ICAC Overview of the Status of GHG Control Technologies

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Presentation Overview

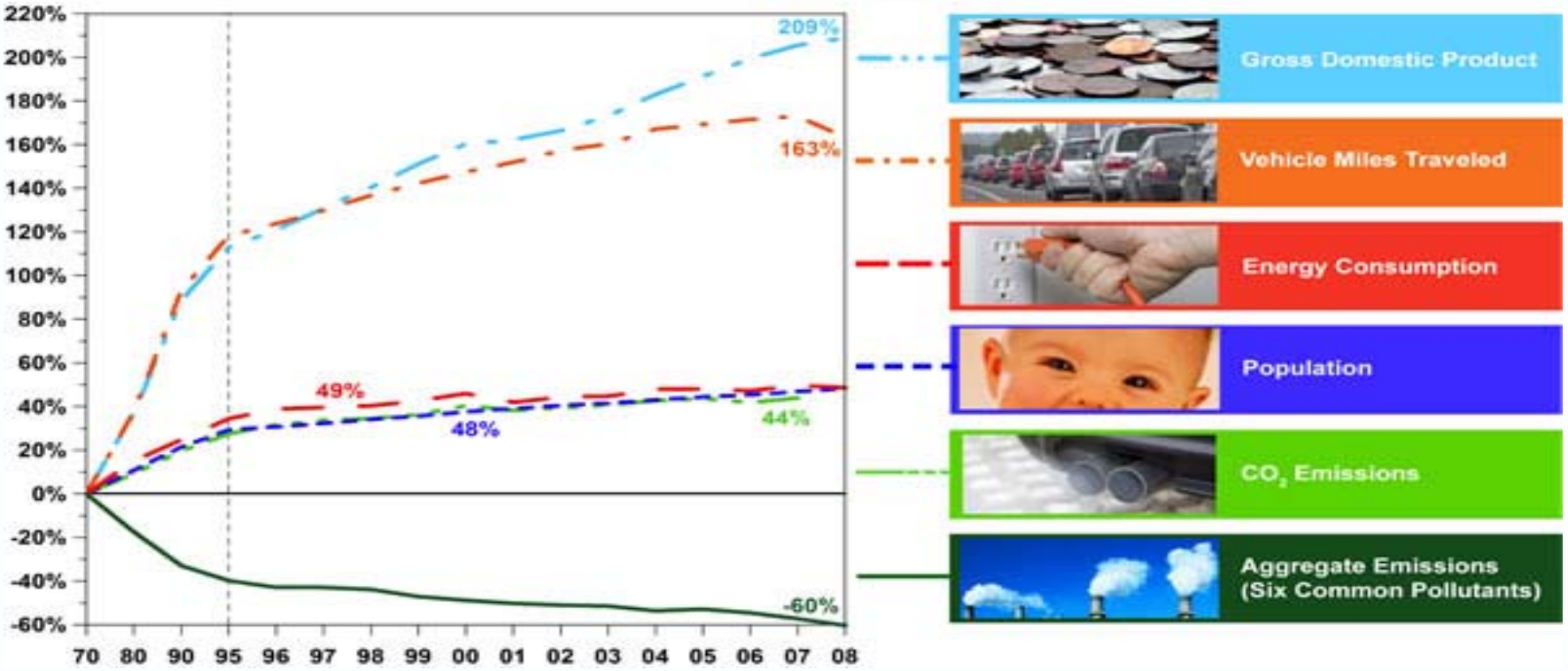
- Who is ICAC
- Drivers for Emission Control Technology
- Stages of CCS Technology Development
- What is Needed in the Short, Medium and Long Terms
- Summary

Institute of Clean Air Companies (ICAC)

- The National Association for Air Pollution Control Manufacturers
  - More than 100 Leading Manufacturers
  - Emissions Control (FGD,SNCR,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 to overcoming “chicken & egg” dilemma
- Improvements in emission control technology result after technology has been installed and operated



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)
  - Moutaineer, chilled ammonia, 20 MW - 100,000 tpy
  - Plant Barry, advanced amine, 25 MW

Stages of CCS Technology Development (cont.)

- Demonstration field tests at multiple sites: each new site represents new operating conditions and new challenges
  - Recent announcement of B&W and Fluor strategic alliance to jointly market and provide project execution for Fluor's Econamine FG Plus^{SM} technology to existing coal-fired power plants
- Demonstration projects:
  - Mountaineer, with CCPI III funding, 200 MW next by 2014 – 1.5 million tpy
- Commercial deployment:
  - problems will still be found at new sites, but most of the fatal flaws will have already been discovered and resolved

What is Needed in the Short Term

- ICAC Carbon Capture Control Focus Paper:
  - 6-8 demonstration projects needed by 2015 to establish commercial marketability of CCS technology
  - A demonstration project process flue gases from 200-300 MW and captures at least 50% of the CO2
  - Financial incentives and regulatory certainty will accelerate the timeline to achieve commercial marketability
  - First movers galvanize the commercialization of CC technology, and they face higher costs than those who wait
  - Therefore, it is an appropriate use of federal funds to spur the advancement of CC technology and to offset the financial penalty that first movers face for taking the initiative
  - Early distribution of funding is paramount to meet the 2015 date as the lead time to complete demonstration projects is 3-5 years

What is Needed in the Medium Term

- 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

What is Needed in the Long Term

- EPRI 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 in the U.S. 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

Summary

- As with the conventional pollutant pathway, CCS cost reductions will be achieved by:
  - Learning by doing
    - Engineering and construction
  - Learning by using
    - Operations and Maintenance
  - Supply chain improvements
    - Shop capacity
    - Mass production
  - Competition
    - More sub-vendors for major equipment
  - Economies of scale
    - Optimal unit sizing

Summary (cont.)

- There are numerous technology options on solid paths to commercialization in the next 5 years
- Several emerging technologies with great promise to improve the economics of CO_2 capture in the next decade

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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