

# **GREENHOUSE GAS REDUCTIONS IN THE MINING SECTOR: HISTORIC TRENDS AND FUTURE OPTIONS**

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***Second Annual Conference on Carbon Sequestration***

**May 5 - 8, 2003**

# The Climate Change Initiative

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- Reduce the GHG intensity (the ratio of GHG emissions to U.S. gross domestic product) of the U.S. economy by 18% (106 MMTC) over the period 2002-2012
- Evaluate the progress of the 18% reduction goal in 2012 and take additional action to reduce emissions if necessary
- Issued a challenge to American businesses “to make specific commitments to improving the greenhouse gas intensity of their operations and to reduce emissions”

# Voluntary Reporting of Greenhouse Gases

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- To meet its commitments under the Framework Convention on Climate Change, Congress called for voluntary actions to reduce GHG emissions
- Voluntary GHG reporting was established under Section 1605(b) of the Energy Policy Act of 1992
- Beginning in 1993 Peabody developed an emission reporting protocol for its operations starting with a base year of 1990
- Peabody is the only coal mining company to report its emissions every year since 1993

# Peabody's Voluntary GHG Emission Reporting Protocol

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- Adhere to the available guidelines
  - EIA 1605b Voluntary Reporting Program
- Identify emission sources
  - CO<sub>2</sub> from electricity, gasoline, diesel, natural gas, steam, coal, propane and jet fuel use
  - CH<sub>4</sub> from surface and underground mining and post-mining activities
- Derive a methodology for calculating emissions

# Methodology for Calculating CO<sub>2</sub> Emissions

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- Determine the annual quantity of company-wide emission sources
  - Electricity – \$ cost
  - Gas – gallons
  - Jet fuel – gallons
  - Diesel – gallons
  - Propane – pounds
  - Natural gas – therms
  - Coal – tons
  - Steam – mlbs condensate

# Methodology for Calculating CO<sub>2</sub> Emissions

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- Utilize company-wide materials management systems to determine quantity or dollar amount for each emission source and location
- Convert annual quantity of company-wide emission sources into annual BTUs using standard conversion factors
- Convert annual BTUs into lbs of CO<sub>2</sub> using emission factors obtained from the EIA

# Methodology for Calculating CO<sub>2</sub> Emissions

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*Example:*

2002 Diesel Gallons = 53,618,464

53,618,464 gal × 138,691 Btu/gal =

7.4 trillion Btu × 161.4 lbs CO<sub>2</sub> ÷ 1 million Btu =

1,200,130,591 lbs CO<sub>2</sub>, or 600,065 tons of CO<sub>2</sub>

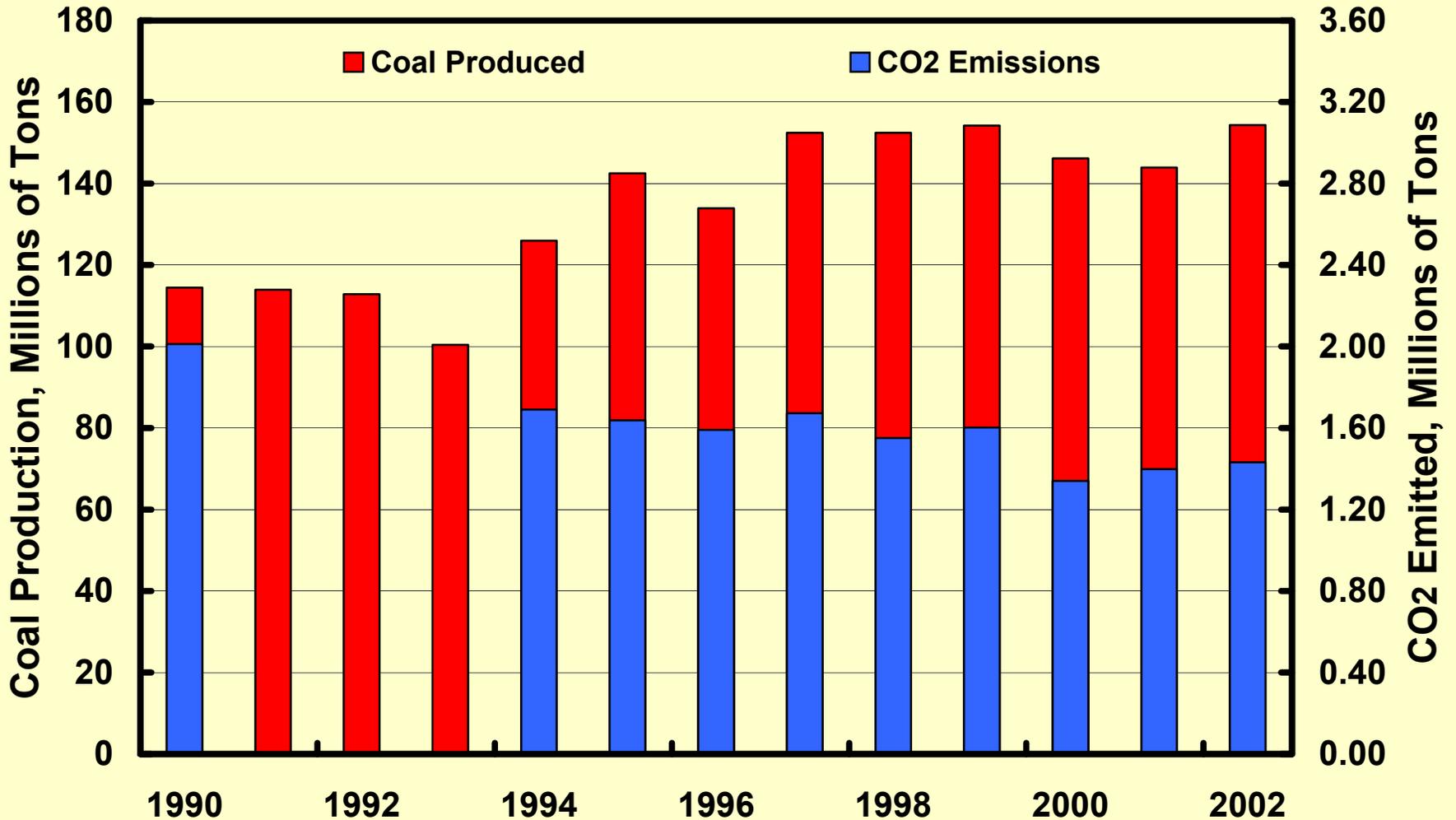
# Methodology for Calculating CO<sub>2</sub> Emissions

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- For indirect CO<sub>2</sub> emissions from electricity:
  - To go from annual \$ to annual kWh of electricity, we reviewed selected invoices and derived a \$ cost per kWh conversion factor that was applied
  - Used a weighted average of state CO<sub>2</sub> emission factors published by the EIA based upon Peabody's state coal production totals

# Peabody Energy<sup>(1)</sup>

## Coal Production and CO2 Emissions from Energy Consumption

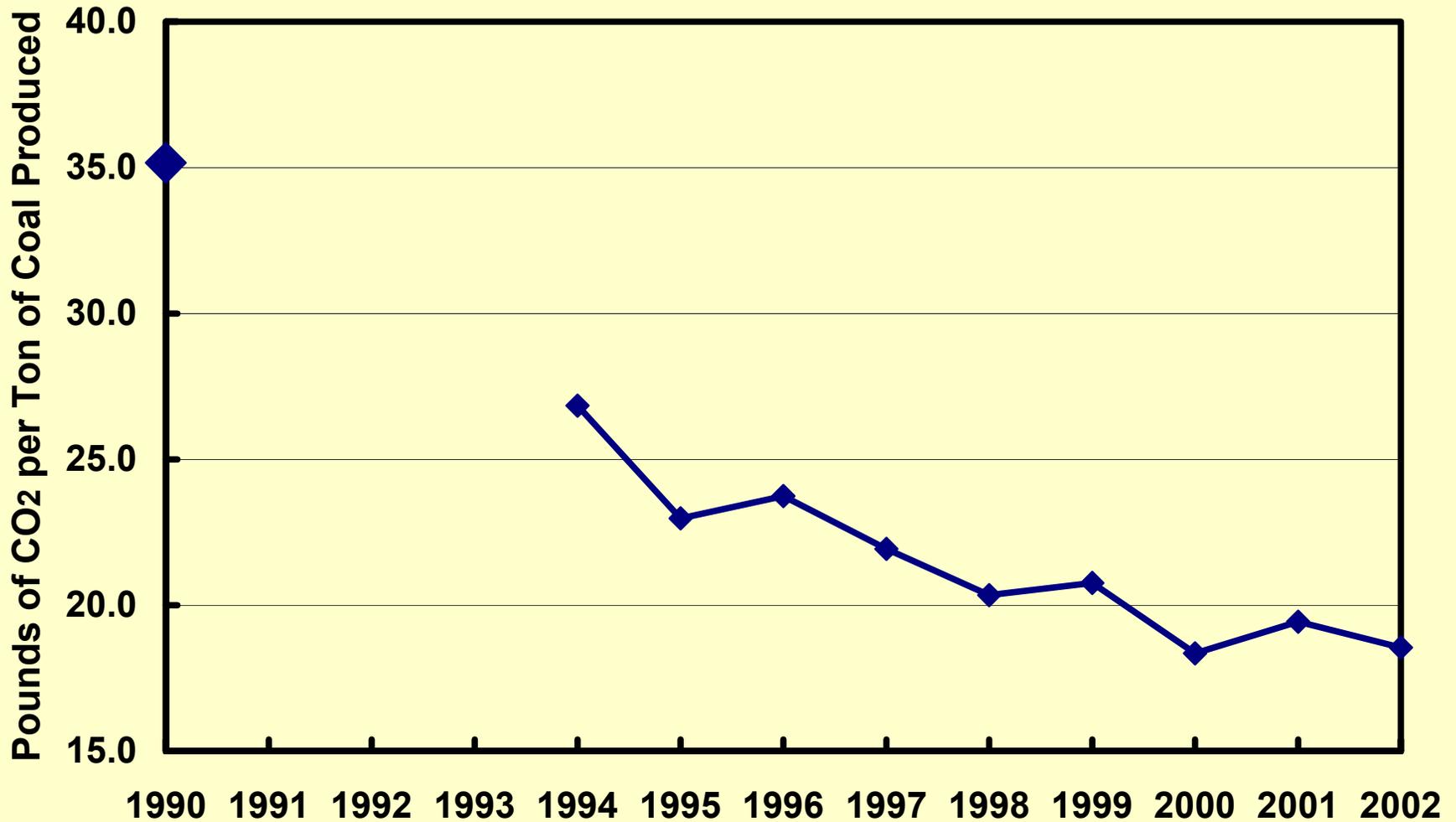


(1) Does not include data from subsidiary companies Black Beauty Coal Company and Arclar Company



# Peabody Energy<sup>(1)</sup> Annual Carbon Dioxide Intensity

Pounds of CO<sub>2</sub> Emitted from Energy Consumption per Ton of Coal Produced



(1) Does not include data from subsidiary companies Black Beauty Coal Company and Arclar Company



# Methodology for Calculating CH<sub>4</sub> Emissions

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- Followed the protocol listed in an EPA document, “Method for Estimating Methane Emissions from Coal Mining”
- Total methane emissions from coal mining were calculated as the sum of total underground, surface and post-mining emissions minus methane recovered, such as from coal bed methane utilization

# Methodology for Calculating CH<sub>4</sub> Emissions

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- Underground (ventilation) methane emissions data were obtained from the EPA for mines with greater than 1 million cubic feet of methane release in a given year
- Ventilation emissions data from mines with less than 1 million annual cubic feet of emissions were calculated using a coal seam-specific, or basin-specific coefficient of annual cf methane per ton of coal mined that was derived from the more gassy mines with available data

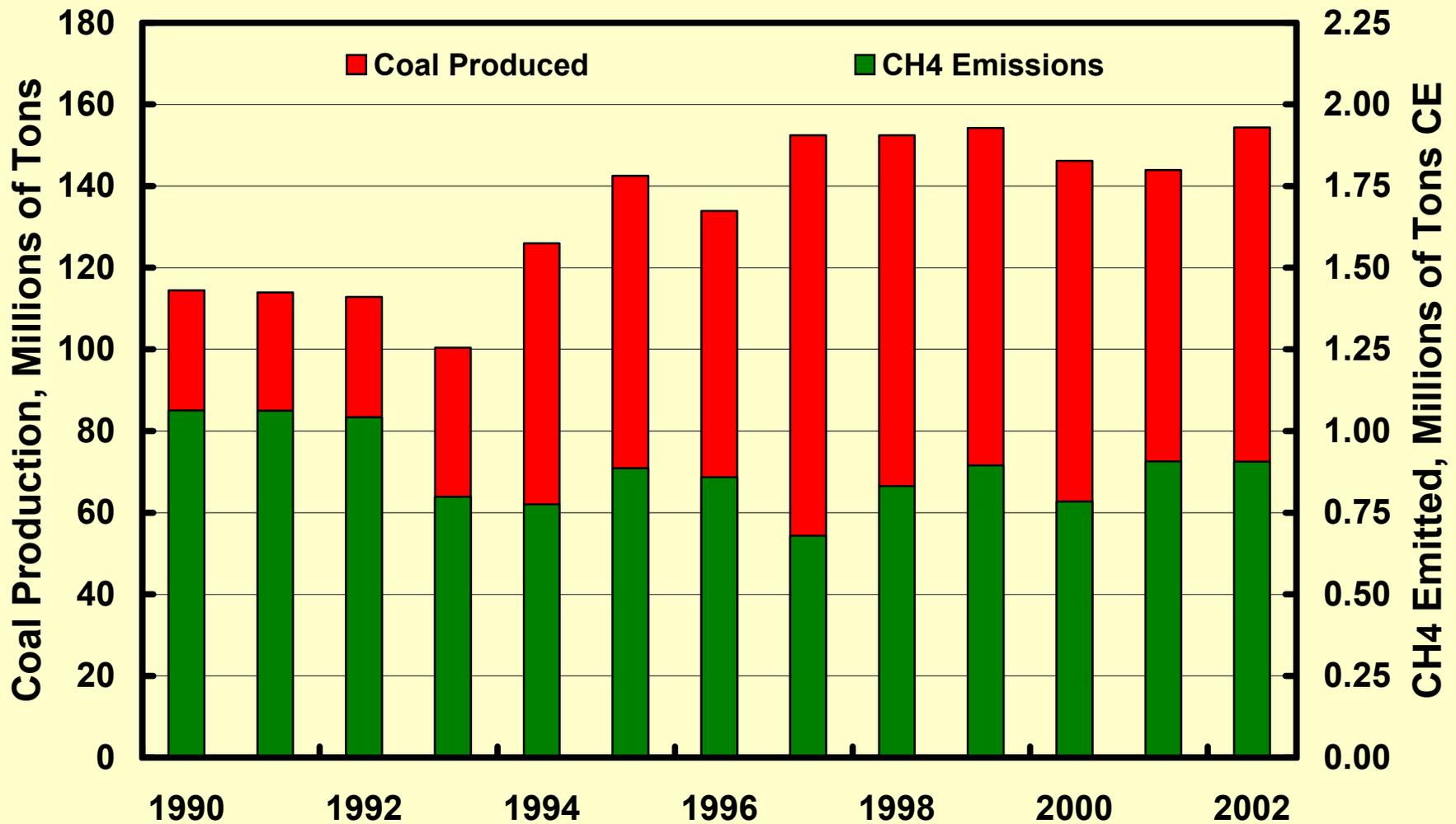
# Methodology for Calculating CH<sub>4</sub> Emissions

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- Surface methane emissions were calculated using basin-specific coefficients provided in the EPA document described previously
- Post-mining methane emissions were calculated as 16% of ventilation or surface mine emission values

# Peabody Energy<sup>(1)</sup>

## Coal Production and CH<sub>4</sub> Emissions from Energy Consumption

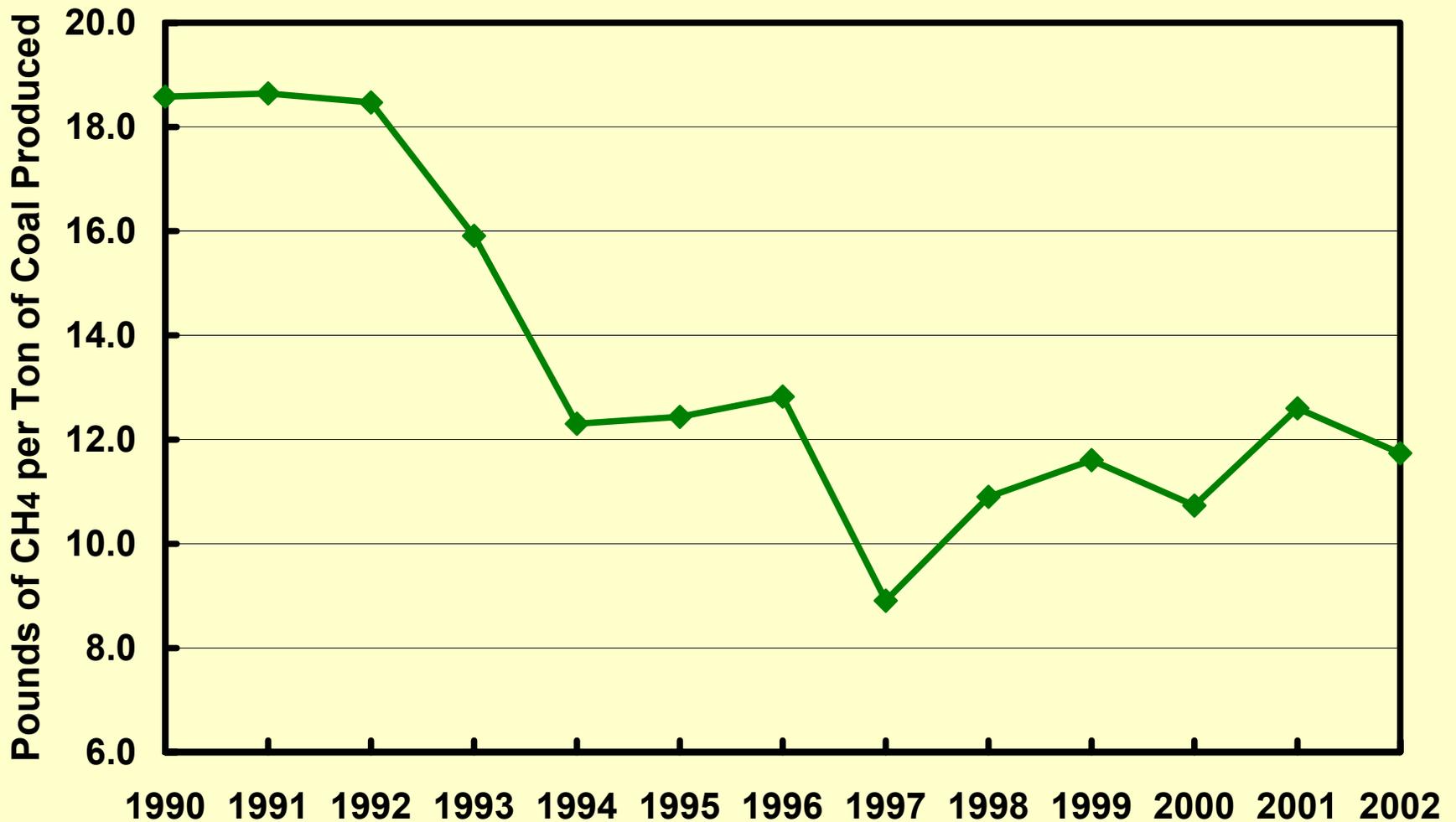


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# Peabody Energy<sup>(1)</sup> Annual Methane Intensity

Pounds of CH<sub>4</sub> Emitted from Energy Consumption per Ton of Coal Produced



(1) Does not include data from subsidiary companies Black Beauty Coal Company and Arclar Company



# Peabody Energy GHG Emissions

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For the period 1990 – 2002:

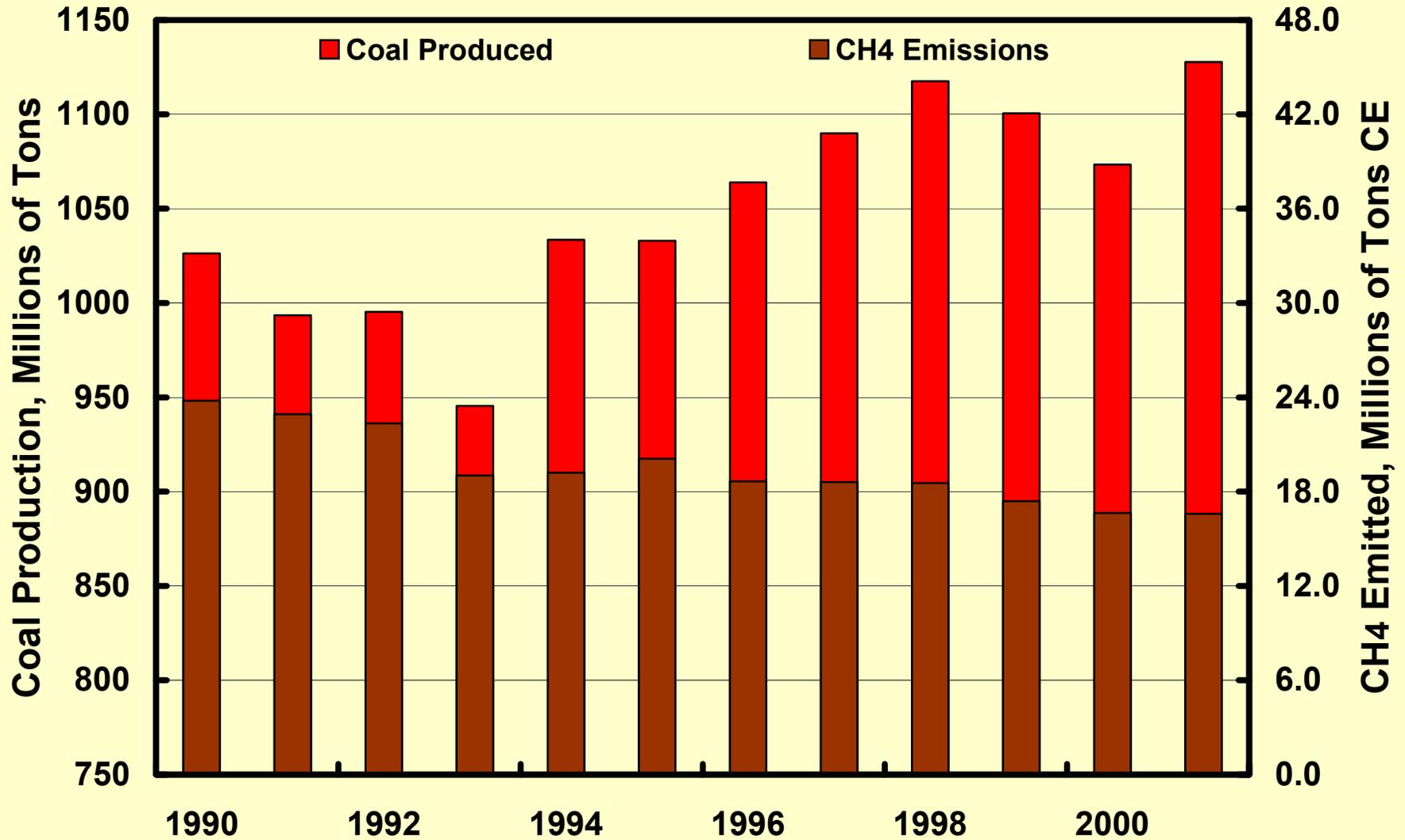
- Gross CO<sub>2</sub> emissions have declined by 579,768 tons, or 29%
- CO<sub>2</sub> intensity (lbs of CO<sub>2</sub> per ton of coal mined) has declined by 47%
- Gross CH<sub>4</sub> emissions have declined by 142,518 mtce, or 15%
- CH<sub>4</sub> intensity (lbs of CH<sub>4</sub> per ton of coal mined) has declined by 37%

# Industry GHG Emissions

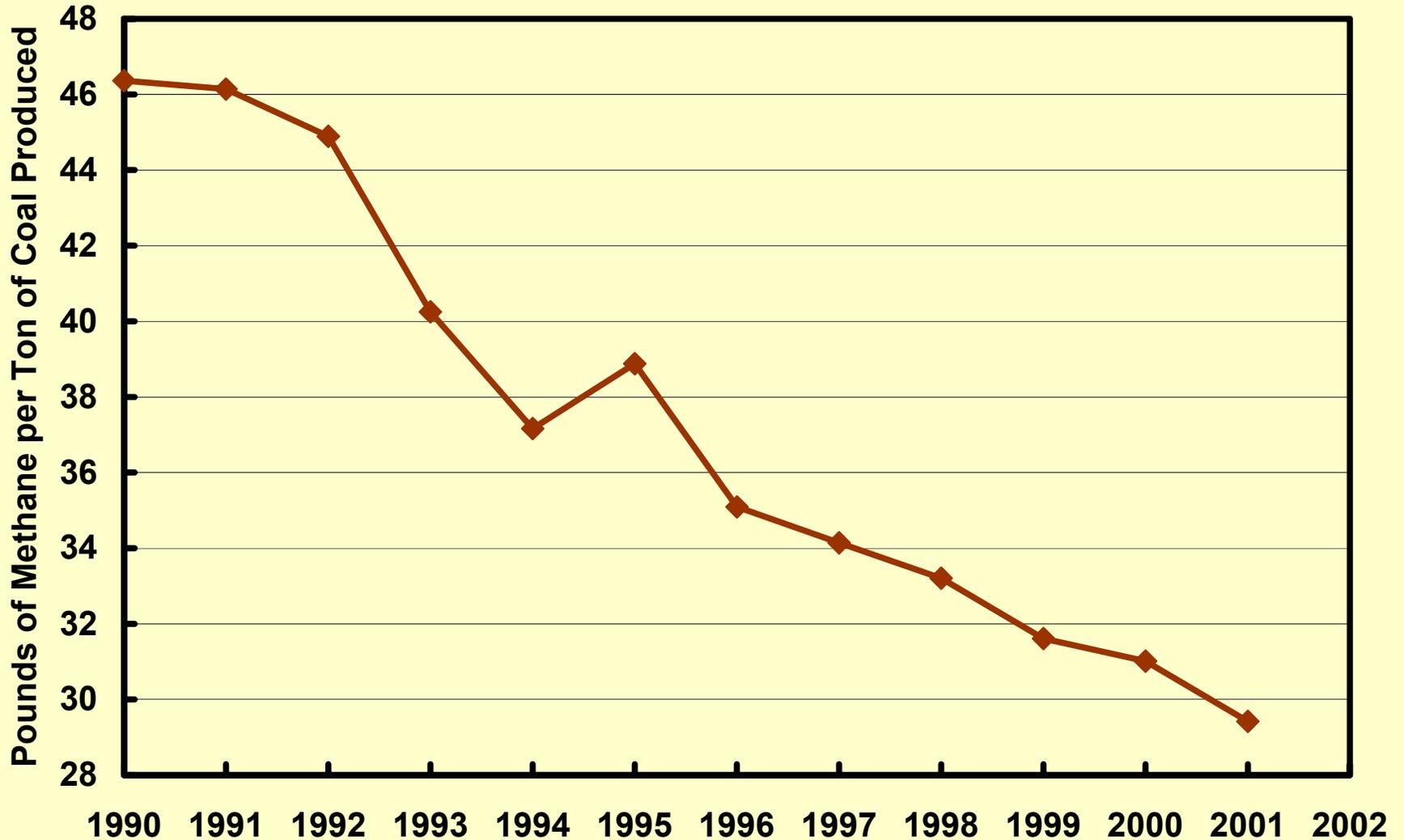
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- Because of proprietary information, there is no way of determining industry-wide CO<sub>2</sub> emissions
  - However, we can reasonably assume that trends since 1990 have followed a similar decline as has been calculated for Peabody
- We can estimate industry-wide methane emissions from data that exist in the public domain based upon the reporting protocol demonstrated previously

## U.S. Coal Production and Estimated Methane Emissions from Coal Mining



## Estimated U.S. Annual Methane Intensity (1990-2001) Pounds of Methane Emitted per Ton of Coal Produced



# Estimated Industry Methane Emissions

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For the period 1990 - 2001:

- Gross methane emissions have declined by 7,201,557 MTCE, or 30%
- Methane intensity (lbs of CH<sub>4</sub> per ton of coal mined) has declined by 37%

# Future GHG Emission Reduction Options

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- Efficiency improvements
  - Reduce electricity demands and diesel fuel use
- Carbon sequestration projects
  - Afforestation, reforestation, forest management
  - Increase the vegetative productivity of current and future mined land reclamation
    - Change SMCRA to allow for more flexibility in original contour and soil compaction requirements that currently do not favor enhanced tree growth and vegetative productivity

# Future GHG Emission Reduction Options

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- Reforestation of Abandoned Mine Lands (AML) that have already been reclaimed using AML funds
- Enhance the reclamation of AML properties through reforestation with minimal soil compaction
- Reforest post-SMCRA reclaimed lands and get a credit against AML fees

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