

CCSI

Carbon Capture Simulation Initiative

Building Confidence in the Business Case for CO₂ Capture

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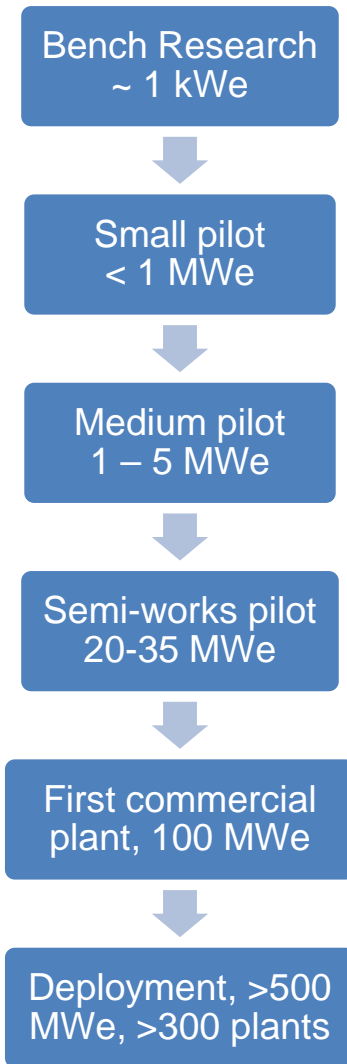
National Energy Technology Laboratory



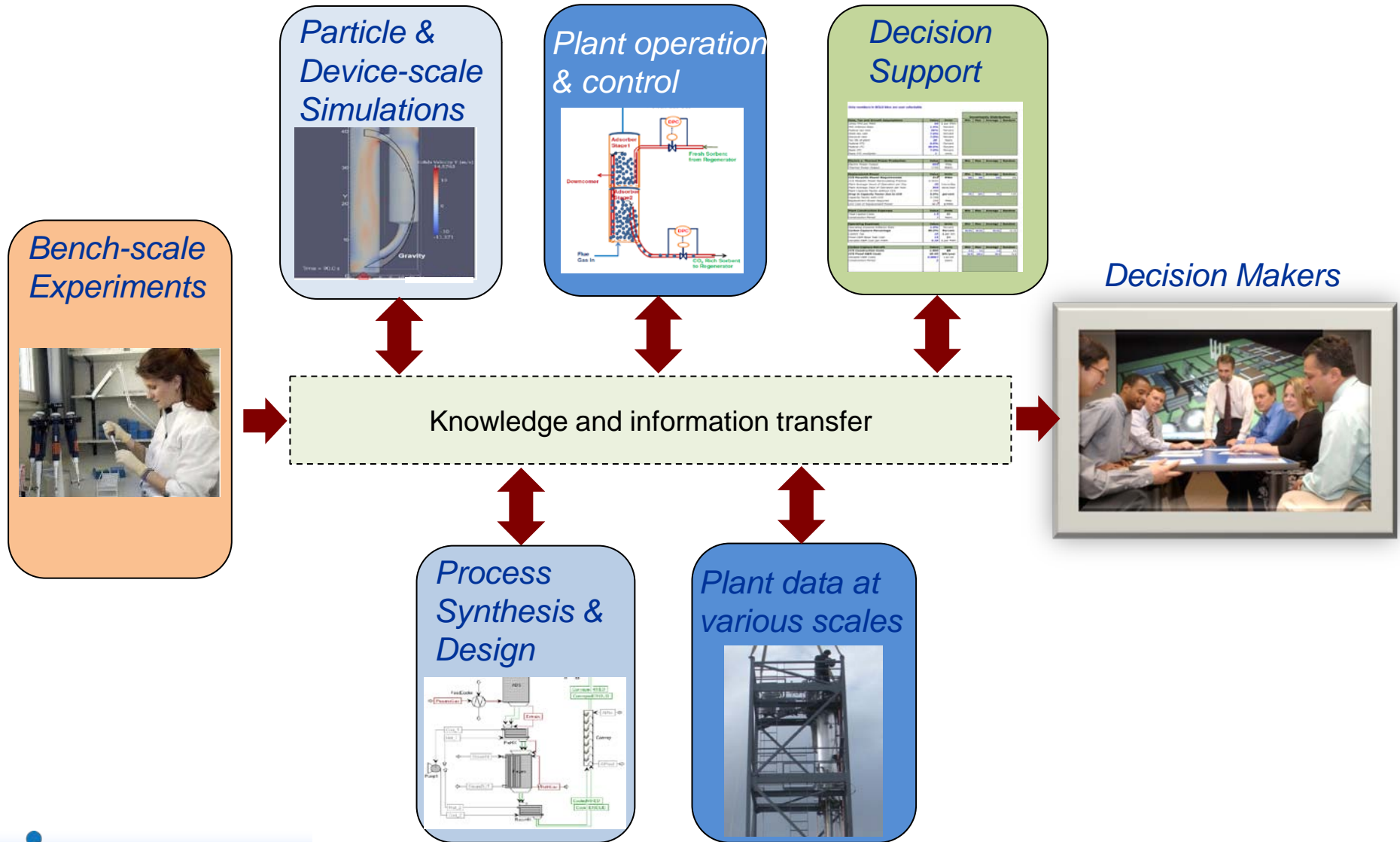
CCS Deployment Challenge

- The pathway of taking energy technologies from lab to power plant is long, 20-30 years
- President's plan requires that barriers to the widespread deployment of CCS be overcome within 10 years
- Therefore, new approaches are needed for taking CCS concepts from lab to power plant, quickly, and at low cost and risk
- Recent advances in science-based simulations will be brought to bear on the problem by Carbon Capture Simulation Initiative (CCSI)

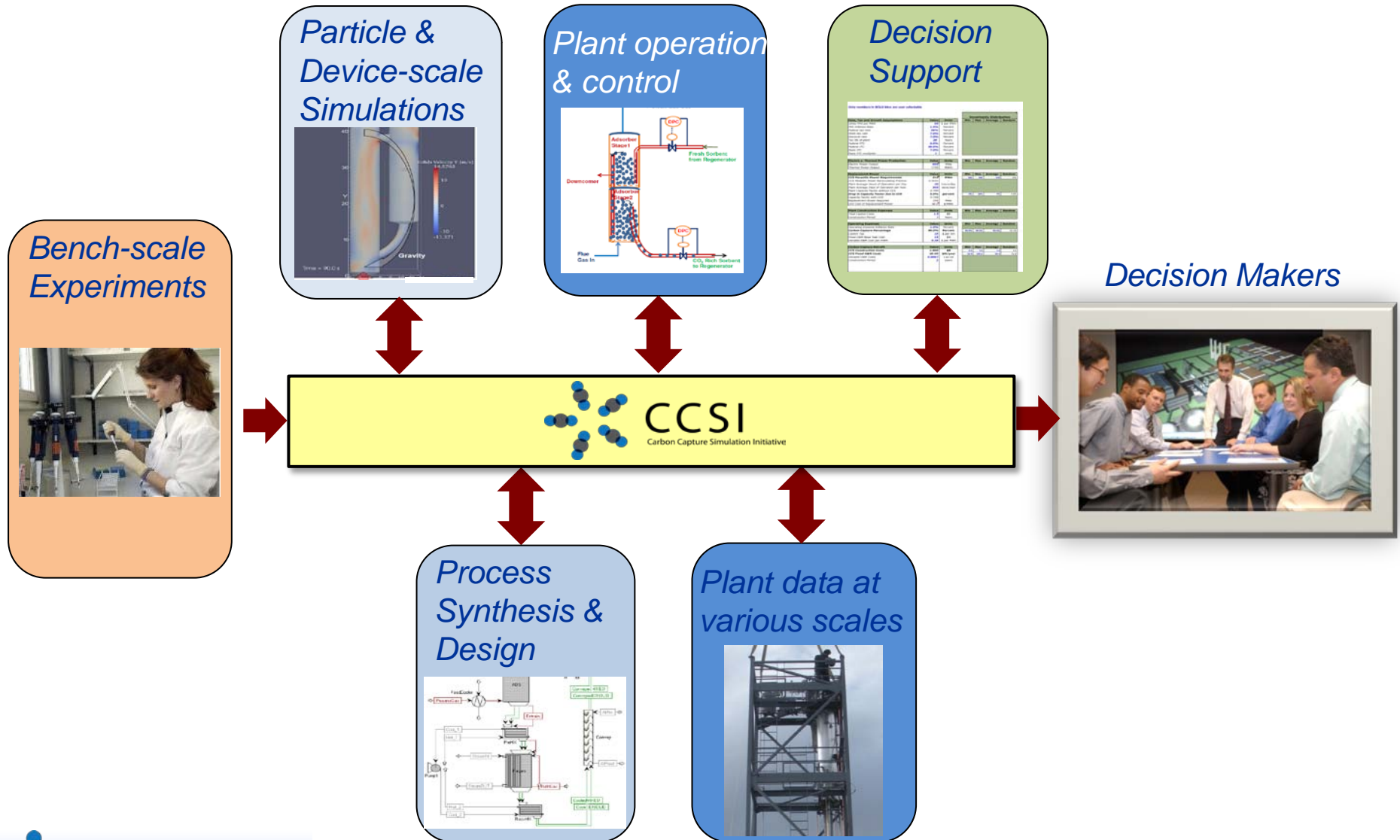
Essential for building confidence in the business case for CO₂ capture



Currently knowledge capture is incomplete

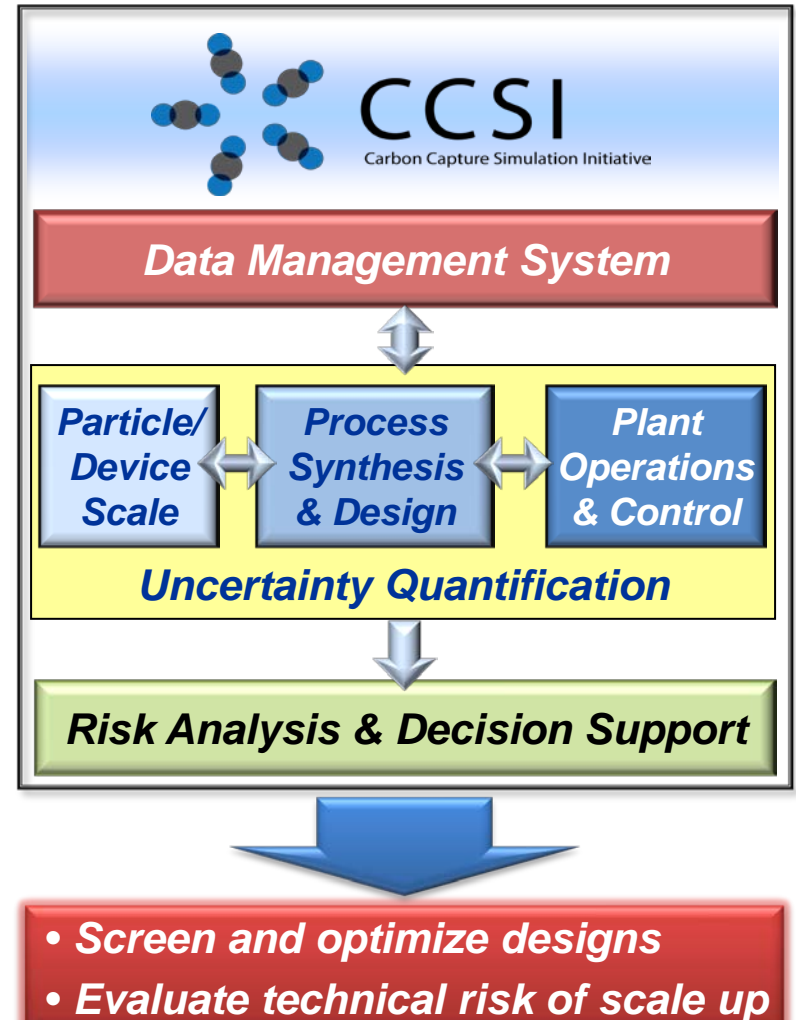


CCSI will enable complete knowledge capture



Toolset will integrate M&S with uncertainty quantification & technical risk analysis

- Complements experimental projects in DOE's CCS RD&D roadmap
- Development focused on post-combustion capture based on solid-sorbents
- Embodies innovations in Model Integration, UQ and Optimization, Technical Risk Analysis
- Promotes early adoption by integrating existing tools, widely used by the industry, into the CCSI Toolset
- Leverages core strengths of industry, academia, and national labs
- Primary users of CCSI Toolset
 - Technology providers: screening and optimizing designs
 - Power generators: evaluating technical risk of scale-up



Relevance to Technology Providers – 1

- Need to reduce uncertainty across the deployment pathway, including moving from demonstrations to early adopters/commercial users.
- “At scale” demonstrations required for:
 - Technology validation from pilot plant work
 - Project execution confirmation
- CCSI “role” is both:
 - Drive technology innovations into the process (such as solid sorbents), and
 - Risk reduction to enable next steps, sooner



Source: Don Langley, B&W (1/25/2011)



Relevance to Technology Providers – 2

- The Promise (and Challenge) of CCSI
 - Pack the pipeline for second gen technologies for demonstration; support accelerated learning.
 - Accelerate through early adopter phase by providing greater certainty of performance, thereby reducing risk and strain on business models (predictability)
 - Provide a platform for continuous optimization and for evaluation of alternatives in commercial embodiments of CCS technology



Source: Don Langley, B&W (1/25/2011)



Relevance to Power Generators – 1

- Needs of industry
 - Reducing risk of new technologies
 - Accelerating development and deployment
- Products can inform CCS deployment
 - CCSI will increase technical understanding, helping to decide to go to next scale of testing
 - For utilities, risk areas are harder to judge, application of risks in technology easier to apply directly than for financial and capital risks (due to regulated business model)



Source: Larry S. Monroe, Southern Co. (1/25/2011)



Relevance to Power Generators – 2

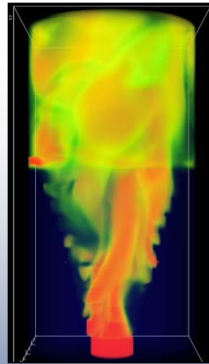
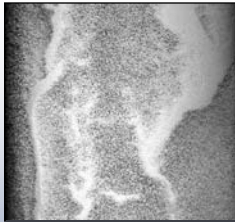
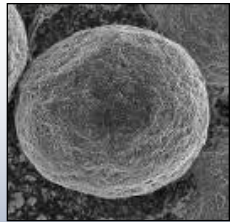
- Case studies are relevant
 - Solid sorbents, advanced solvents, oxy-coal are important potential technologies for Southern Company
- Potential users of CCSI are involved and are willing to engage with needs and required endpoints
 - Through IAB, major utilities and equipment vendors are represented
 - Utilities are focused on risk management, not product development itself
 - Utility decisions are not made only on quantitative scorecards



Source: Larry S. Monroe, Southern Co. (1/25/2011)



Carbon Capture Simulation Initiative



Identify promising concepts



Reduce the time for design & troubleshooting



Quantify the technical risk, to enable reaching larger scales, earlier



Stabilize the cost during commercial deployment

National Labs



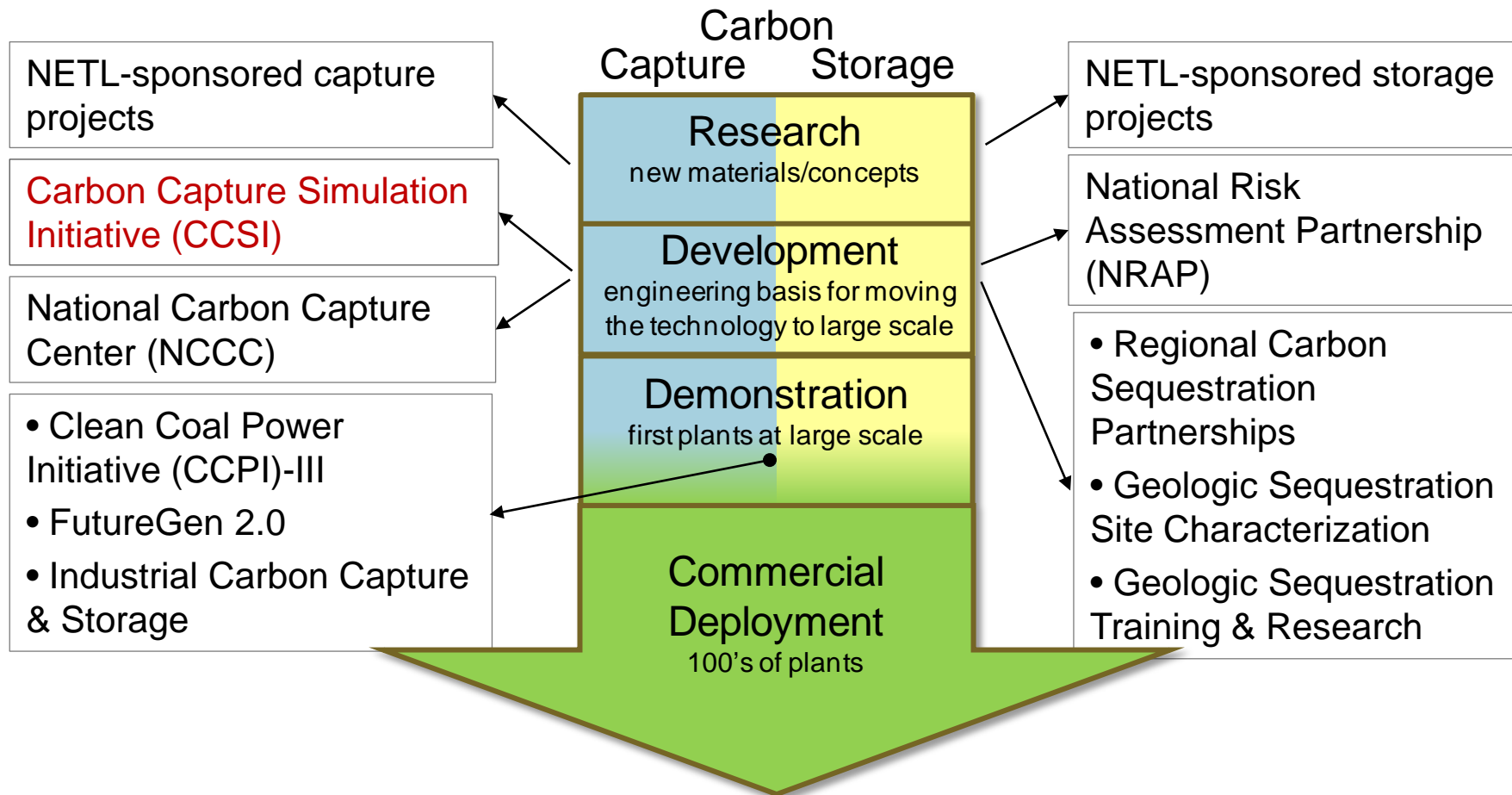
Academia



Industry



CCSI is a Pathway on DOE CCS RD&D Roadmap



Industrial Challenge Problems (ICP) will Underpin CCSI Toolset Development

Desirable ICP Attributes

- Provides relevant results to problems of current interest
- Develops CCSI capability that can be used for a wide range applications later
- Data available for validation

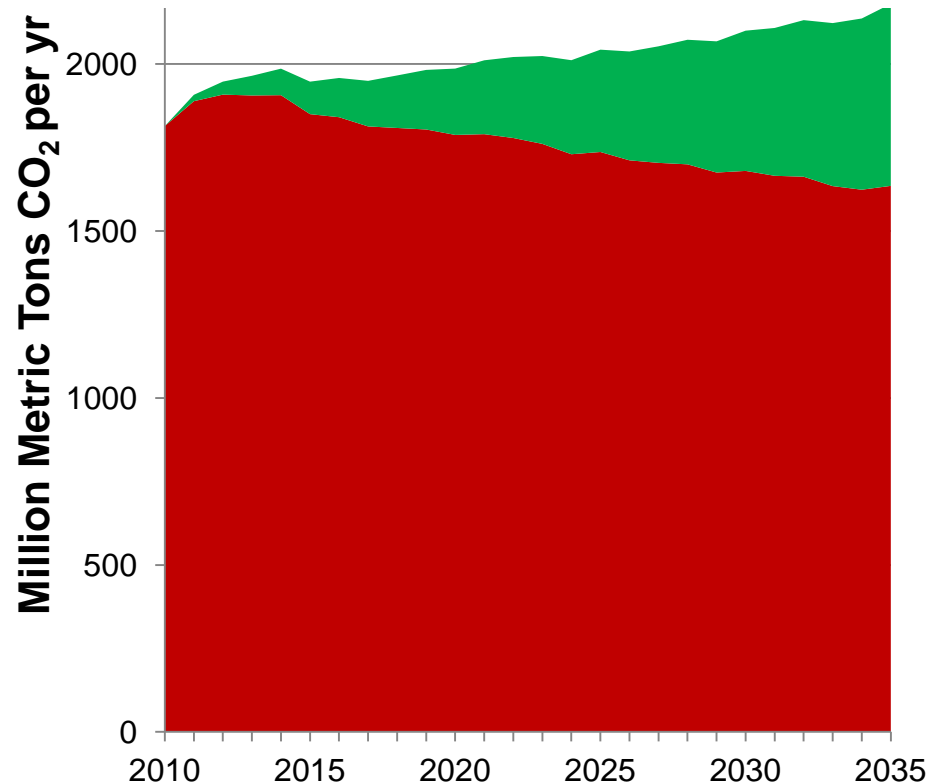
ICP priority: Pulverized coal plants

- 80% of emissions in 2030 will be from plants existing in 2010
- Approximately 280 U.S. pulverized coal plants are CCS candidates*

Initial focus: Solid Sorbents

- Opportunity to impact reactor & system design

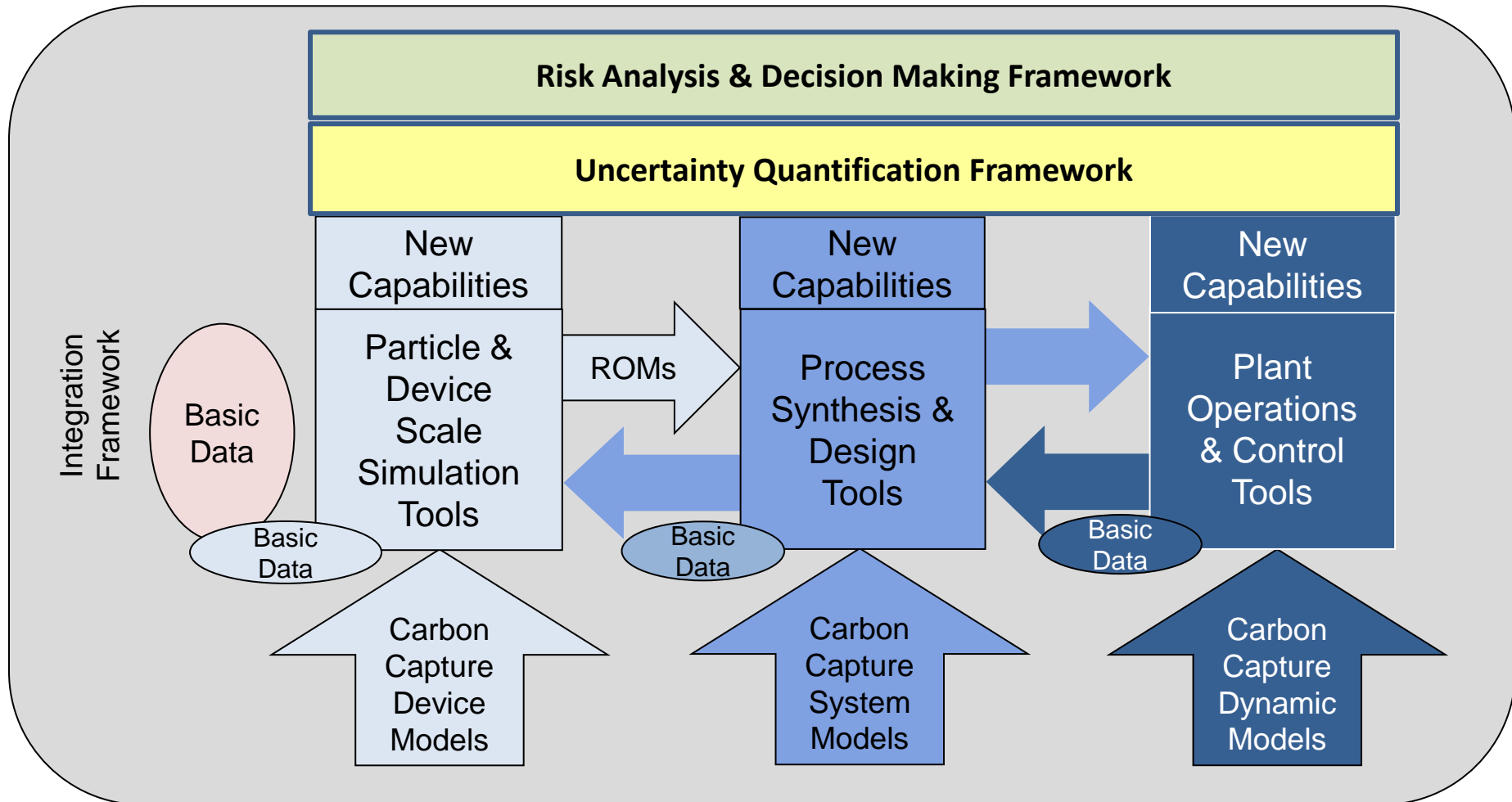
Projected CO₂ Emissions from U.S. Coal-Fired Power Plants



Source: EIA, Annual Energy Outlook 2010 Early Release, Dec. 2009

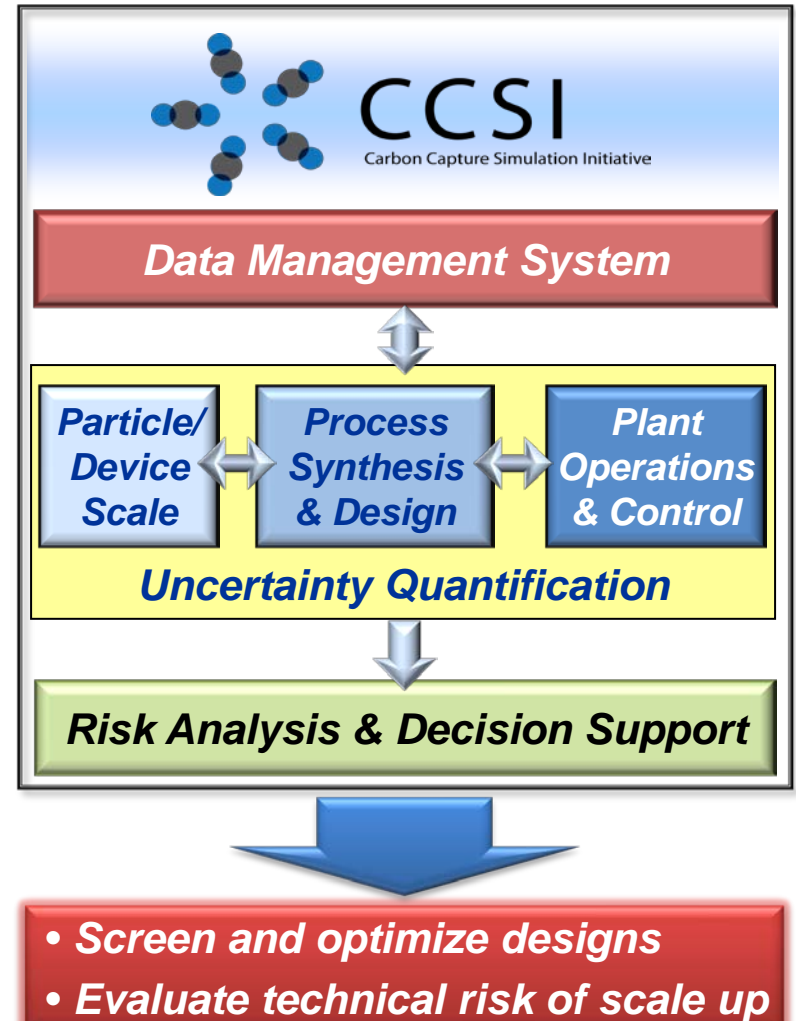
*Nichols, C., (2010). "Coal-Fired Power Plants in the United States: Examination of the Cost of Retrofitting with CO₂ Capture Technology and the Potential for Improvements in Efficiency", DOE/NETL-402/102309

CCSI Toolset Overview



The presentations in this session

1. Building Confidence in the Business Case for CO₂ Capture, Madhava Syamlal
2. Kinetic Model for silica supported amines with uncertainty quantification, David Mebane
3. Synthesis of optimal capture processes using advanced optimization, David Miller
4. Multi-Track Strategies for Carbon Capture Risk Assessment , Bruce Letellier
5. High-fidelity models of solid sorbent carbon capture equipment, Emily Ryan
6. CCSI industry engagement, John Shinn



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