



# Global Opportunities in the Power Industry

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# Opportunities?

# Are you serious?

- **The retirement of 200 coal plants as of July 2015 nationwide represents the phase out of nearly 40 percent of the 523 U.S. coal plants that were in operation just five years ago.**

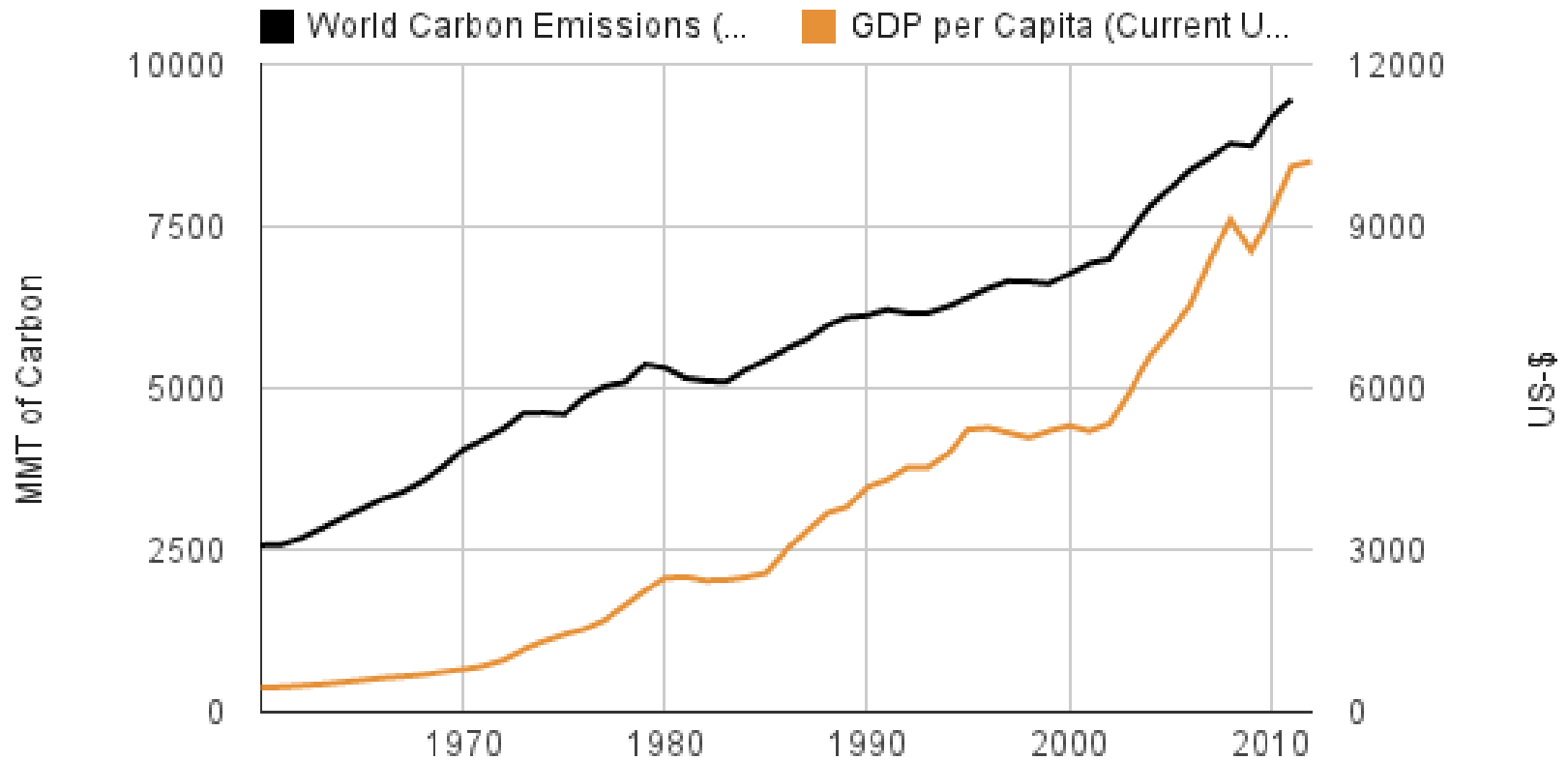
# CO2 Rules

- **Rules for New Plants**
  - 1400 lbs/mwh
- **Rules for Existing Plants**
  - Efficiency Improvements
  - Natural Gas Reliance
  - Renewable Offsets

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## Global Carbon Emissions and World GDP / capita



(Sources: Boden, T.A., G. Marland, and R.J. Andres. 2013. Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laborato...

# Electric demand is growing

- **3 Gigawatts in North Dakota (~10 years)**

# Electric demand is growing

- **47 Gigawatts in Japan (~10 years)**



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- **30 Gigawatts in China**

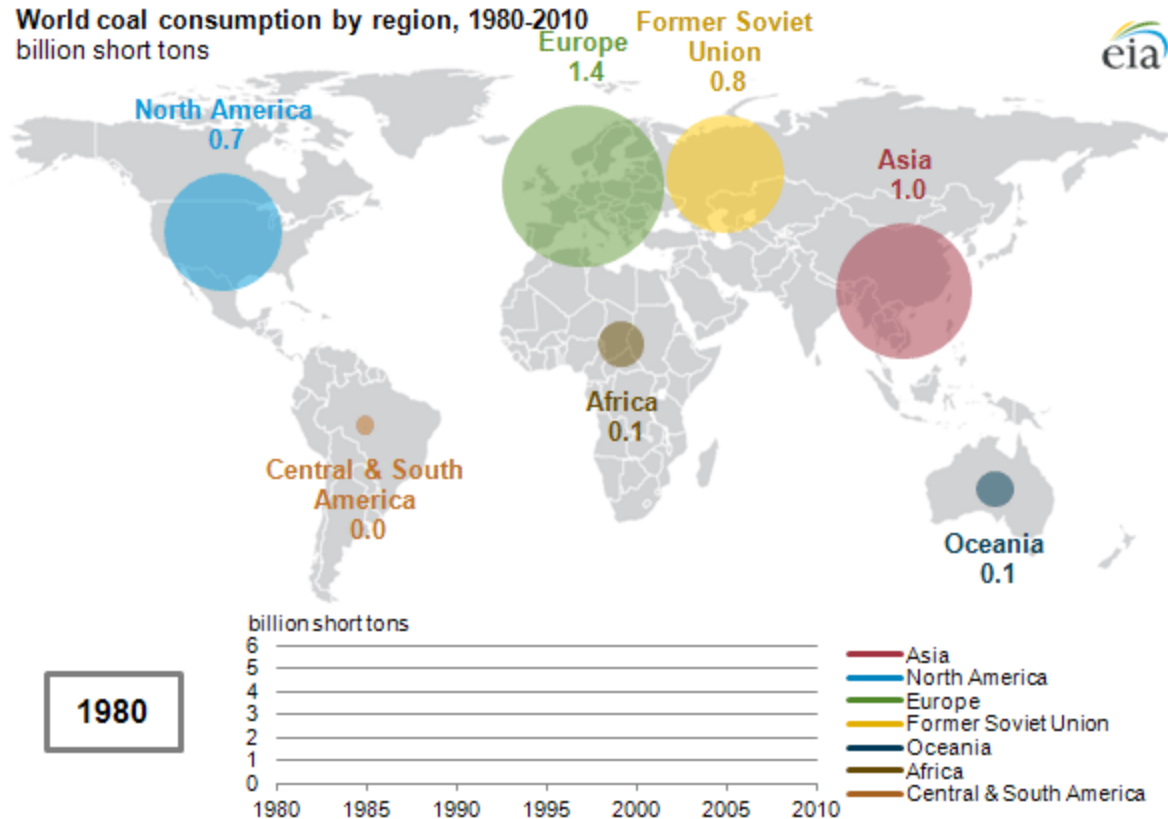
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  - **For 16 years**

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# Coal meets that need



# **Electric demand is growing, but so is the realization that CO2 must be addressed**

- **A lower carbon intensity is now the norm, but that means different things to different people.**

# In America, that is with the Clean Power Plan

# The Chinese Approach

- **Reduce coal usage to 60% of power supply by 2035.**

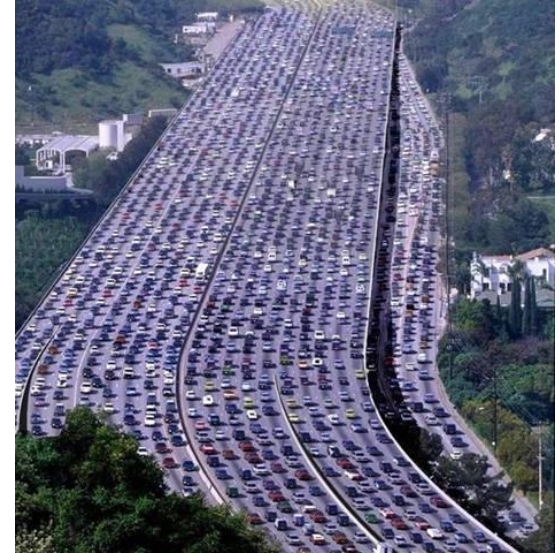
# Where are the US Opportunities

- **North Dakota, with CO<sub>2</sub> for EOR**

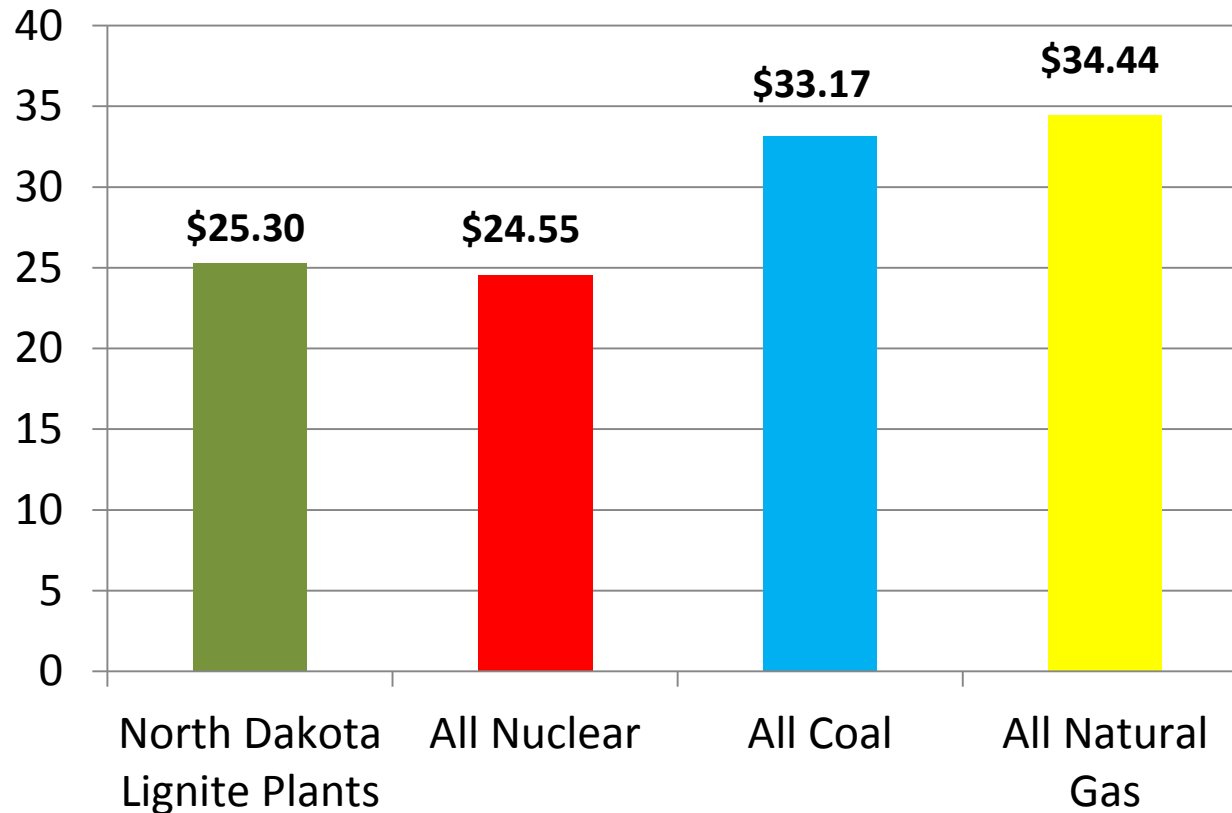


# Lignite: Domestic Energy

- **North Dakota produced 27.7 million tons of lignite in 2013...the equivalent of 70 million barrels of oil**
- **The average car in the United States consumes 280 gallons of gasoline. So on a BTU basis, the 27.7 million tons of lignite would produce enough energy to run 10 million cars for a year.**



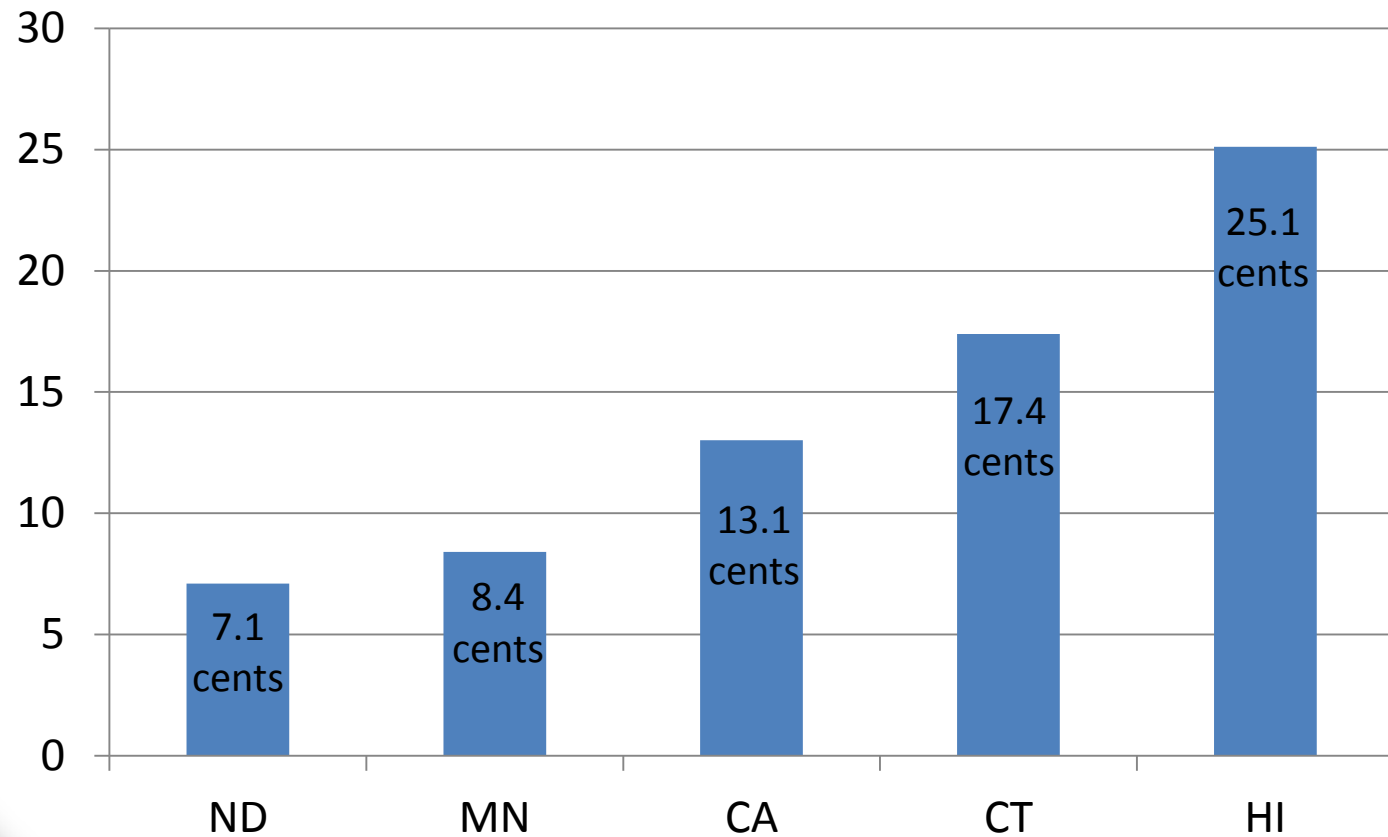
# Average Electricity Costs 2012 Megawatt-Hour



Source: Ventyx

# Regional Low-Cost Electricity

Average retail electricity prices - EIA



# North Dakota's Answer

- **Increased R&D**
  - **\$5m from last session**

# North Dakota's Answer

- **Increased R&D**
- **New Power Cycles**
  - **Supercritical CO<sub>2</sub>**

# North Dakota's Answer

- **Increased R&D**
- **New Power Cycles**
- **Oil partnerships**
  - **CO2 for re-use could extract billions more in Oil revenue**

# North Dakota's Answer

- **Increased R&D**
- **New Power Cycles**
- **Oil partnerships**
- **Biggest Challenge is time**
- **Keep coal industry up to date, alive while pursuing technology**