BUSINESS AS UNUSUAL

Gaining Advantage in a Dynamic Project Landscape

FORUM PRESENTER

# Air Pollution Control Industry Focus on Carbon Capture Control Technology

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# Presentation Overview

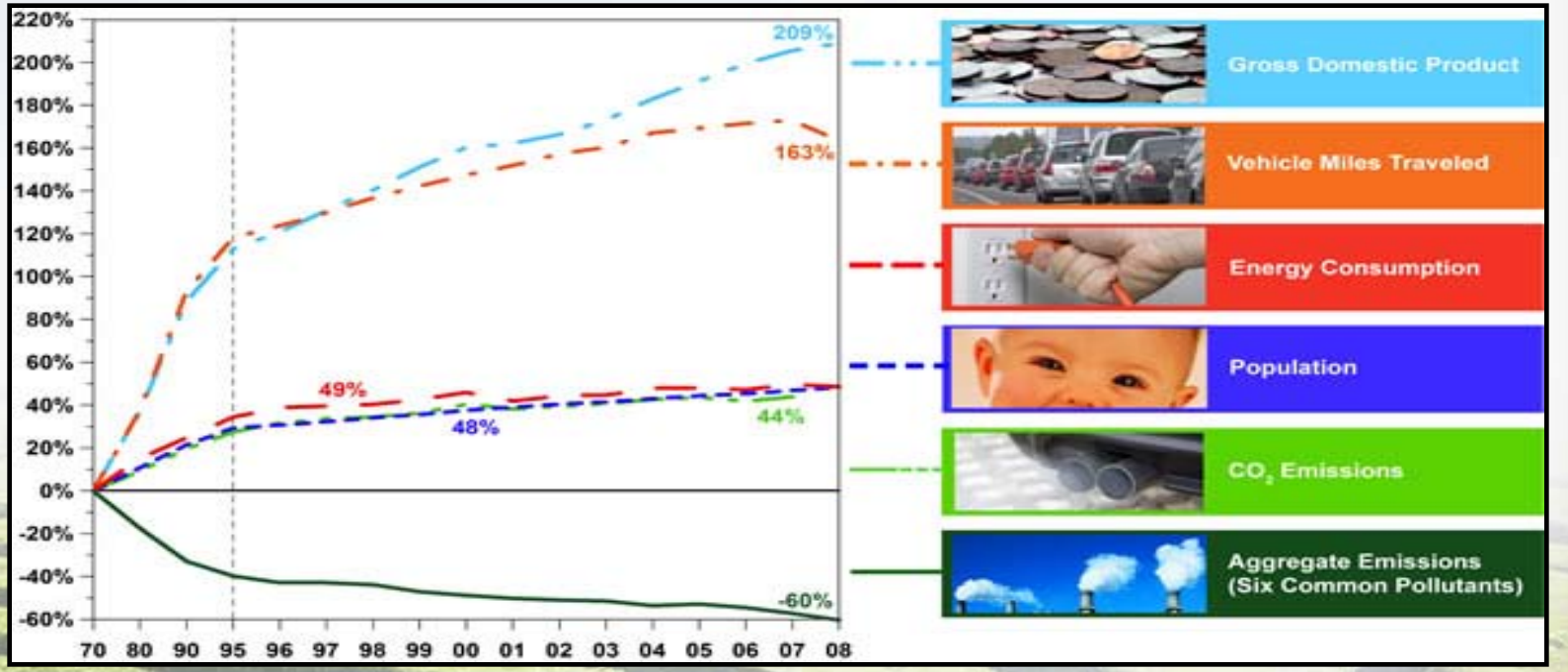
- Who is ICAC ?
- Drivers for Emission Control Technology
- What Is Needed?
- Stages of CCS Technology Development
- Government Funding
- CC Projects on the Rise
- Interagency Task Force Recommendations
- Summary

# Institute of Clean Air Companies (ICAC)

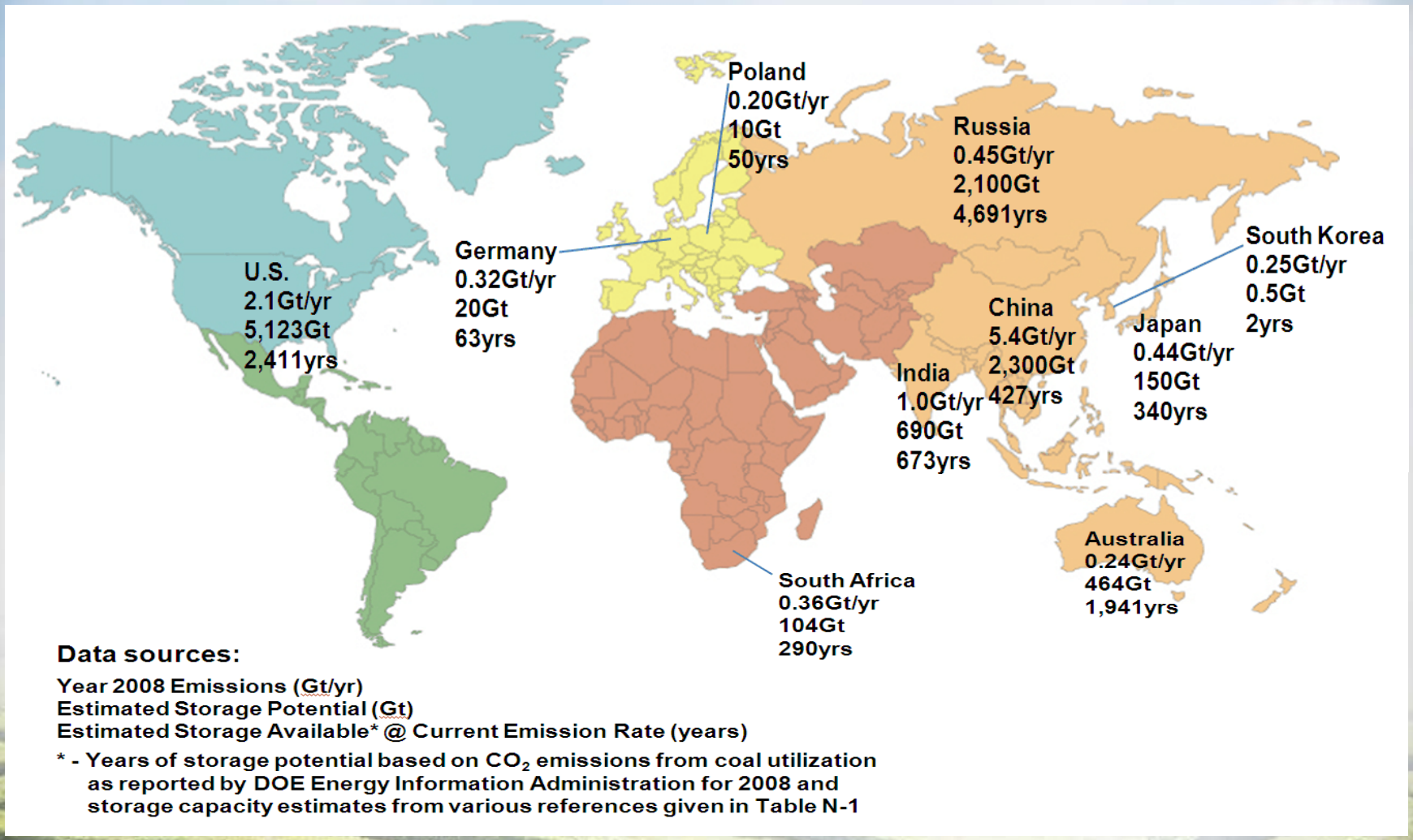
- The National Association for Air Pollution Control Manufacturers
  - More than 100 Leading Manufacturers
  - Emissions Control (FGD, SCR, ESP, FF) and Measurement Technologies
  - OEMs, A&Es, Component Suppliers, Reagent Providers
- Promote Air Pollution Control Industry and Suppliers
  - Affected Industry, Regulators, and other stakeholders
- Stationary Source Emissions Controls
  - Electric Power and Industrial Sectors
- Promote Understanding of Technology and Industry Capabilities
  - Technical Publications, Workshops, Trade Journals, etc.

# Drivers for Emission Control Technology

- Regulations Drive Technology Investment, Innovation and Implementation
- Government Sponsored R&D critical
- Improvements in emission control technology result after technology has been installed and operated



# Coal CO2 Emissions & Storage Capacity




**Data sources:**

Year 2008 Emissions (Gt/yr)
Estimated Storage Potential (Gt)
Estimated Storage Available* @ Current Emission Rate (years)

* - Years of storage potential based on $CO_2$ emissions from coal utilization as reported by DOE Energy Information Administration for 2008 and storage capacity estimates from various references given in Table N-1

# What is Needed?

- EPRI (Electric Power Research Institute) Prism / MERGE Analyses 2009 Update “Full Portfolio”:
  - Completed pilot and demonstration projects for post-combustion capture, IGCC capture, oxygen separation, and oxy-firing
  - 90% CO2 capture for all new coal and NGCC plants built after 2020
  - CCS retrofit for 60 GW of existing coal generation at 90% capture efficiency
  - Existing coal units >500 MW capacity and <12,00 Btu / kWh heat rate with all installed environmental controls (SO2, NOx, and HAPs), and placed in service after 1970, are viable candidates for CCS retrofit

# What is Needed?

- International Energy Agency (IEA) “Technology Roadmap”:
  - The next decade is a key “make or break” period for CCS
  - OECD governments will need to increase funding for CCS demonstration projects to an average annual level of $3.5 to $4 billion from 2010 to 2020
  - Incentives for commercialization beyond 2020 in the form of mandates, GHG reduction incentives, tax rebates or other financing mechanisms
  - CCS development will start in the industrialized countries but is expected to rapidly shift to developing regions after 2020

# Stages of CCS Technology Development

- Laboratory testing: provides a cost effective means to determine general feasibility and test a variety of parameters
  - Concept verification (laboratory)
- Pilot-scale: test under actual flue gas conditions but at reduced scale of equipment
  - Scale-up to verify concept (0.25 – 5 MW)
  - Pleasant Prairie, chilled ammonia, 1.7 MW
  - Burger, ECO2 multi-pollutant, 1 MW
- Demonstration field tests: scale up the size of the equipment and perform tests under optimum operating conditions to define capabilities and limits of the technology (20+ MW)
  - Mountaineer, chilled ammonia, 20 MW - 100,000 tpy
  - Plant Barry, advanced amine, 25 MW

# Stages of CCS Technology Development

- Demonstration field tests at multiple sites: each new site represents new operating conditions and new challenges
- Demonstration projects:
  - ICAC GHG White Paper – 6-8 demonstration projects needed by 2015
  - Mountaineer, with CCPI III funding, 200 MW next by 2015 – 1.5 million tpy
  - in 2008, the G8 leaders recommended that 20 demonstration projects be launched globally by 2010
- Commercial deployment: Problems will still be found at new sites, but most of the fatal flaws will have already been discovered and resolved

# Government Funding

## The American Recovery and Reinvestment Act of 2009 (ARRA)

- Provides an Additional $3.4 Billion for Fossil Energy Research and Development to:
  - Develop and Demonstrate CCS Technology in Partnership with Industry to Reduce GHG Emissions
  - Transition this Technology to Industry for their Deployment and Commercialization
  - Become the World's Leader in Science and Technology
  - Implement Projects to Support Economic Recovery

# Government Funding

## American Recovery and Reinvestment Act of 2009 (ARRA) – Fossil Energy CCS

| Fossil Energy ($ in Thousands) | Funding Amount |
|---|---|
| Clean Coal Power Initiative – Round 3 FOA | $ 800,000 |
| Industrial Carbon Capture Solicitation | $1,520,000 |
| Geologic Formation Site Characterization | $50,000 |
| Geologic Sequestration Training & Research | $20,000 |
| Carbon Capture and Storage (FutureGen) | $1,000,000 |
| Program Direction | $10,000 |
| Total, Fossil Energy | $3,400,000 |

# Government Funding – Current Projects

## Current CCPI Round 3 Projects

- Basin Electric – 2014 start
  - Post Combustion - 450,000 - 1,360,000 tons CO2 / year
  - $100M – DOE
- NRG Energy, TX - 2014 start
  - Post Combustion - 400,000 tons CO2 / year
  - $167M – DOE $334M - Total
- AEP Mountaineer, WV – 2015 start
  - Post Combustion - 1,500,000 tons CO2 / year
  - $334M - DOE; $668M - Total

# Government Funding – Current Projects

## Current CCPI Round 3 Projects (cont.)

- Summit Texas Clean Energy – 2014 start
  - IGCC with EOR – 2,700,000 tons CO2 / year
  - $350M – DOE; $1,727M - Total
- Hydrogen Energy California – 2016 start
  - IGCC with EOR – 1,800,000 tons CO2 / Year
  - $308M – DOE; $2,840M – Total

# CC Projects on the Rise

- In 2008, the G8 leaders recommended that 20 demonstration projects be launched globally by 2010
- DOE/NETL tracks over 192 projects globally
- Eight Active Projects Capturing and Injecting $CO_2$
  - In Salah Gas Storage Project, Algeria
  - CRUST Project – K12-B Test, The Netherlands
  - Sleipner Project, Norway
  - Snøhvit Field LNG and $CO_2$ Storage Project, Norway
  - Zama Field, Canada
  - SECARB Cranfield, United States
  - Weyburn-Midale, Canada
  - Mountaineer CCS Project, United States
- Canadian G8 Summit in July 2010

# CC Projects on the Rise

## World-Wide CCS Projects Database

- Data compiled from a multitude of sources
  - Websites, factsheets, reports, news postings, etc…
- To date ~195 projects
  - Includes active, developing, proposed, on hold, or completed
    - USA: ~ 80 projects
    - International: ~ 115 projects
- Approximately ~125 active projects
  - Either capturing, injecting, developing infrastructure, site characterization/selection, designing, or in the permitting process
    - USA Projects: ~ 50 projects
    - International Projects: ~ 75 projects

# Interagency Task Force Recommendations

- Established on February 3, 2010
- Co-chaired by DOE and EPA -14 agencies
- Goal: Propose a plan to overcome the barriers to the widespread cost-effective deployment of CCS within 10 years with a goal of bringing 5-10 commercial demonstrations online by 2016
- First public meeting held May 6, 2010
- Report issued August 2010:
  - The lack of comprehensive climate change legislation is the key barrier to CCS deployment
  - Create a Federal agency roundtable to act as a single point of contact for project developers

# Summary

- Ultimately, the winning technologies should be those that can meet environmental goals at a reasonable cost, with high reliability and with the flexible fuel and operating parameters appropriate to grid based power generation.
- To meet potential future carbon constraints, new coal fired steam power plants should be designed for the highest efficiency levels.
- New coal fired power plants can be designed and built today with provisions to accommodate a future retrofit for $CO_2$ capture.
- There are numerous technology options on solid paths to commercialization in the next 5 years that can provide options for cost competitive post combustion $CO_2$ capture from steam power plants and several emerging technologies with even greater promise to improve the economics of $CO_2$ capture in the next decade.

# Summary (cont.)

- A balanced portfolio of coal-based power technologies, using both pre and post combustion, will create a healthy competitive market, drive innovation and reduce risk of reliance on any single technology.
- The market will drive these technologies IF regulators allow competitive open markets to function.
- Carbon issue not in a vacuum - the utility industry faces decisions on what to do with smaller, older, less-efficient coal-fired plants
- Pending / soon-to-be-proposed EPA regulations may force decisions in the next 2-3 years:
  - Proposed Transport Rule (replacement for Clean Air Interstate Rule) (SO2 and NOx)
  - Utility MACT will be proposed in March 2011, final in November (S02 and air toxics)
  - Ozone National Ambient Air Quality standard (NAAQS) reconsideration – currently 75 ppb, proposed form 60-70 ppb (NOx)
  - Annual PM2.5 NAAQS review – currently 15.0 ug/$m^3$, could be 11-13 ug/$m^3$

# For More

Institute of Clean Air Companies
The national trade association for air pollution control and measurement technologies for stationary sources

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