

# Energizing the Electricity Market for Methane

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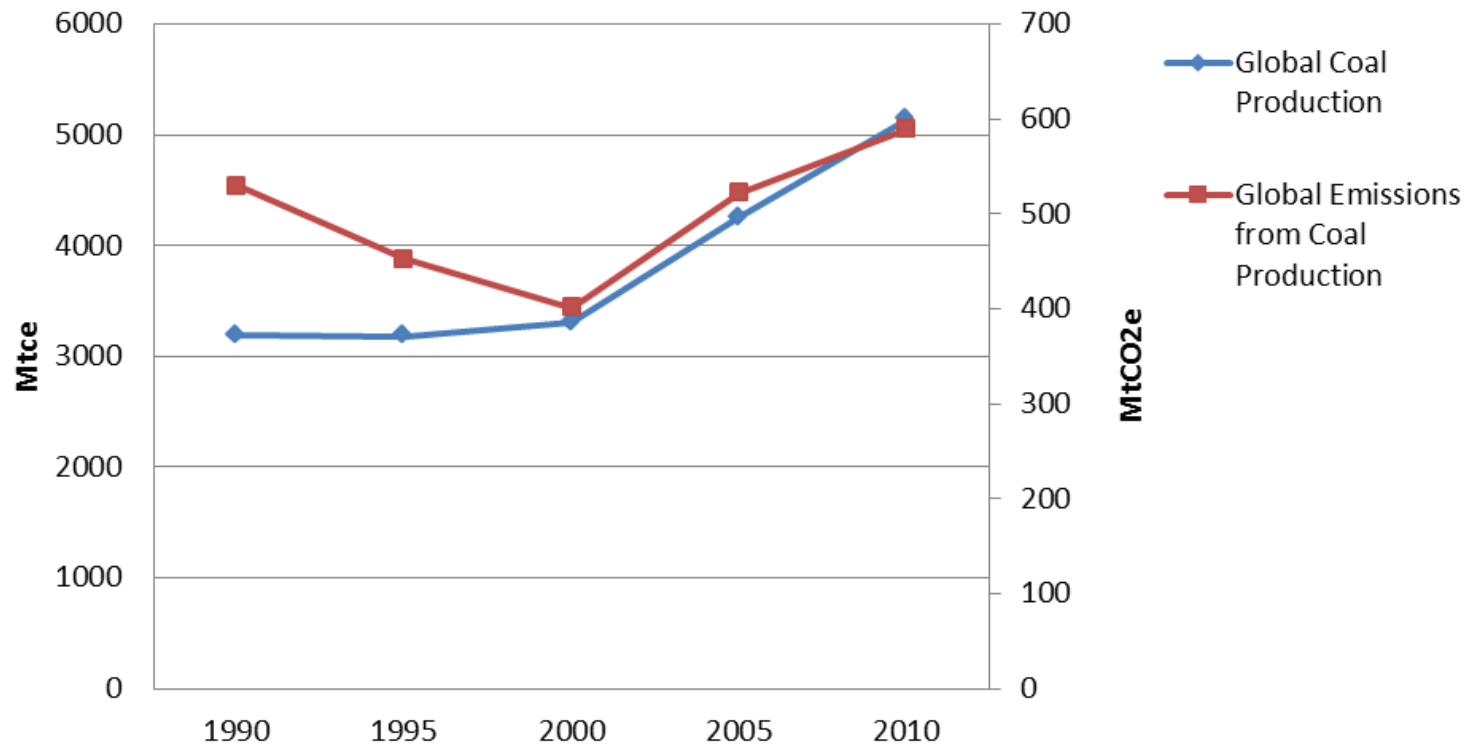
- ▶ Methane emissions and coal production
- ▶ Coal mine methane (CMM) and the electricity sector
- ▶ Selling to the grid
- ▶ Case studies:
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  - Ukraine
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- ▶ Policy recommendations for increased utilization of CMM for electricity



# Methane Emissions and Coal Production



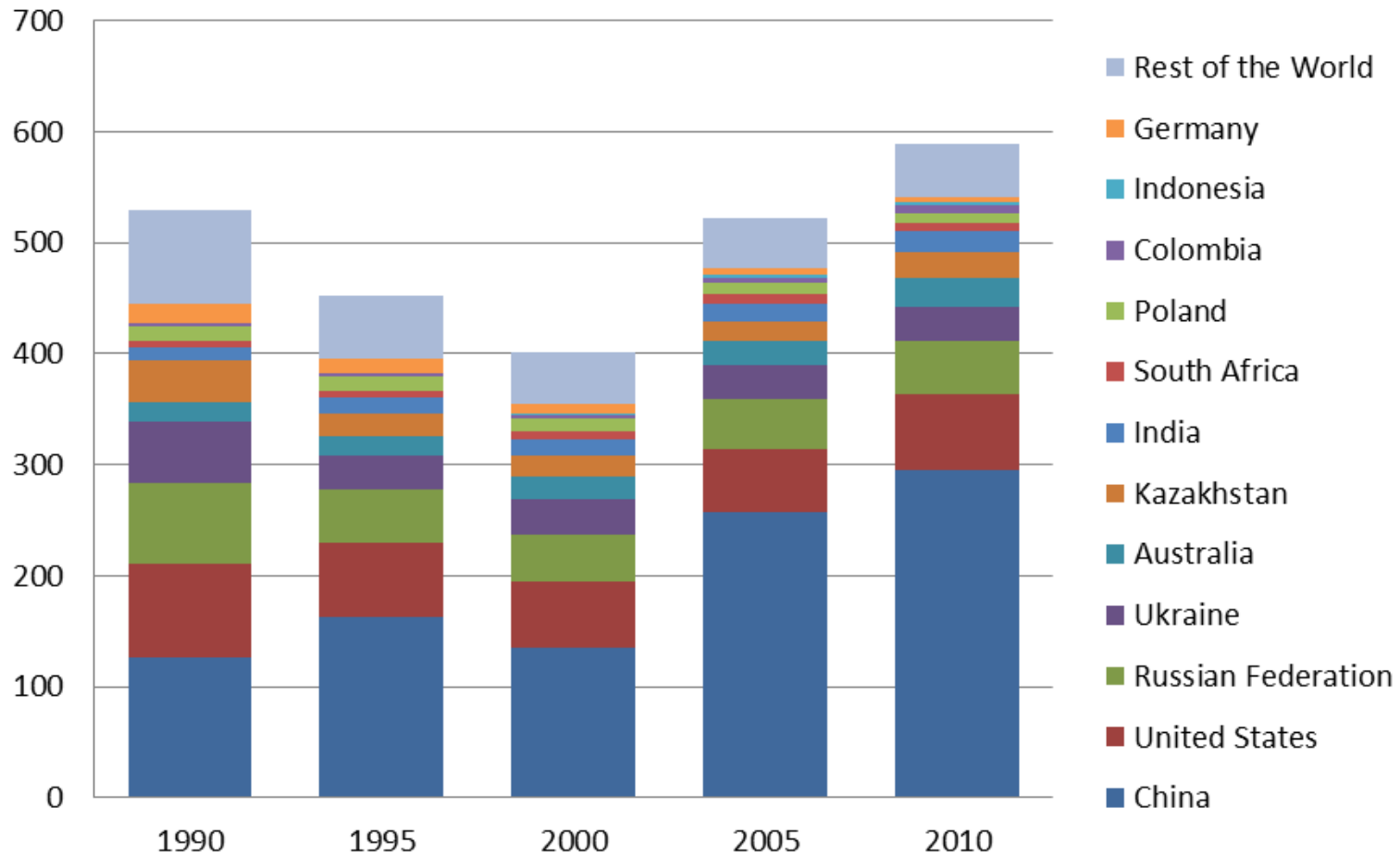
# Methane Emissions and Coal Production



(Source: Data from USEPA 2011 and IEA 2012).



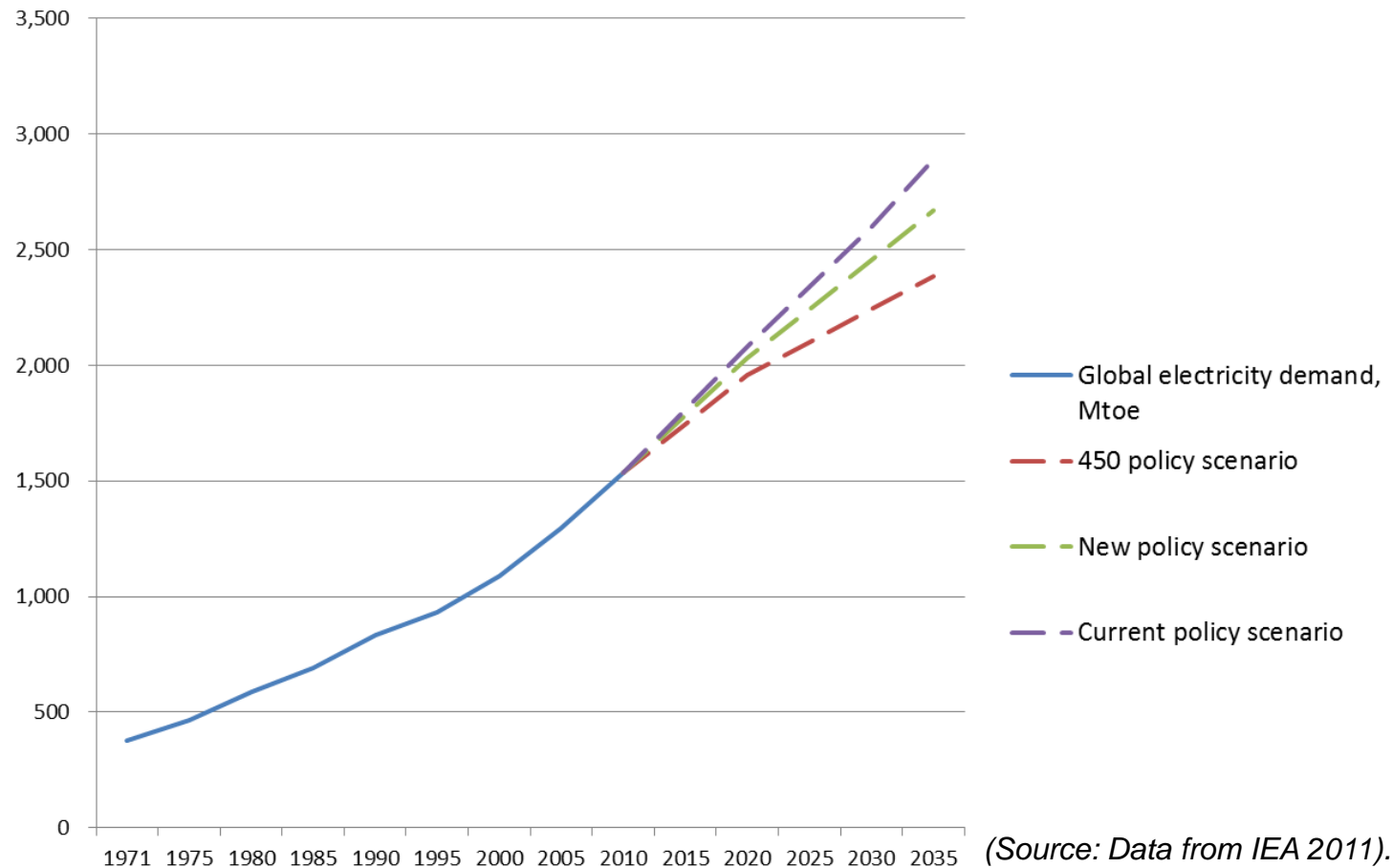
# Trends in CMM Emissions



(Source: Data from USEPA 2011).



# Trends in Electricity Consumption



► In all IEA policy scenarios, electricity consumption is expected to significantly increase by 2035



# Coal Mine Methane (CMM) and the Electricity Sector



# Methane Emissions from Coal Mines



- ▶ Underground mines are a major source of methane emissions in all significant coal producing countries
- ▶ Degasification systems present the easiest opportunity to utilize CMM, because of high methane concentrations
- ▶ If captured, methane is commonly used for power generation, district heating, boiler fuel, or direct sales to the pipeline
- ▶ Utilization of methane for power generation takes advantage of proven technologies and does not require pipeline-quality methane or compression



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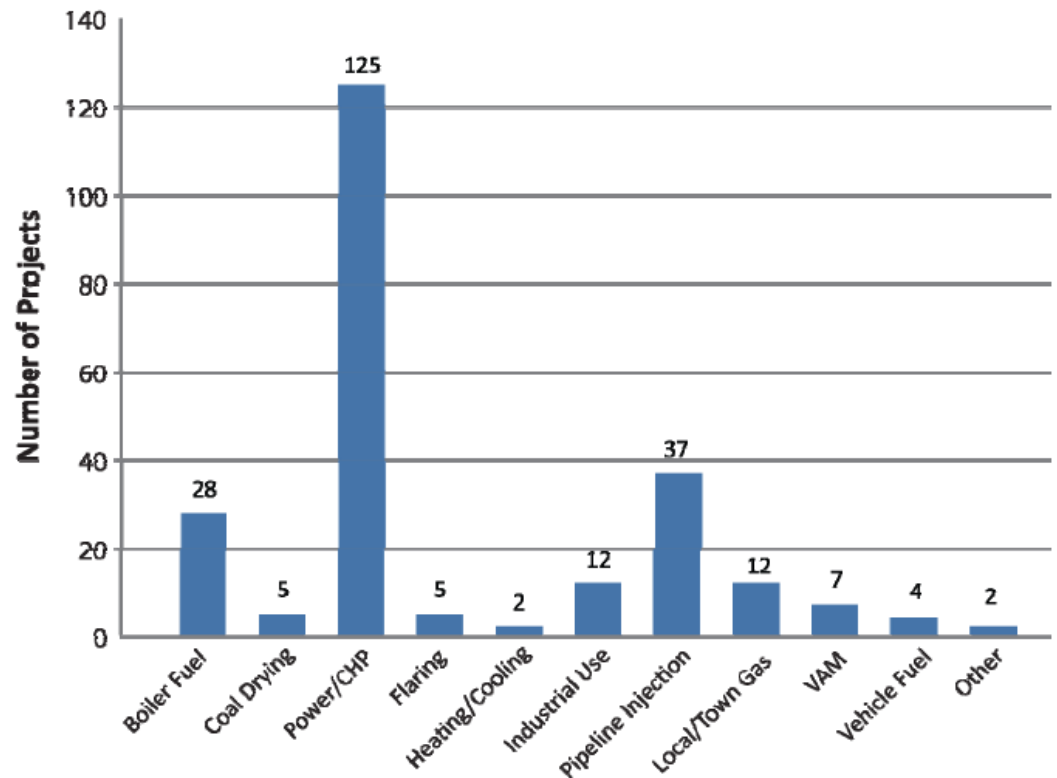
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# CMM and Power Production



- ▶ Power and heat/power co-generation are most common CMM projects, according to Global Methane Initiative.
- ▶ Utilization of methane on-site is common because coal mines have significant electricity loads; selling power to grid can increase demand, but many countries have barriers.



(Source: Methane to Markets Partnership, 2009)

# Electricity Regulation and CMM



- ▶ The structure of the electricity sector has a large impact on whether CMM projects can materialize, generate electricity out of excess methane, and sell it to the grid.
  - Are electricity prices cost-reflective or subsidized?
  - Is there easy access to the grid?
  - Can electricity producers participate in the wholesale market?
  - Do CMM projects have special tariffs or other support from the government?
  - Is there institutional framework to support CMM projects?



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# Selling to the Grid



# Selling to the Grid



- ▶ Power generation allows for utilization of medium-quality gas that is too poor for pipeline marketing.
- ▶ Mines can generate electricity for on-site needs or sell it to utilities. Selling to utilities expands the potential demand, though it can add risk.
- ▶ Power generation projects using CMM exist in mines in many countries, including China, Australia, the United Kingdom, Germany, United States, Czech Republic, and others.
- ▶ According to GMI database on CMM projects,
  - Germany, China, UK and Czech Republic are leaders in the number of projects generating power or combined heat and power.
  - Germany is known to sell power generated from CMM methane.



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# Policies Encouraging CMM Power Generation



- ▶ Policies that favor CMM projects in general and increase the volume of methane extracted from coal seams will increase the share of CMM electricity on the market.
- ▶ Easy access to the market for CMM projects.
- ▶ Cost-reflective prices for electricity are beneficial for CMM projects wishing to sell to the grid—it is hard to compete against low-cost, subsidized electricity.
- ▶ Feed-in tariffs can help boost investment while market for CMM develops.
- ▶ Additional examples of supporting policies:
  - Tax incentives (eliminating production tax on CMM).
  - Clear methane ownership rules, preferably with transferrable ownership.
  - Strong implementation of safety requirements regarding degasification.

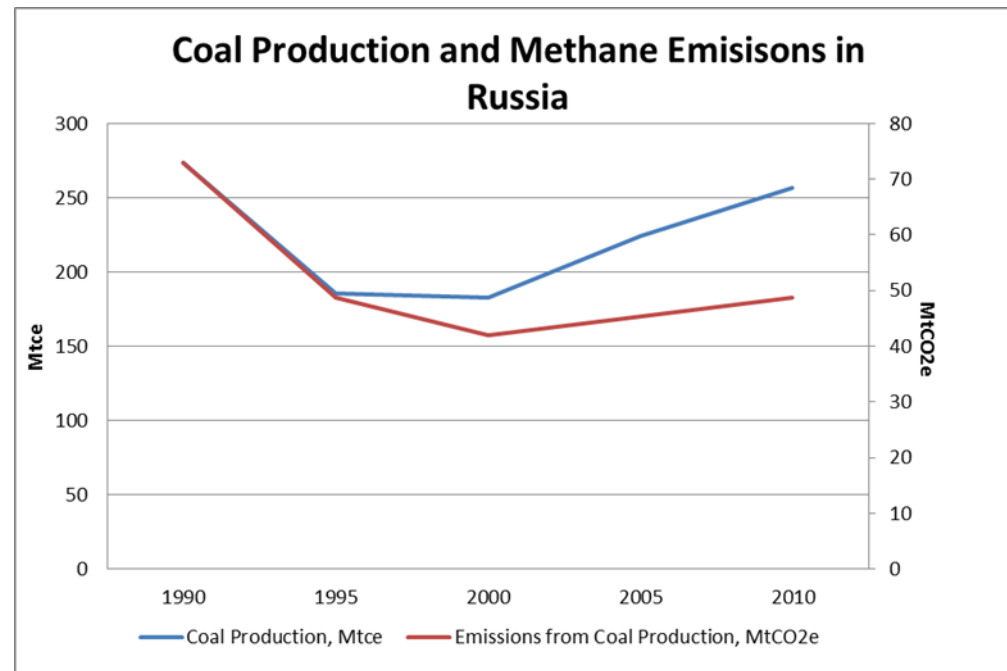


# Case Studies



# CMM in Russia

- ▶ Russian mines are some of the gassiest in the world (11.6 m<sup>3</sup>/t compared to 7 m<sup>3</sup>/t in the U.S.).
- ▶ If a mine has over 13 m<sup>3</sup>/t of methane, mine has to be degasified by Russian law.
- ▶ 25% of active mines have degasification systems.
- ▶ In 2010, 49 Mt CO<sub>2</sub>-equivalent was released from coal mines in Russia, world's third emitter after China and U.S.



(Source: Data from USEPA 2011 and IEA 2012).

# CMM in Russia

- ▶ Around 30 mine explosions in the past 10 years.
- ▶ In recent years, enforcement of safety regulations has strengthened.
- ▶ Recent policy developments also favor CMM projects.



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## Four dead, four missing in Russian coal mine blast



Russian coal miners (file photo)

**Four miners have been killed and four others declared missing after a methane blast in the Kuzbass coal basin of Russia's Kemerovo region.**

Sun Jan 20, 2013 5:25PM



# Russia: CMM-fueled Electricity



- ▶ Currently, 4 CMM installations owned by SUEK-Kuzbass generate electricity in Russia with total capacity 4.4 MW:
  - 3 at Kirova mine and 1 at Komsomolets mine.
  - All electricity is used for mine needs (assessed at 20 MW each).
- ▶ SUEK also developed Joint Implementation project.
- ▶ But electricity prices have doubled over the past decade. Thus, CMM projects have become more attractive financially.
  - SUEK mines generate electricity from CMM at 30%-50% below what it pays when purchasing electricity.



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# Russia: Possibilities for Selling to the Grid



- ▶ With larger-scale production, selling to the grid will become possible.
- ▶ Access to the grid for CMM-fueled electricity is by law equally available in Russia.
  - In SUEK's case, the company owns a significant share of JSC Kuzbassenergo's stock, which may facilitate grid sales.
- ▶ Mines do not pay production taxes on CMM extracted.
- ▶ Gazprom, Russia's largest energy company, has been increasing its capacity to capture and utilize CBM/CMM, primarily in the Kuzbass region.
  - Currently, have a power installation in Taldinskoye reserve.



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# Russia: Challenges for CMM

- ▶ Biggest challenge: abundance of cheap natural gas to compete with. Gas-fired power plants make up 44% of installed electric capacity (cogeneration plants included).
  - But gas prices have been going up as well.
  - Liberalized electricity market can make CMM-fueled electricity marketable in the future.



*Photo credit: PNNL.*

# CMM in Ukraine



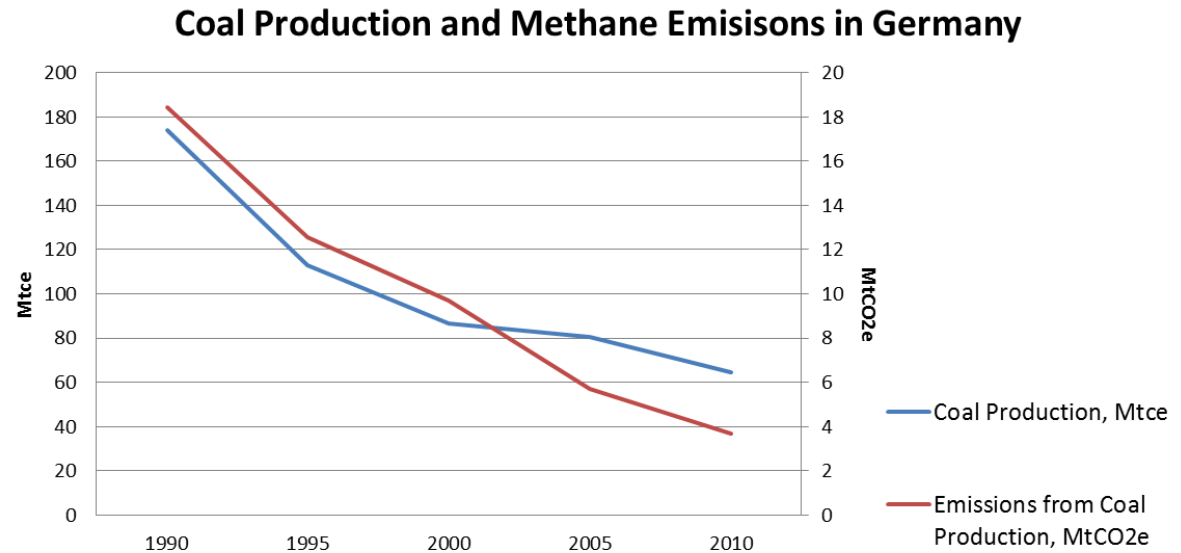
- ▶ High energy prices in Ukraine make CMM projects attractive.
- ▶ Ukraine's legislation in general supports CMM projects, but there is room for improvement.
  - Coal production licenses automatically authorize coal producers to extract and emit or utilize CMM, but no easy transfer of ownership.
  - Attempt at Green Tariff Law, but not specific for CMM
  - No production taxes on CMM gas, but there have been changes recently.
- ▶ 10 JI projects in Ukraine, most using CHP or new boilers.
- ▶ Zasyadko Mine: 12 CHP units with capacity 36 MW for electricity and 34 MW for heat; 12 more were planned to sell electricity to network.



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# CMM in Germany

- ▶ Germany is the leader in utilizing CMM as a percentage of total mine-related methane emissions, largely due to progressive legislation.
  - According to the so-called EEG (Erneubare Energie Gesetz, Renewable Energy Law), the supply of renewable power into the grid is guaranteed and the price is fixed for a period of 20 years.
  - CMM has the status of renewable energy source, and thus, CMM-based electricity is sold at subsidized prices.



(Source: Data from USEPA 2011 and IEA 2012).

# Germany: Push for CMM



- ▶ The Ruhr area is particularly known for CMM-utilization projects.
- ▶ In 2000, Minegas GmbH was founded to develop CMM from abandoned coal mines in the Ruhr area for generation of electricity and heat to be sold to the market.
- ▶ Today, the company operates 59 CMM-fueled co-generation plants, with ranging capacity between 0.3 to 1.5 MW.



# Germany: CMM-fueled Electricity



- ▶ In one project, Stadtwerke Herne utilizes CMM captured from an abandoned coal mine located in Herne, Ruhr area in Germany.
- ▶ 3 cogeneration gas engines with a total capacity of 4.05 MW were adapted to utilize CMM.
- ▶ The power produced is fed into the electricity grid and displaces conventionally produced power.
- ▶ In addition, Germany has the highest electricity prices in Europe.



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# Policy Recommendations





# Policy Recommendations



- ▶ Financial/legislative incentives can foster CMM projects:
  - Feed-in tariffs,
  - Obligations (minimum percent of renewable or clean energy),
  - Tax incentives.
- ▶ Liberalized electricity market with cost-reflective energy prices favor CMM projects and sale of CMM electricity to the grid.
- ▶ Clear rules regarding ownership rights to the methane.
- ▶ Education and information dissemination through CMM clearinghouses and information centers, technology transfer programs, and international cooperation.
- ▶ Institutional framework, such as designated CMM authorities and regulatory agencies to identify policy measures and technical barriers.



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**Thank you!**



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