Carbon Capture R&D at EPRI

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Palo Alto, California, USA

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Stanford University
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About The Electric Power Research Institute

- Mission: To conduct research on key issues facing the electricity sector on behalf of its members, energy stakeholders, and society.

- Established 1973 as independent, not-for-profit research center

- Major locations in Palo Alto, CA; Charlotte, NC; Knoxville, TN

- Nearly every area of electricity generation, delivery, use, health, environment, efficiency

- ~$400 million/yr revenue; 650 staff
EPRI Members…

• 450+ participants in more than 40 countries

• EPRI members generate more than 90% of the electricity in the United States

• International funding of more than 18% of EPRI’s research, development and demonstrations

• Programs funded by more than 1,000 energy organizations
EPRI’s Role...

Help Move Technologies to the Commercialization Stage...

Technology Accelerator!
Portfolio Spans the Entire Electricity Sector

**Generation**
- Advanced Coal Plants, Carbon Capture and Storage
- Combustion Turbines
- Environmental Controls
- Generation Planning
- Major Component Reliability
- Operations and Maintenance
- Renewables

**Nuclear Power**
- Advanced Nuclear Technology
- Chemistry, Low-Level Waste and Radiation Management
- Equipment Reliability
- Fuel Reliability
- Instrumentation and Control
- Long-Term Operations
- Material Degradation/Aging
- Nondestructive Evaluation and Material Characterization
- Risk and Safety Management
- Used Fuel and High-Level Waste Management

**Power Delivery & Utilization**
- Transmission Lines and Substations
- Grid Operations and Planning
- Distribution
- Energy Utilization
- Cross Cutting Technologies

**Environment**
- Air Quality
- Environmental Aspects of Renewables
- Global Climate Change
- Land and Groundwater
- Occupational Health and Safety
- T&D Environmental Issues
- Water and Ecosystems
Foundation of EPRI’s Work on Post-Combustion CO₂ Capture

- EPRI evaluated ~120 post-combustion technologies. Most are TRL 2-4.
- Breakthroughs will require collaboration between synthesis chemists, process developers, and power plant personnel
- Experiments with in-house models
Timescale for Capture Process Development

Concept to Commercialization
10-15 years on aggressive, well-funded schedule
Post-Combustion CO₂ Capture R&D at EPRI

- Process Simulations
- Materials Development
- Lab Tests
- Bench Tests
- Alpha Pilot (~1 MWe)
- Beta Pilot (~25 MWe)
- Pre-commercial Pilot (~150 MWe)
- Commercial Demo (~500 MWe)

TRL Levels:
1. TI
2. TI
3. TRL 1
4. TRL 2
5. TRL 3
6. TRL 4
7. TRL 5
8. TRL 6
9. TRL 7
10. TRL 8

Major Participants:
- EPRI, VRI
- U of TX, ION*, LBNL*, UC Berkeley*, NU Singapore#
- NJIT, U Colorado*, LANL*, U of Colorado
- 3H*, U of KY, U of WY
- URS*, ADA-ES*, MTR*
- National Carbon Capture Center*
- Calera*
- Alstom, MHI

Technology Areas:
- Absorption
- Adsorption
- Membrane
- Biological/Mineral/Other

Informal Participants:
- NETL and ARPA-E

*NETL and ARPA-E
Future R&D

• Lower-cost CO$_2$ capture processes
  – RRRRR & DDDDD
  – New separations materials
  – Novel process configurations
  – Close integration with power plants
  – Need to integrate disparate disciplines

• CO$_2$ Chain
  – Capture impact on other constituents
  – Constituent impact on energy use, compression, transport, storage, monitoring
Together…Shaping the Future of Electricity