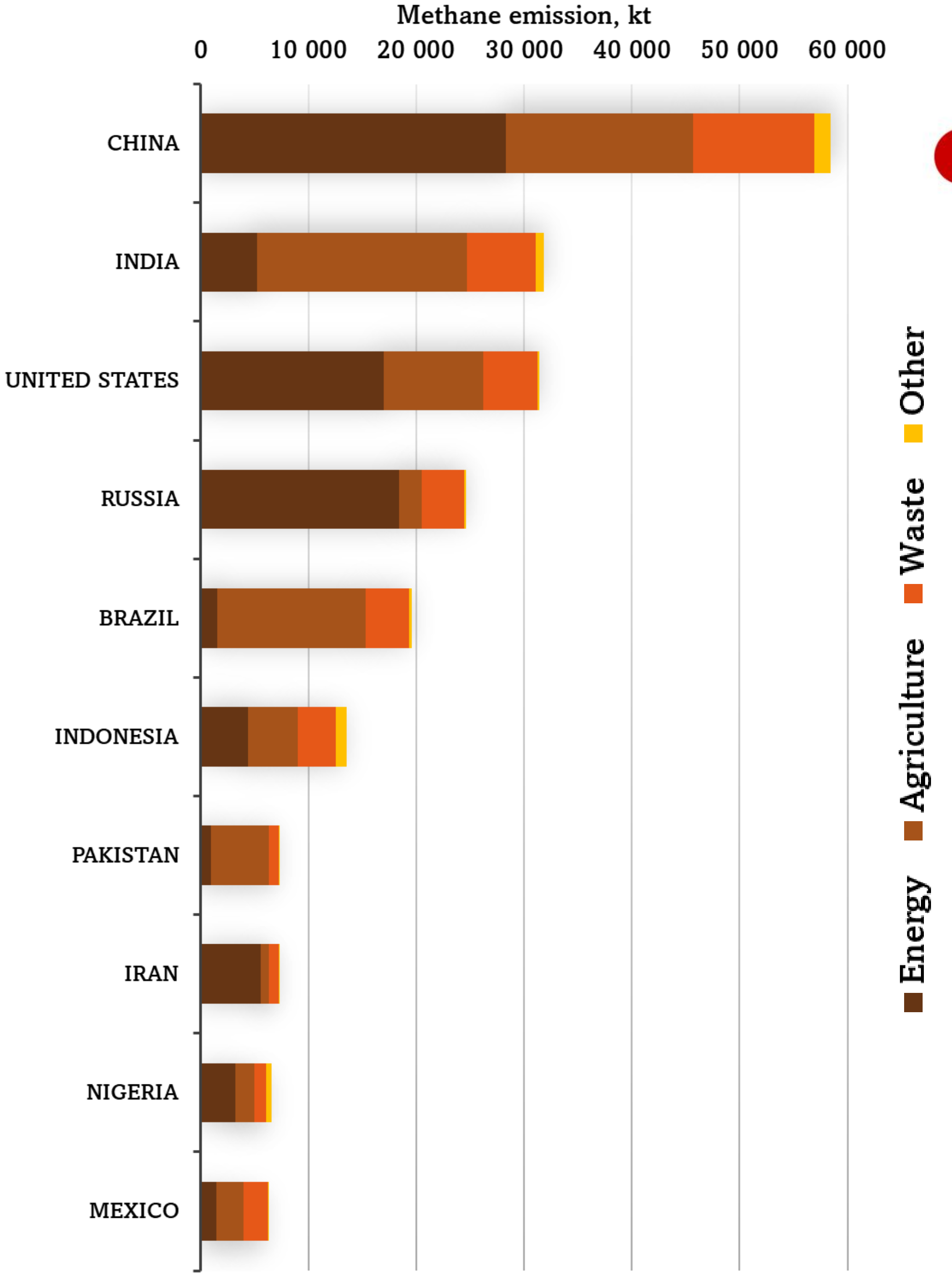


Figure 6. Ten countries with the highest methane emissions. Based on data from the International Energy Agency (2022) Methane Tracker Database – IEA.

Total methane emissions in the world

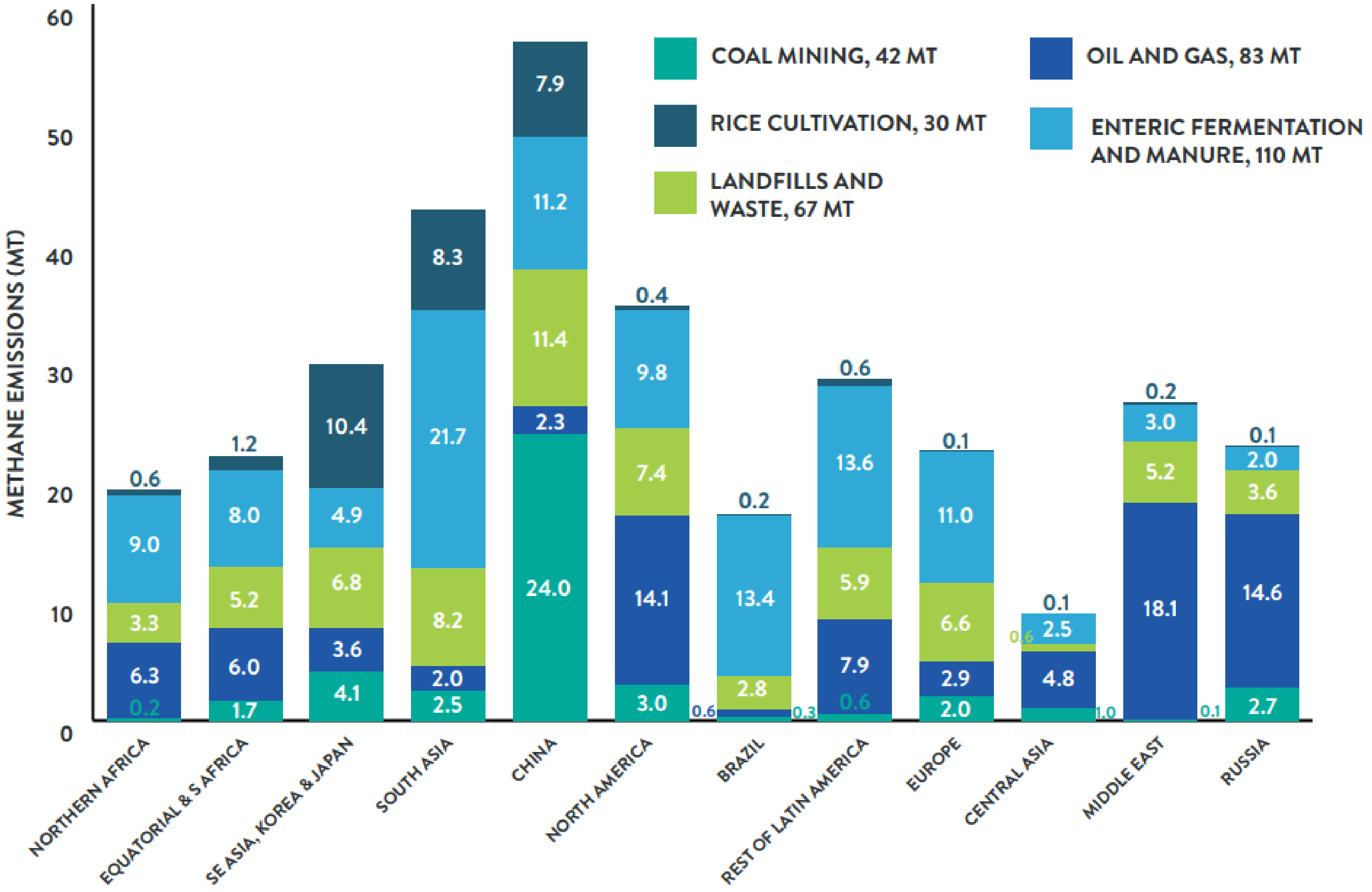


Figure 7. Estimated annual sectoral methane emissions by region and total global sectors, excluding Oceania, 2017, million tonnes

Methane emissions related to the mining sector in the world

- In the energy sector, methane leaks occur in fossil fuel production, processing plants, and transmission and distribution systems.
- Some of the emissions from the fossil fuels sector result from failures (e.g., leaks in installations) and are accidental. Methane is also released into the atmosphere intentionally, e.g., for safety reasons.

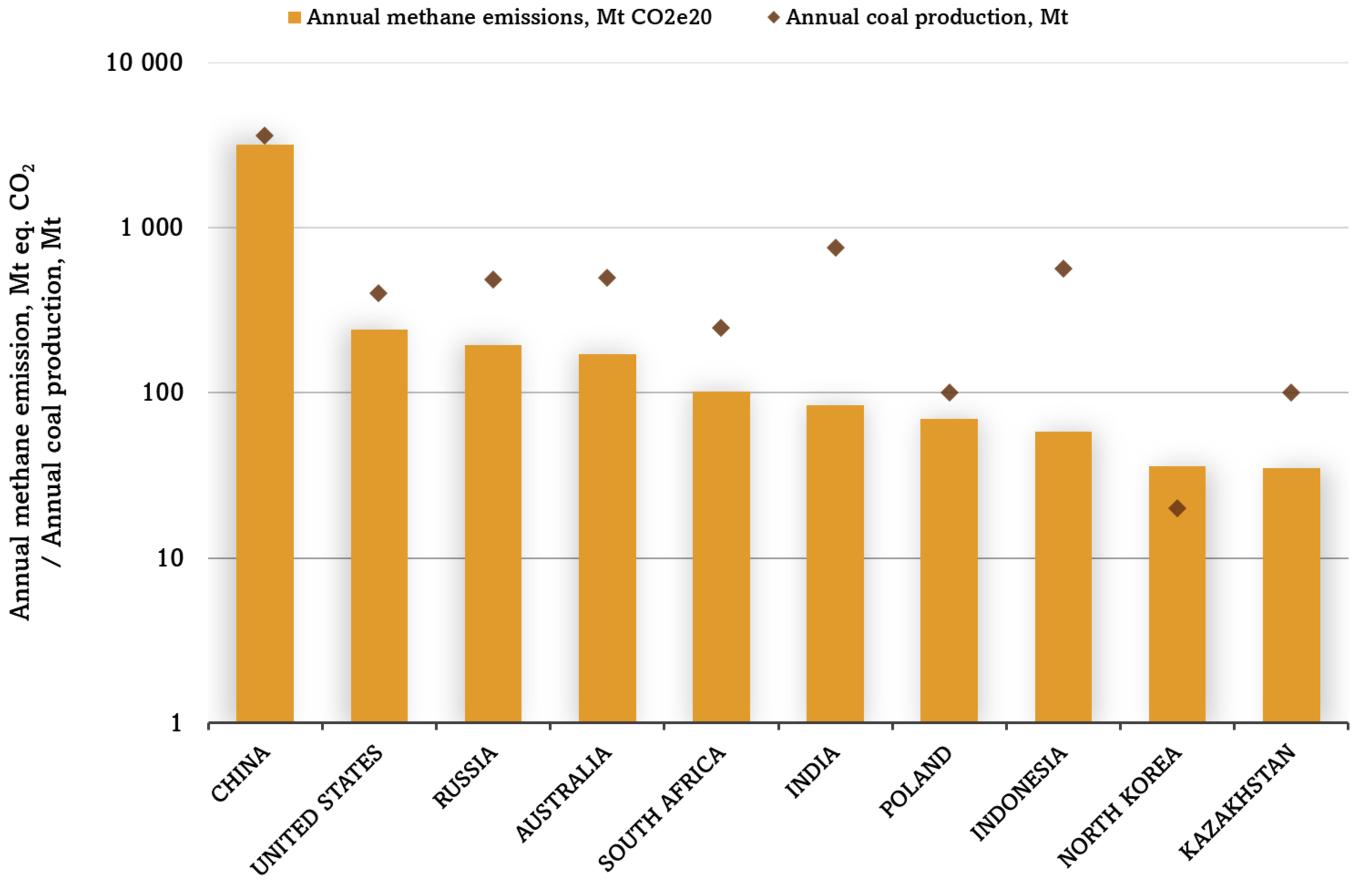


Figure 8. Ranking of countries with the highest emissions from operating coal mines. Based on data from the Global Energy Monitor.

Methane emissions related to the mining sector in the world

- The world's coal bed methane resources are naturally located in regions rich in hard coal deposits.
- According to EPA forecasts, coal mining will account for approximately 10% of global methane emissions in 2030. These emissions mainly come from key coal-producing countries, including China, Russia, the United States, India, and Australia.

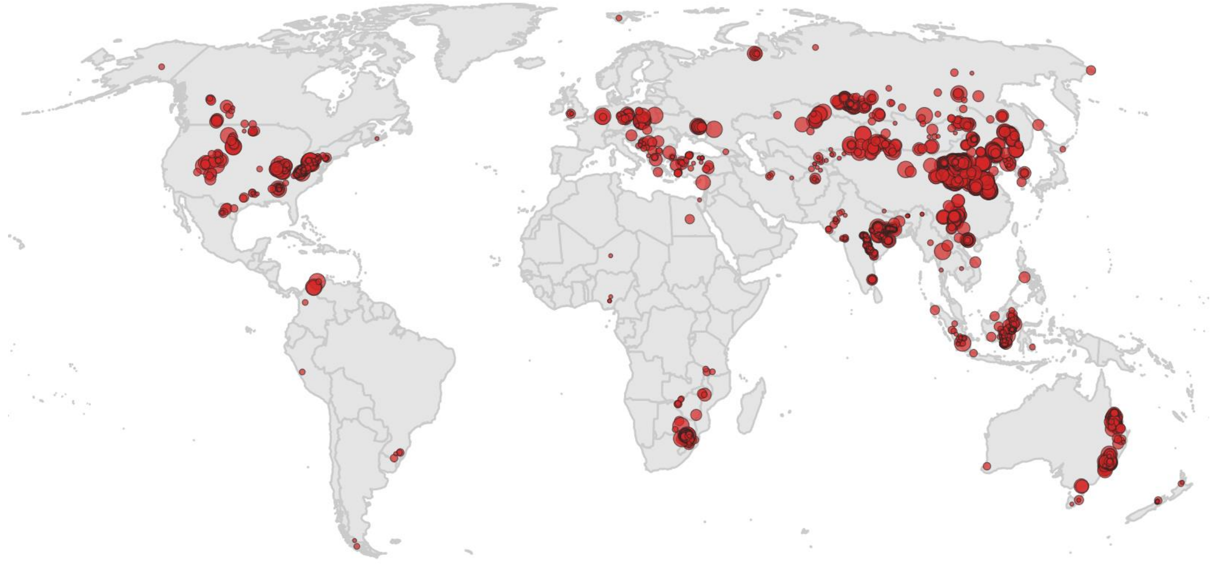


Figure 9. Global methane emissions from active coal mines (red dots represent methane emissions from coal mines scaled to emissions in millions of cubic meters per year). Source: Global Energy Monitor.

Methane emissions related to the mining sector in the world

- EU methane emissions decreased by 36% between 2020 and 1990.
- The largest reduction was observed in the energy supply sector, which includes energy and fugitive emissions (-65%), waste (-37%), and agriculture (-21%).

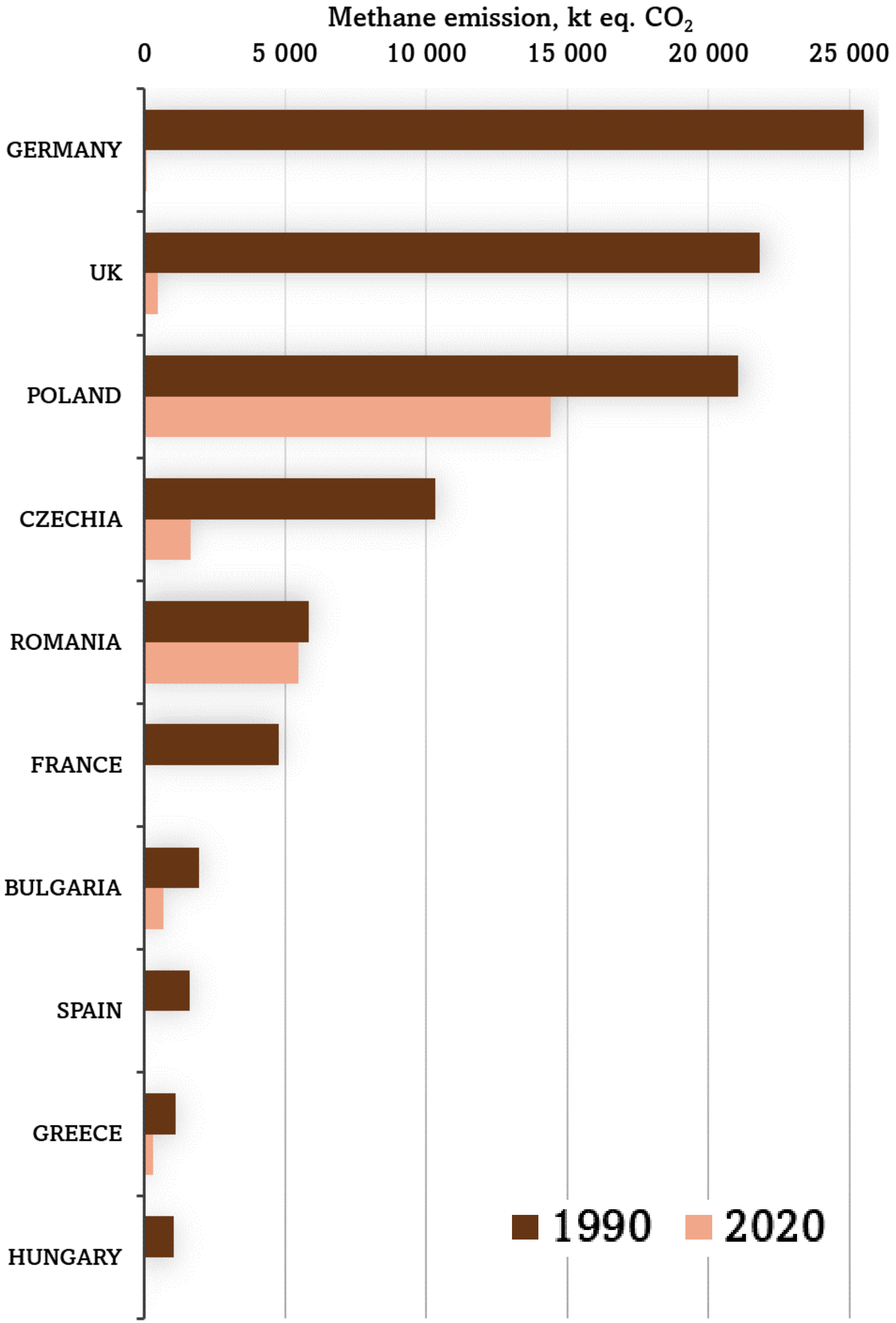


Figure 10. Total emissions from coal mining in 1990 and 2020 for the ten countries in the EU-KP with the highest emissions. Based on data from the Annual European Union greenhouse gas inventory 1990–2020 and inventory report 2022 .

Methane emission in Poland

- Total annual emissions in 2020 amounted to 1,774.23 kt, i.e., 44,355.80 kt. CO_2.
- Emissions in 2020 compared to 1988 decreased by 39.7% and by 0.4% compared with data from 2019.

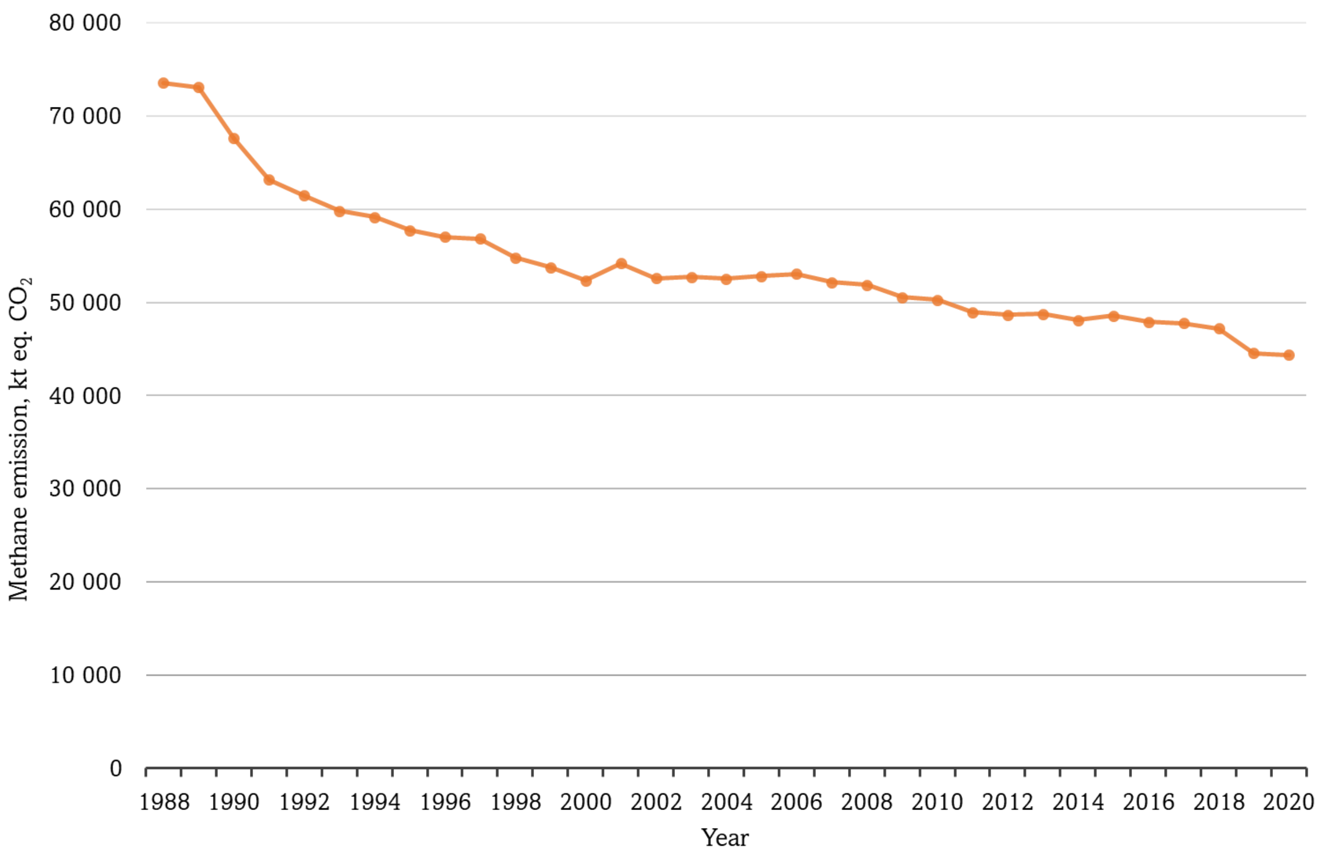


Figure 11. Change in methane emission level in Poland in 1988-2020. Based on data from the National Inventory Report 2022 - Synthetic Report.

Methane emission in Poland

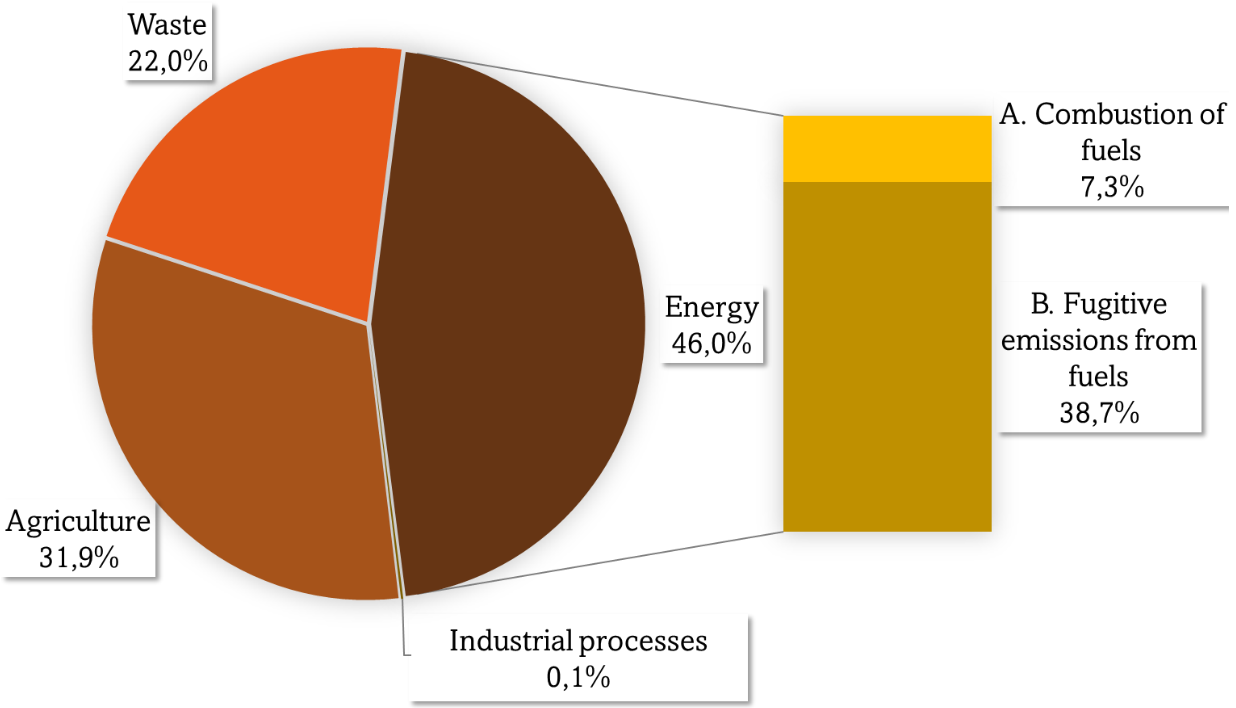


Figure 12. Summary of methane emissions from anthropogenic sources in Poland by main sectors. Based on data from the National Inventory Report 2022 - Synthetic Report.

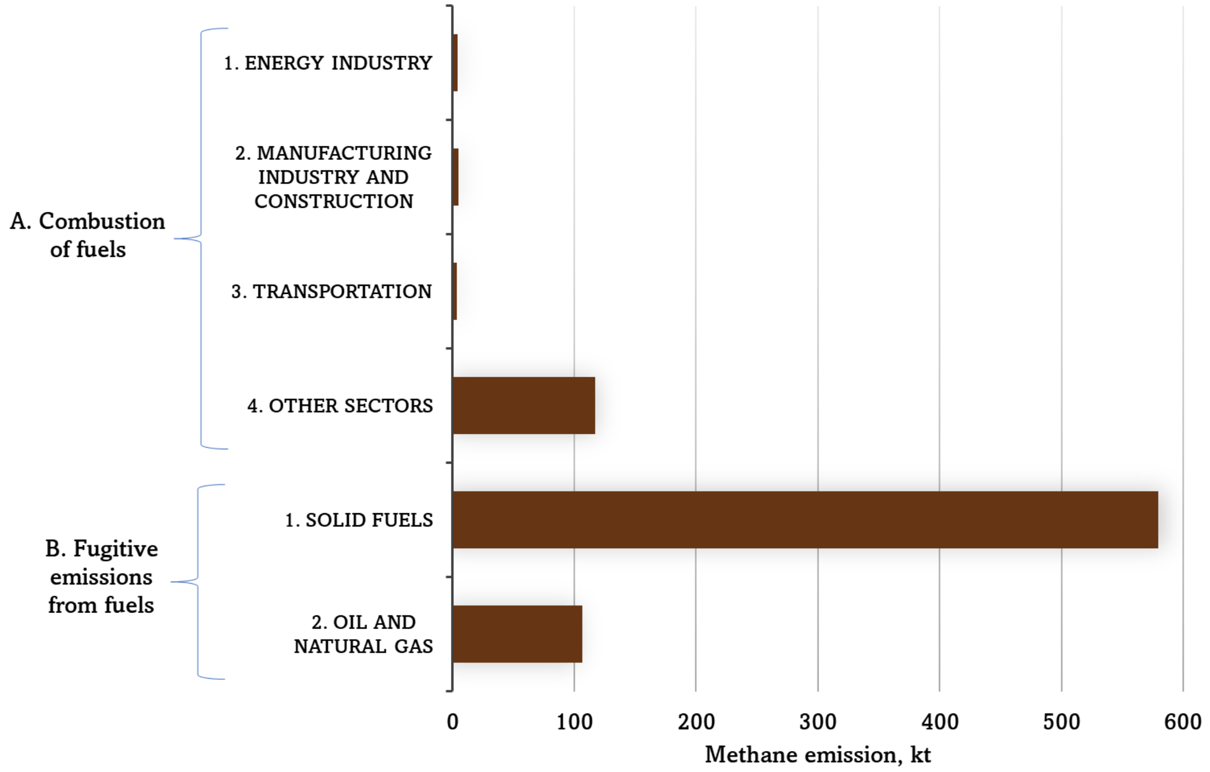


Figure 13. Summary of methane emissions related to the energy sector in Poland for 2020. Based on data from the National Inventory Report 2022 - Synthesis Report.

Methane emission in Poland

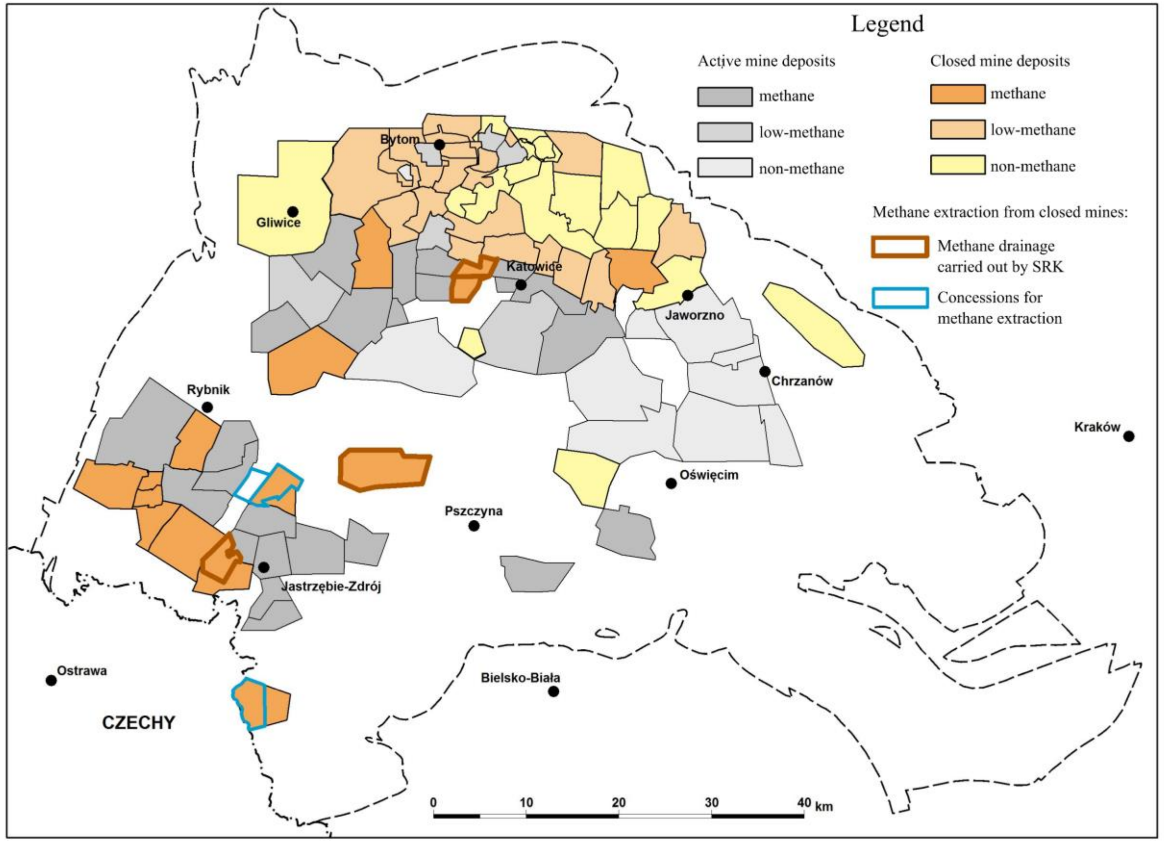


Figure 14. The methane-bearing capacity of hard coal mines in the Upper Silesian Coal Basin, according to the data of the State Mining Authority.

- Out of 21 active mines, only five mines operate in non-methane conditions (as of 2021). Most of them are heavily methane mines, which must be methane-drained for operational safety reasons.
- Coal bed methane is not subject to industrial exploitation. It is still a waste accompanying mining activities, with a high risk to the safety of mining and recovery to a small extent (mainly for the needs of mines).

Methane emission in Poland

Table 1. Methane emissions in various countries with information on the country's percentage share in global emissions - for total emissions and emissions related to the energy sector.

No.	Country	Emission			
		Total, kt	% in total	Energy sector, kt	% in Energy
1	China	58443,90	16,4%	28326,87	20,9%
2	India	31840,99	8,9%	5237,81	3,9%
3	United States	31459,73	8,8%	16986,76	12,6%
4	Russia	24593,39	6,9%	18392,31	13,6%
5	Brazil	19556,65	5,5%	1547,46	1,1%
6	Indonesia	13516,58	3,8%	4413,79	3,3%
7	Iran	7263,13	2,0%	5527,37	4,1%
8	Nigeria	6534,20	1,8%	3233,70	2,4%
9	Mexico	6330,53	1,8%	1465,99	1,1%
10	Australia	5920,05	1,7%	2345,94	1,7%
			…		
21	Poland	2159,58	0,6%	1113,54	0,8%
	World	**356889,12**	**100,0%**	**135231,72**	**100,0%**

Sector	Emission	
	Total, kt	% of World
Steam coal	383,89	1,37%
Coking coal	175,07	1,46%
Other from coal	431,55	12,04%
Bioenergy	44,44	0,46%
Gas pipelines and LNG facilities	37,65	0,34%
Onshore oil	4,18	0,01%
Offshore oil	1,48	0,02%
Onshore gas	18,02	0,09%
Offshore gas	0,09	<0,01%
Other from oil and gas	17,17	0,69%

What's next?

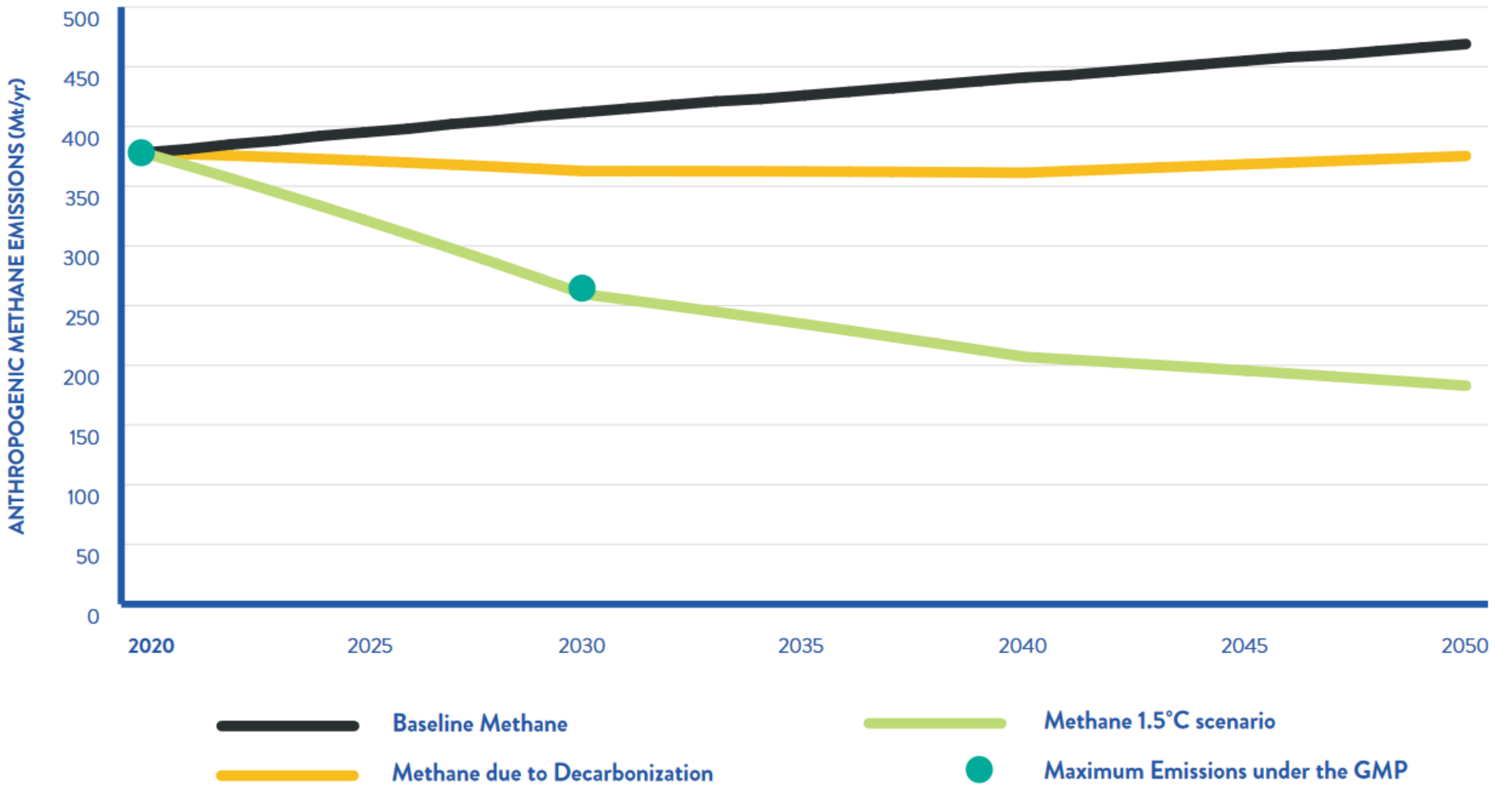


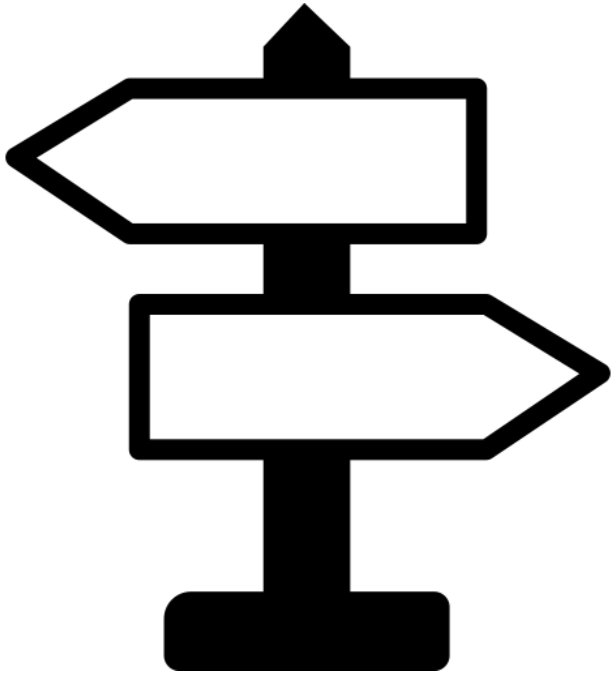
Figure 15. Methane emissions according to 1) baseline projections, 2) deep decarbonization and phase-out of fossil fuels scenario, 3) complete 1.5°C scenario. The green dot shows a 30 percent reduction in emissions in 2030 compared to 2020 values (Global Methane Pledge minimum target) [UNEP, 2022].

According to the GMA 2030 Baseline Report:

- Base value as emissions of 380 Mt in 2020 and projected growth in 2020-2030 of 34 Mt per year (from 25 to 49).
- The scenario of full reduction of methane emissions is based on percentage reductions in the 1.5°C scenario.
- Deep decarbonization scenario – mainly in the form of reduced fossil fuel consumption, which based on analyzes will account for 30% of the 1.5°C scenario.

Directions of action

- EU plans to reduce methane emissions in the energy sector:
  - Implementation of the rules for measuring and reporting methane emissions;
  - Improving gas infrastructure by limiting leaks;
  - Utilization of methane, including minimizing combustion of undeveloped or unmanageable gas in flares;
  - International cooperation in the field of methane emission reduction, including with non-EU countries that are fuel suppliers.



The future of methane emissions in Poland

1. Inventory of methane emission sources from active and closed mines;
2. Developing a measurement methodology and creating a measurement system to monitor methane emissions;
3. Introduction - for the entire supply chain - of standards for the detection and reduction of methane emissions;
4. Preparation of legal regulations related to methane emissions, including in active and inactive hard coal mines;
5. Reporting of methane emissions from active and closed mines;
6. Tools for verifying methane emissions from active and closed mines;
7. Strategy for reducing emissions and managing captured methane.

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