

# ***Business Case Framework for Projects with CCS***

## ***Negotiating Public-Private Partnerships to Address Commercial Risks with CCS***

### ***CSLF Financing Roundtable*** ***International Concerted Action*** ***on CCS for the G8 / G20***

*Washington, DC*  
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# **Background: CCS Alliance**

[www.ccsalliance.net](http://www.ccsalliance.net)

## **□ Focus of the CCS Alliance (started in 2007):**

- A coalition of entities sharing a common interest in removing impediments to the investment in and development of CCS. (Rural coops, utilities, insurance, resource companies)
- Particularly focused on regulatory requirements regarding financial assurance, site closure certification, post-closure monitoring, and long-term liability.
- Addresses issues regarding the applicability of other federal environmental statutes, project and pipeline siting authority, subsurface property rights, and other issues.
- Promote the development of policy at state and federal levels to address CCS risk and liability issues appropriately. Work with regional partnerships on state level issues.
- Not limited to the power sector; industrial projects are important also for near-term progress.

## **□ Efforts and Accomplishments:**

- Conducted a comprehensive study of risk and legal liability issues, focusing on barriers posed by existing law and regulatory regimes to the commercial-scale deployment of CCS.
- Submitted comments on proposed CCS-related regulatory regimes, including EPA's proposed rule for underground injection wells (a new Class VI) under the SDWA.
- Communicated key issues to policy-makers regarding the treatment of liability and regulatory issues under proposed climate change and energy legislation.
- Examining the design and impact of a variety of incentives and regulatory approaches that stimulate investment and commercial deployment.

## Low-carbon Commercial-Scale Projects with CCS



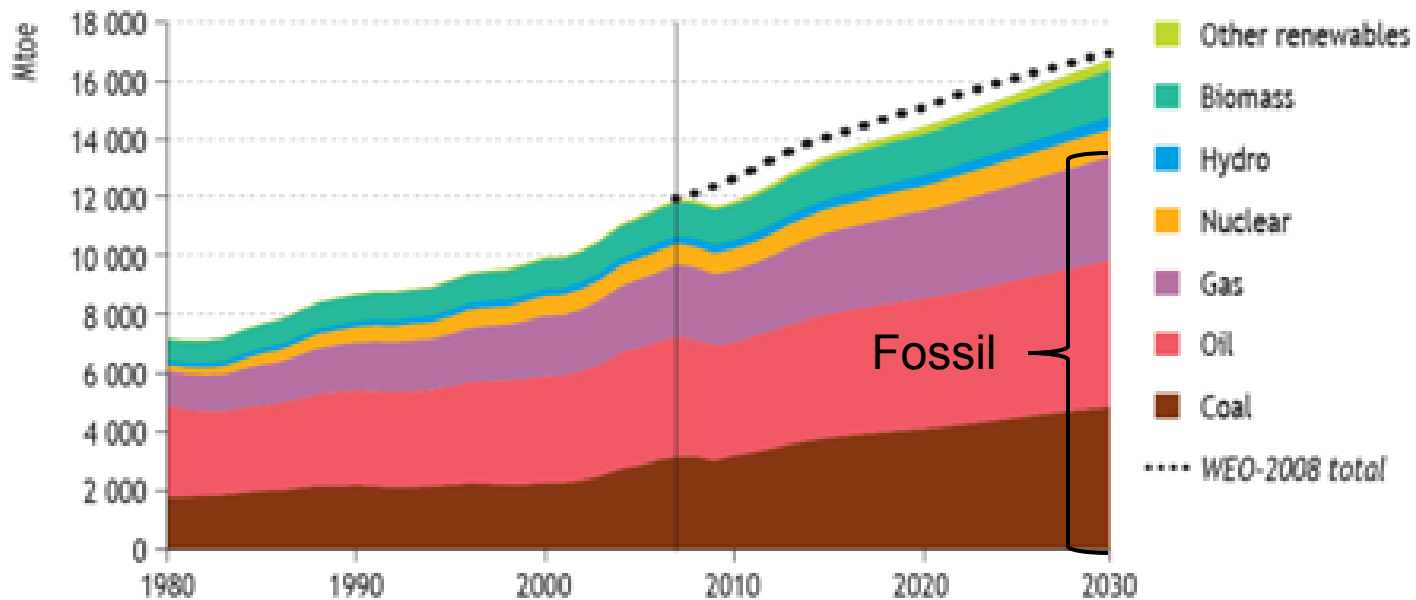
### Roundtable Themes / Issues:

- *How can the first wave of plants be built ?*
- *How can higher costs and critical risks be addressed and negotiated between public and private sectors ?*
- *For financing, what are the critical issues for lenders?*
- *Which policies address key risks; which don't ?*
- *Which approaches can overcome the differences in policy goals within G8 / G20:*
  - *Environmental goals*
  - *Energy security / reliability*
  - *Economic development and national sovereignty*

## IEA World Energy Outlook 2009 (reference scenario)

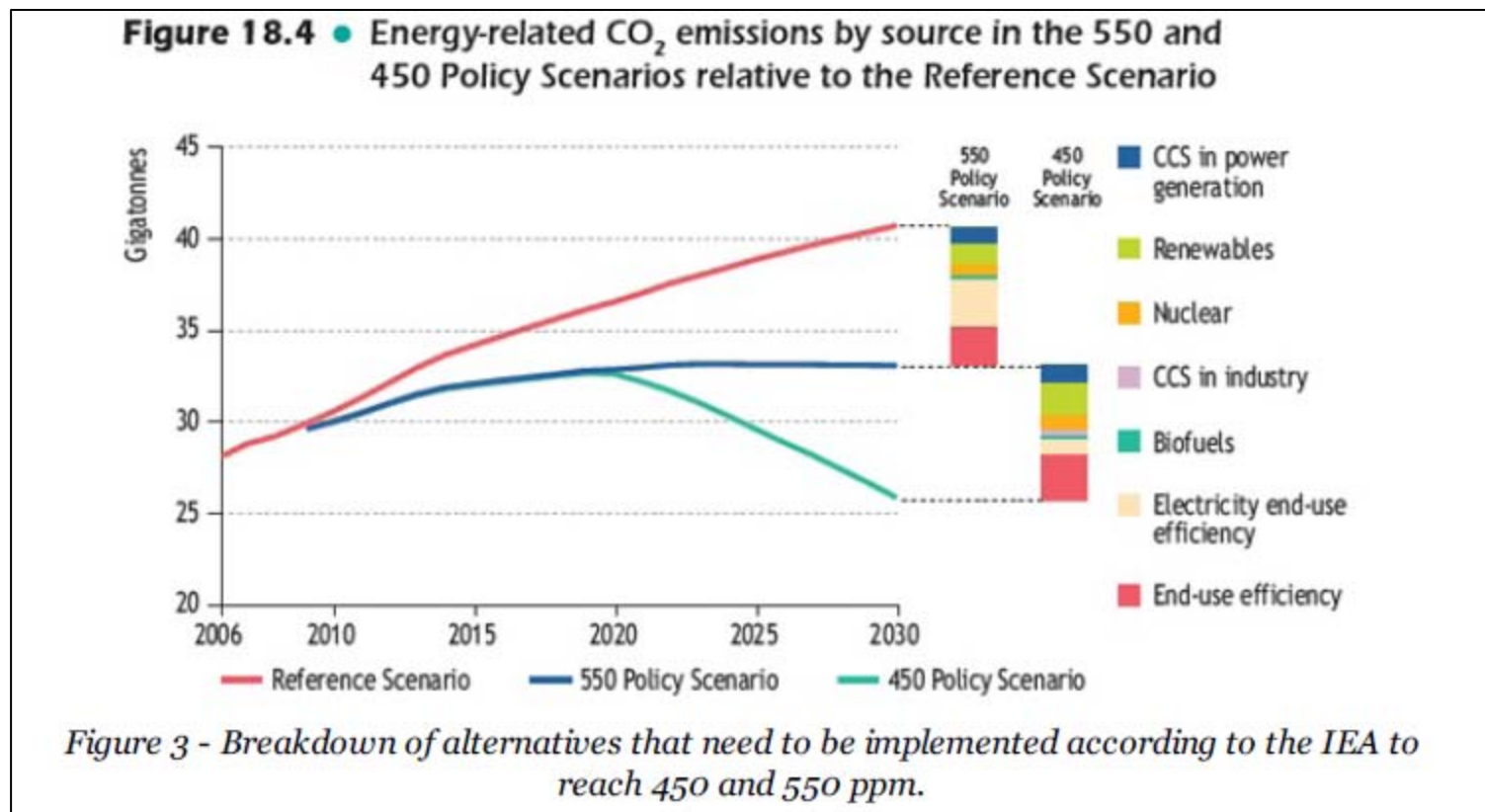
Coal remains an expanding portion of energy supply through 2030, particularly to fuel development in China, India, and N.America.

**Figure 1.1** • World primary energy demand by fuel in the Reference Scenario



## Impact on Fuel Sources: 550ppm vs. 450ppm

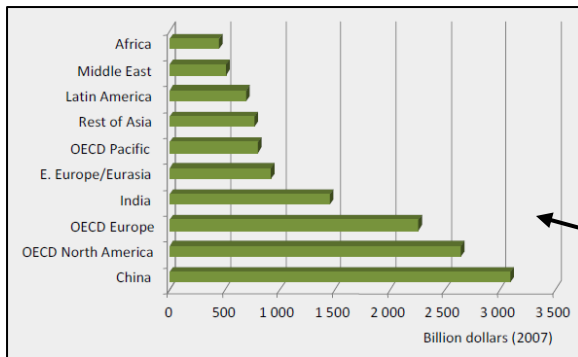
CCS is needed because other sources fall short (nuclear, EE & RE, fuel use), and because it offers carbon management options (EOR / EGR, synthesis).



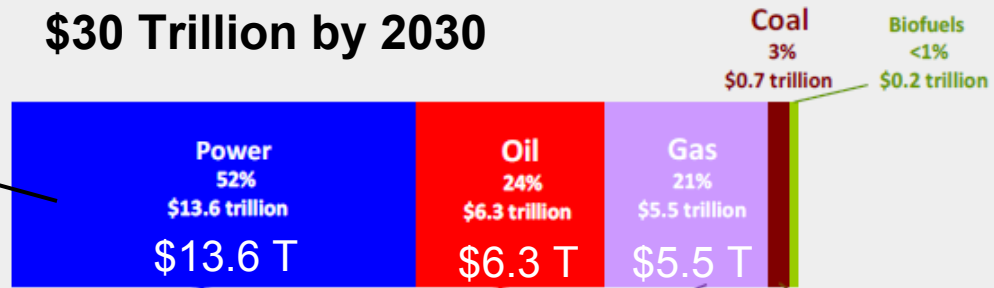
Public -Private Partnerships can flow through the bond market

## Capital Investment Required is Daunting → Debt

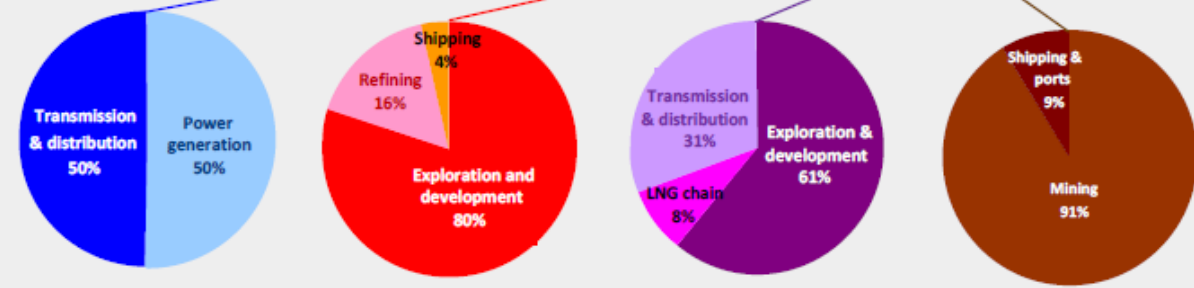
Lenders and bondholders will provide the bulk of energy financing to 2030, NOT venture capital, so a credit risk framework will prevail, focused on predictable, steady cash flows.



### \$30 Trillion by 2030

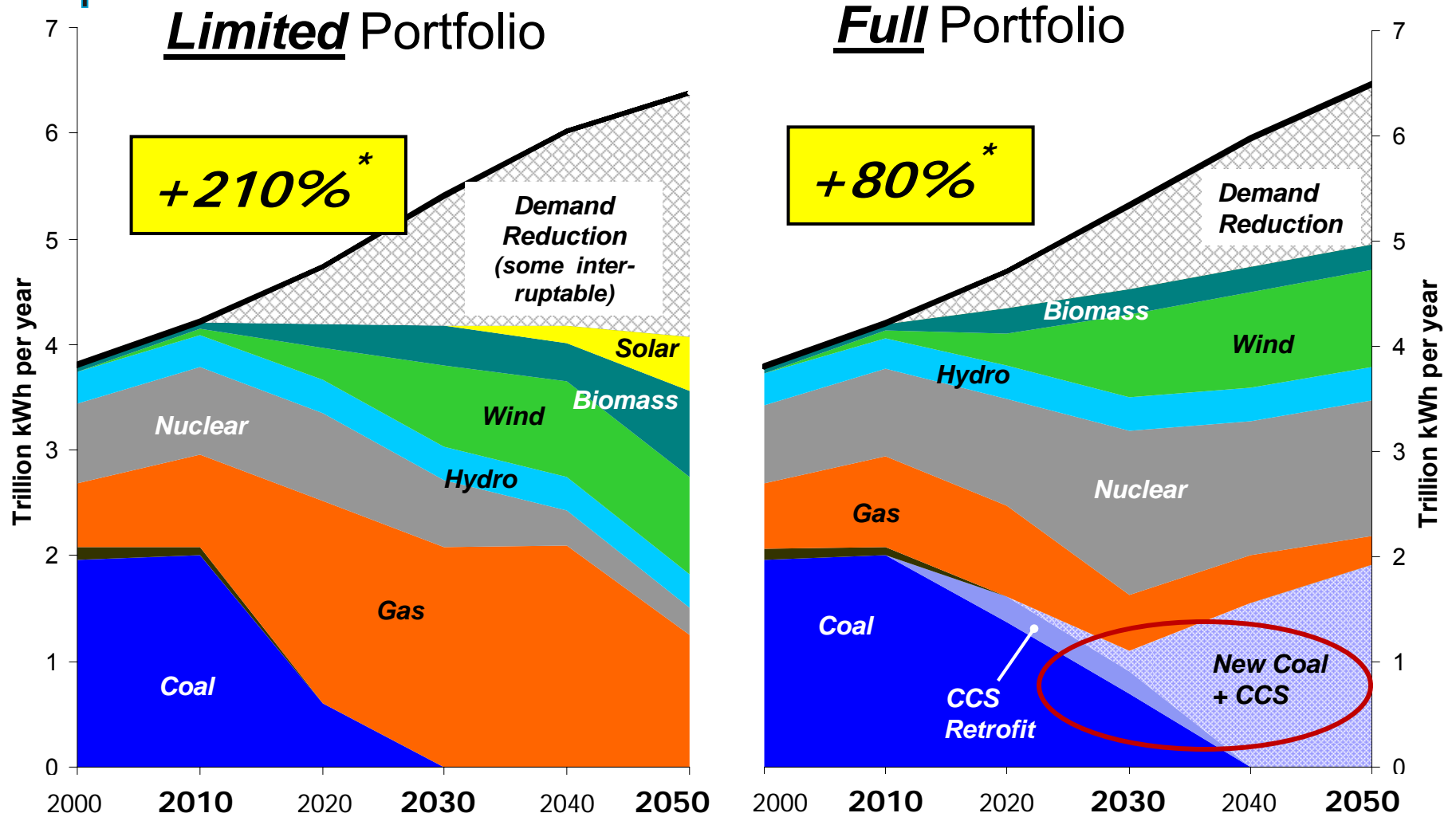


**75% of power sector investment (\$13.6 T) targeted in China, OECD Europe, and N.America**



*Investment of \$26 trillion, or over \$1 trillion/year, is needed, but the credit squeeze could delay spending, potentially setting up a supply-crunch once the economy recovers*

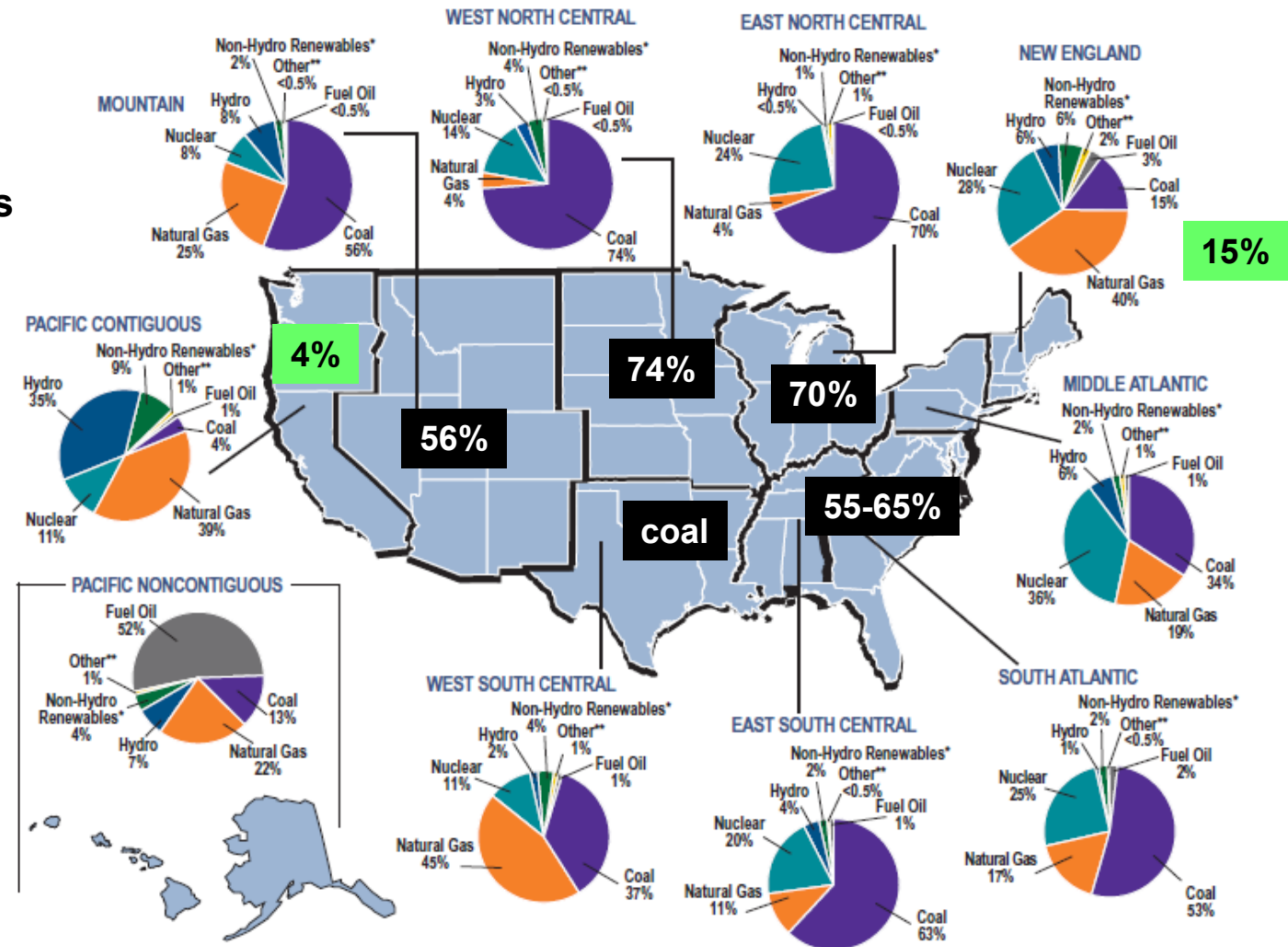
# EPRI: U.S. Generation, Limited vs. Full Portfolio



## Differing Electricity Mix by U.S. Region (EEI), 2008

National averages mask very sharp regional differences on GHGs and electricity fuel sources.

Coal provides half of U.S. electricity, but much more in certain regions.



<http://www.eei.org/>

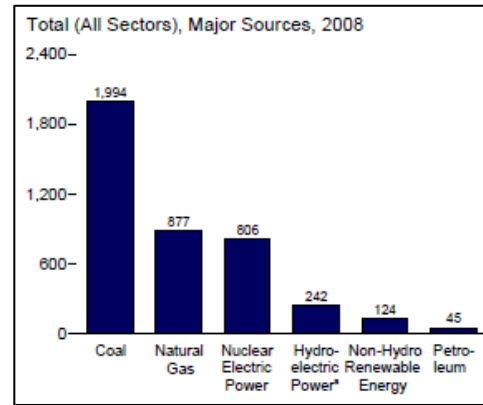
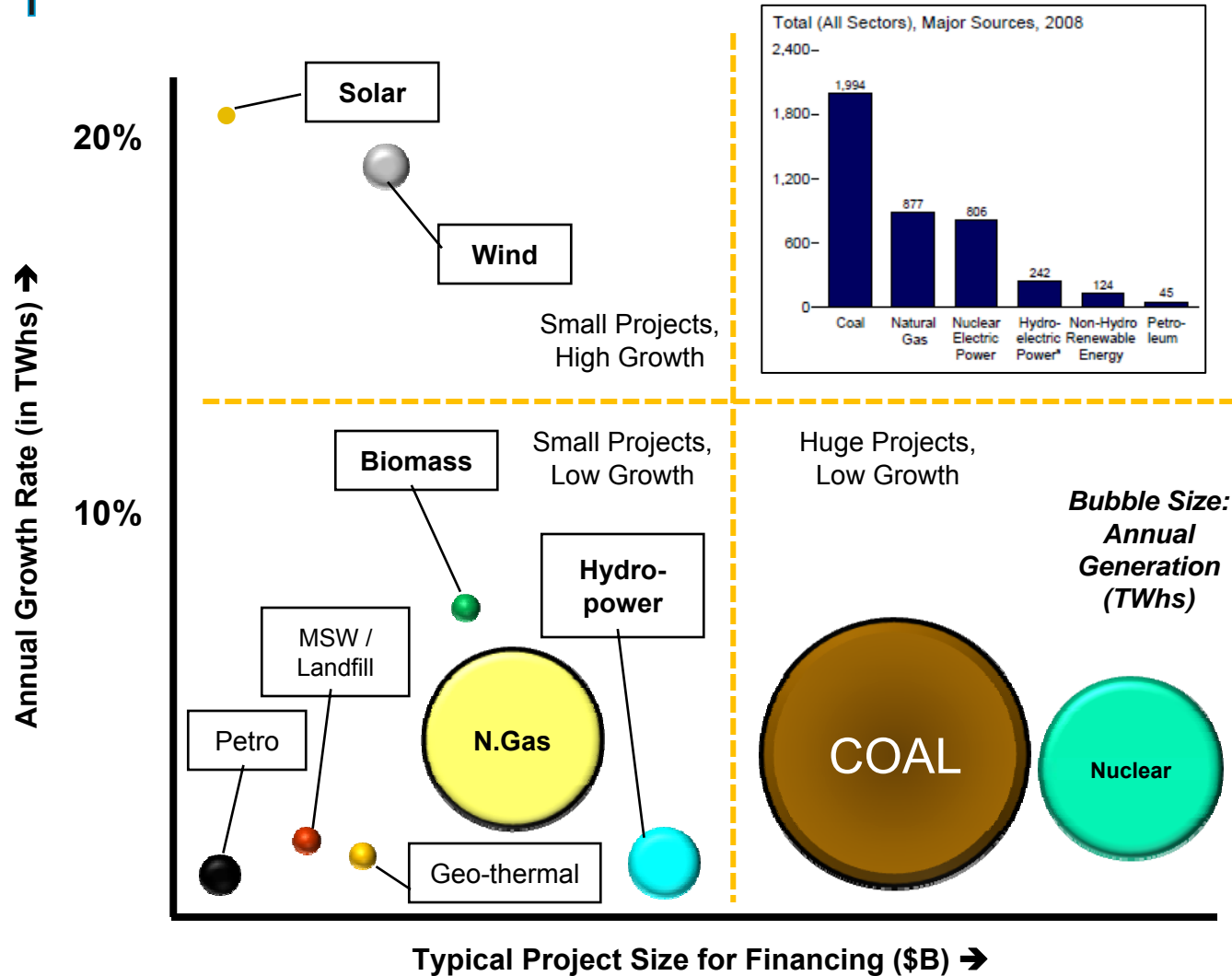
## Opening Observations for CSLF Finance Roundtable

1. Energy use cannot be curbed as much as GHG emissions by 2030; so, carbon management (CCS) enables more efficient use of fossil fuels.
2. Commercial plants and projects with CCS are not being built (except with EOR) for several reasons: not just elevated costs, but higher risks also.
3. Subsidies are NOT enough to get plants built; market uncertainties and emissions regulations and subsurface rules must be addressed as well.
4. The inherent size of projects with CCS requires debt financing, not venture capital; therefore, predictable cash flow (debt service) is the top issue.
5. Dealing with just *some* elevated costs and higher risks of first plants will not promote commercial deployment. Financing industrial plants is like a rocket launch: **all** risks must be addressed.
6. Stove-piping of power, energy and chemicals hinder best use of a broader industrial base with varying access to capital to deploy CCS.
7. A more resilient 21<sup>st</sup>C industrial base can be built, by drawing on broader industrial experience and engineering know-how. Bridging the commercial gap entails more industrial cross-uses and joint ventures.



(Drilling technology in oil sector to power plant CCS; gasification from chemicals to power)

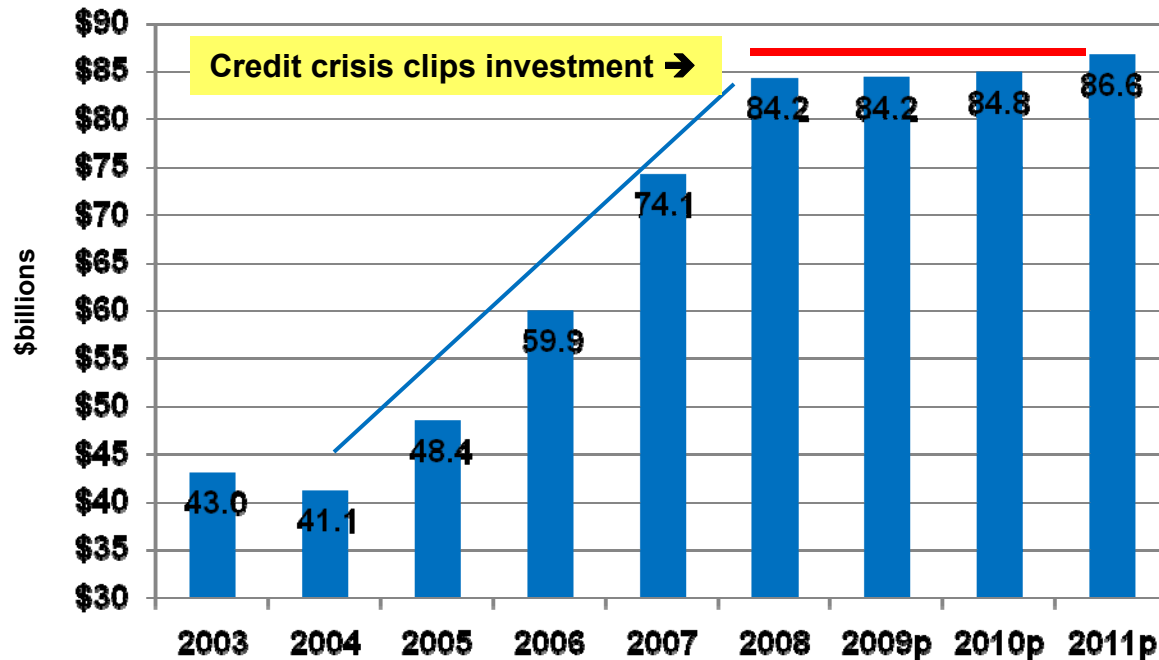
# Power Projects: Market Growth vs. Project Size



Coal use must be addressed globally by Major Emitters, and project size dictates debt financing.

# U.S. Utility Capital Investment Clipped (updated June 2009)

## U.S. Shareholder-Owned Electric Utilities

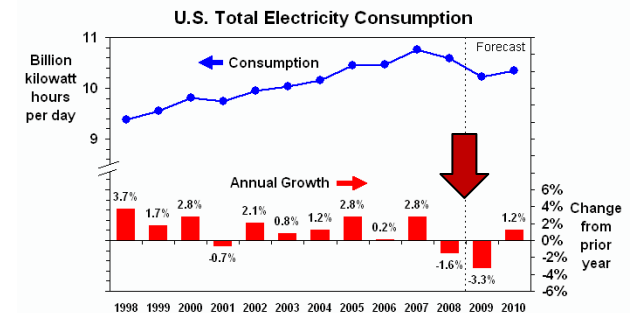
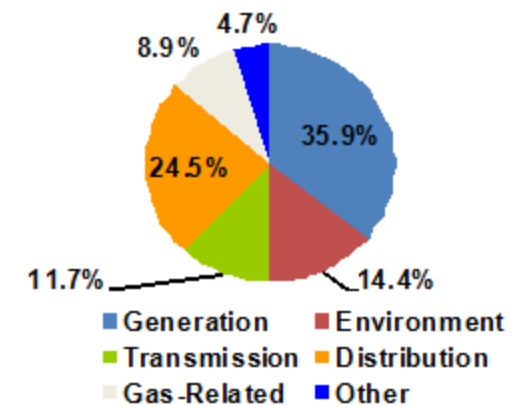


Source: EEI

**Growth in capital spending has subsided given:**

1. Credit crisis and shorter debt terms
2. Slump in overall demand growth with recession
3. Regulatory uncertainty related to GHGs, CAA, UIC
4. Elevated costs for construction

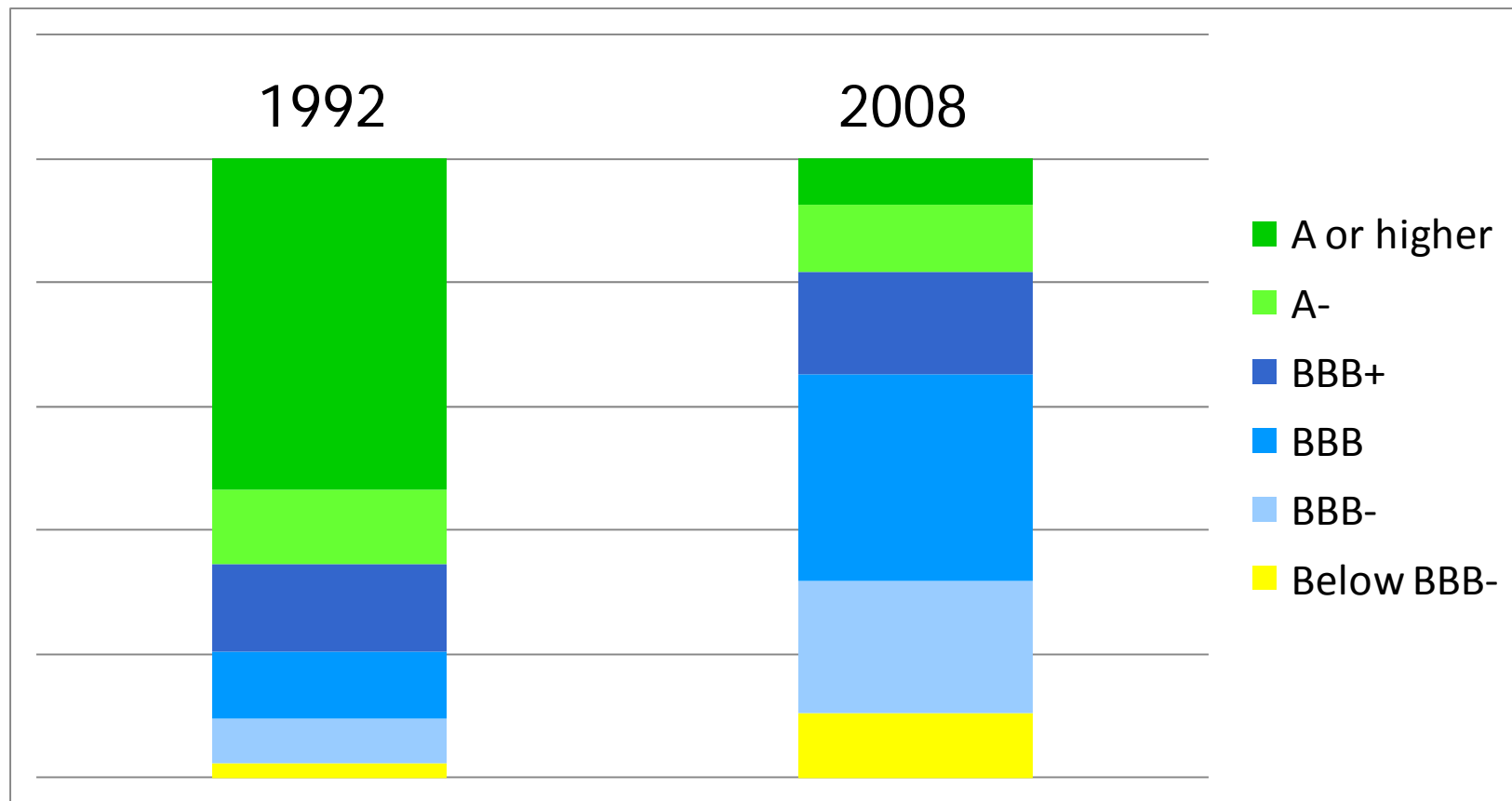
## 2008 Capital Expenditures



Short-Term Energy Outlook, September 2009

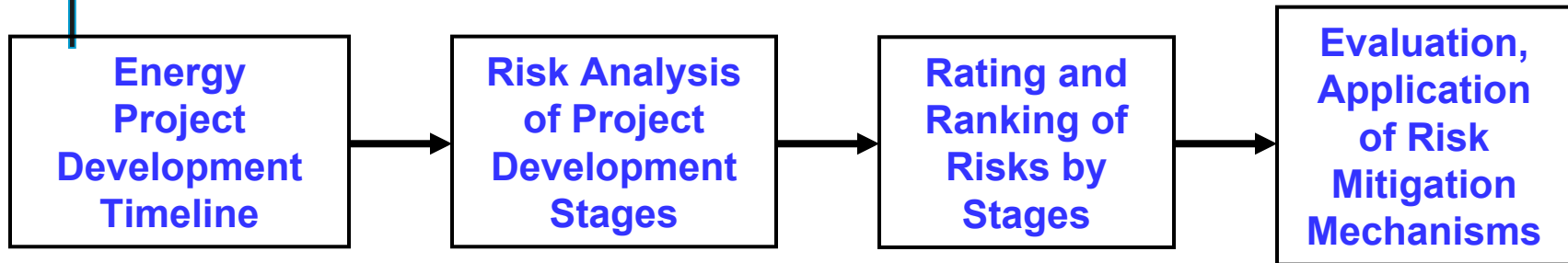
## Declining Credit Ratings of Utilities: 1992 vs. 2008

Erosion of credit standing raises capital costs for the power sector.



Debt Financing Drives the Framework, not “Venture Capital”

## Approach to Business Case Framework



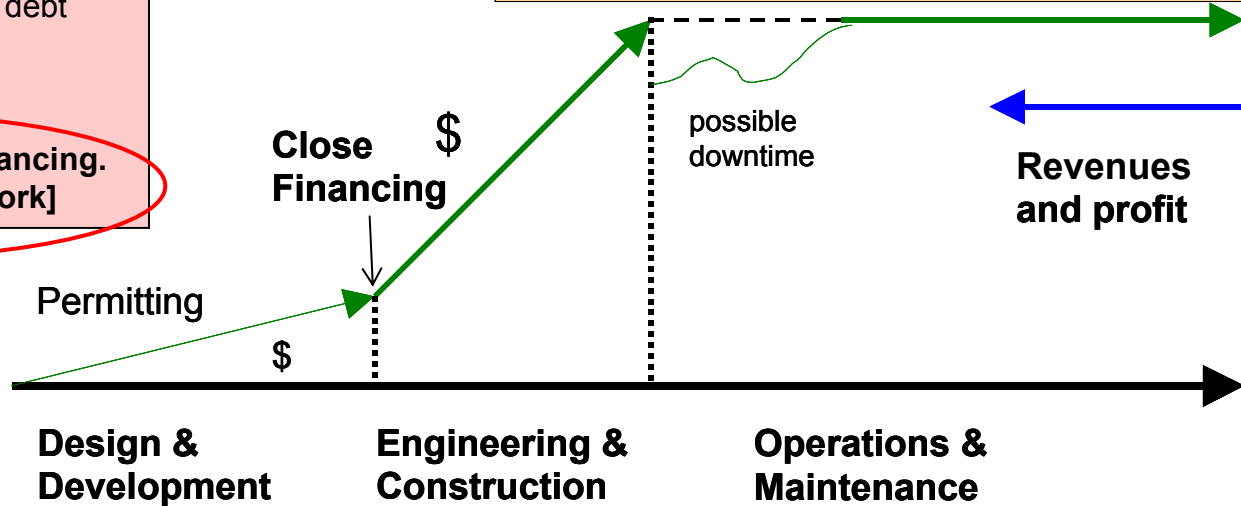
Regulatory and policy risks

Technology and operating risks

Market and Financial risks

Fossil projects with CCS cannot complete financing without a comprehensive commercial risk analysis by creditors with debt financing.

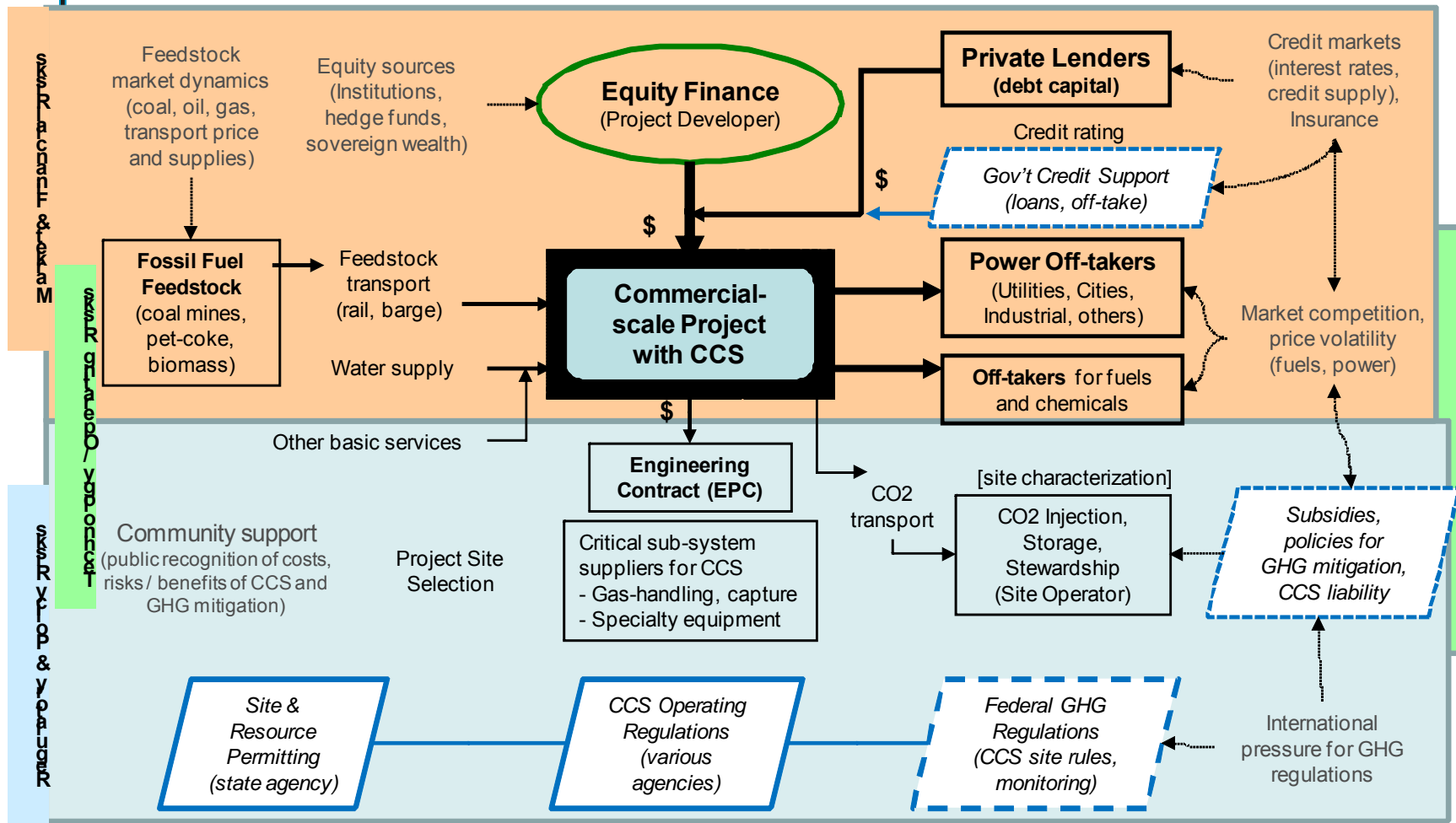
**Deployment = debt financing.**  
[credit risk framework]



Source:  
Scully  
Capital

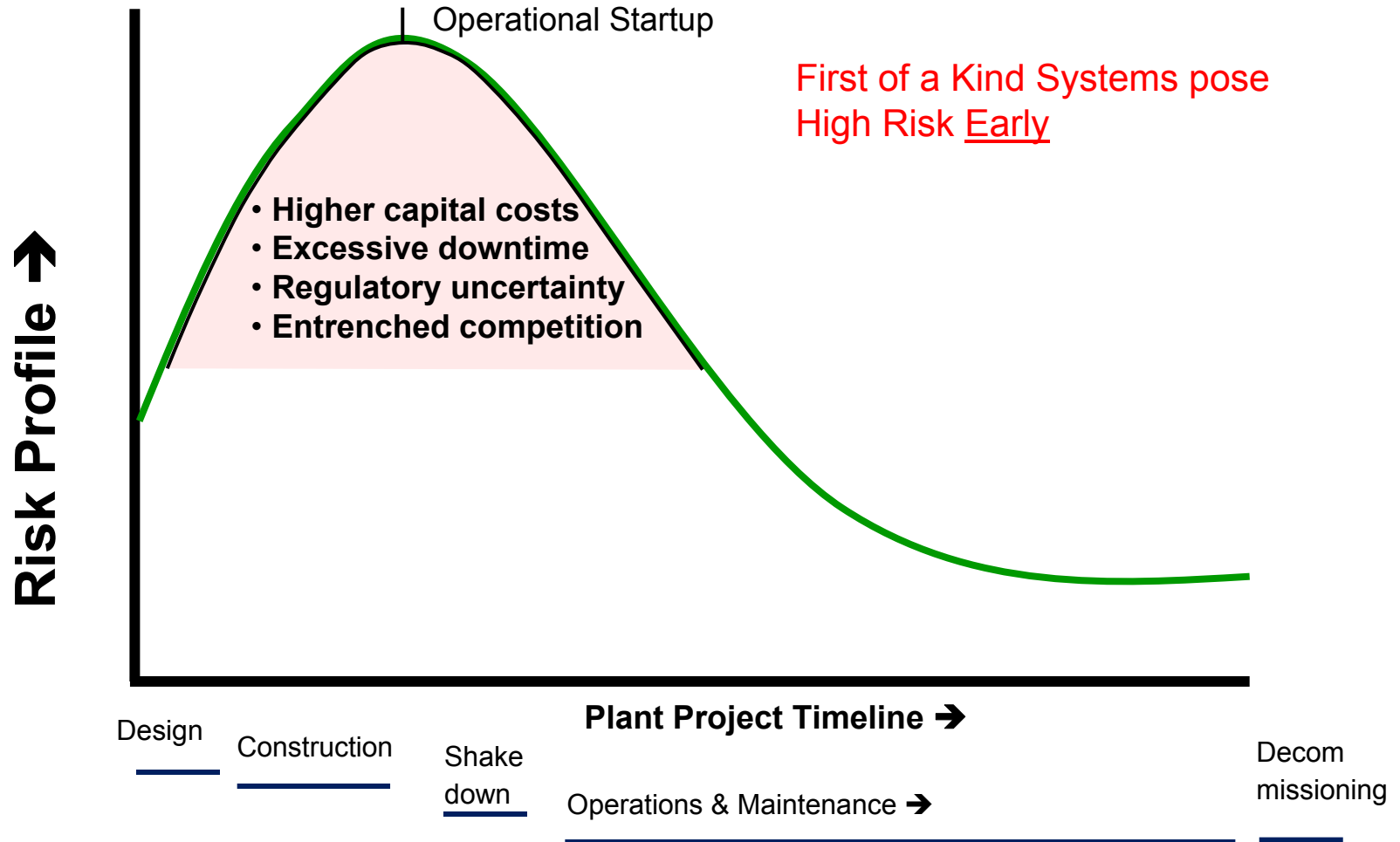
Risk Analysis rooted in Project Structure

# Commercial Scale Projects with CCS: Key Elements

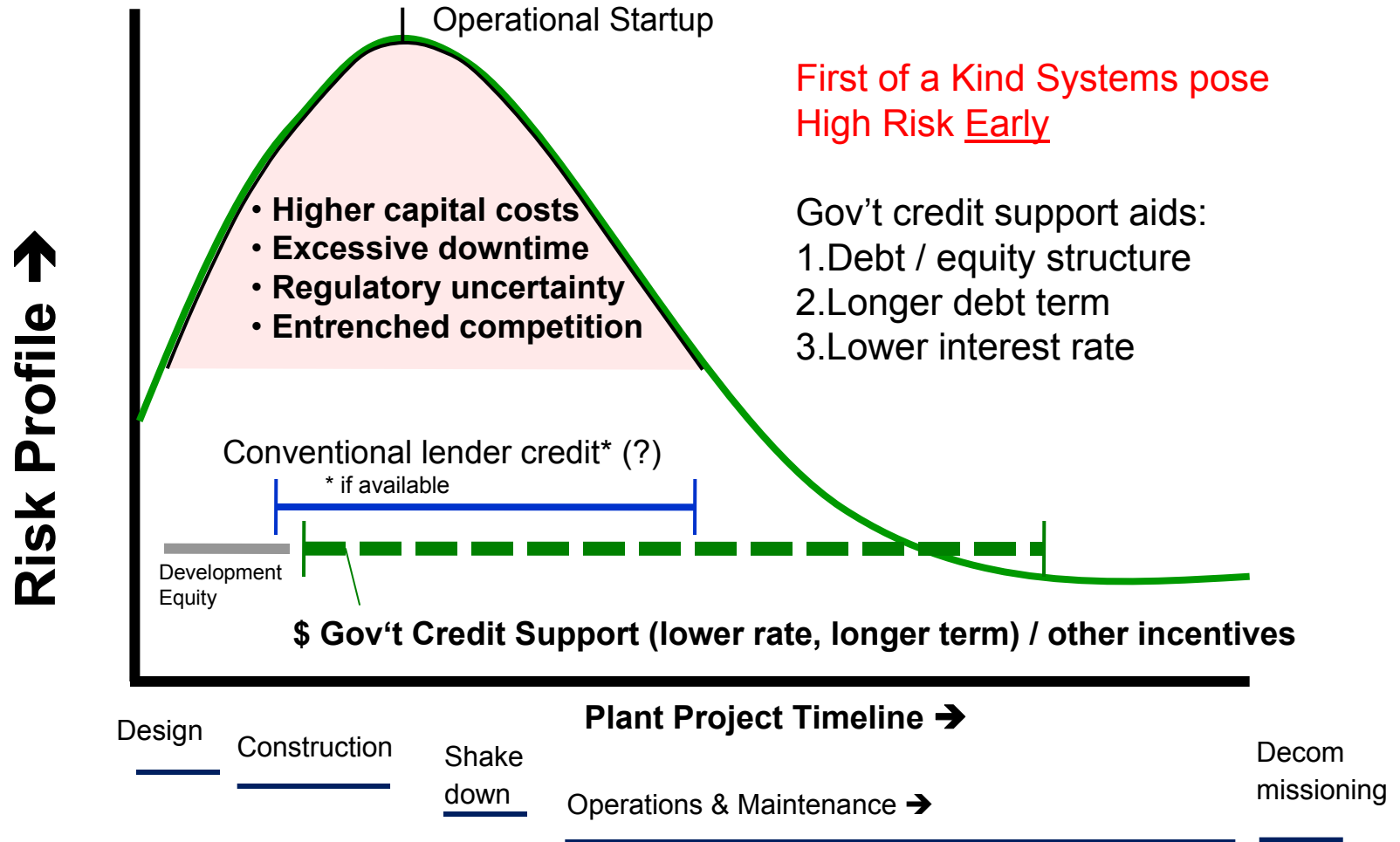


Source: CCS Alliance, ADPaterson

## Risk Profile on Innovative Technology Projects



# Risk Profile on Innovative Technology Projects

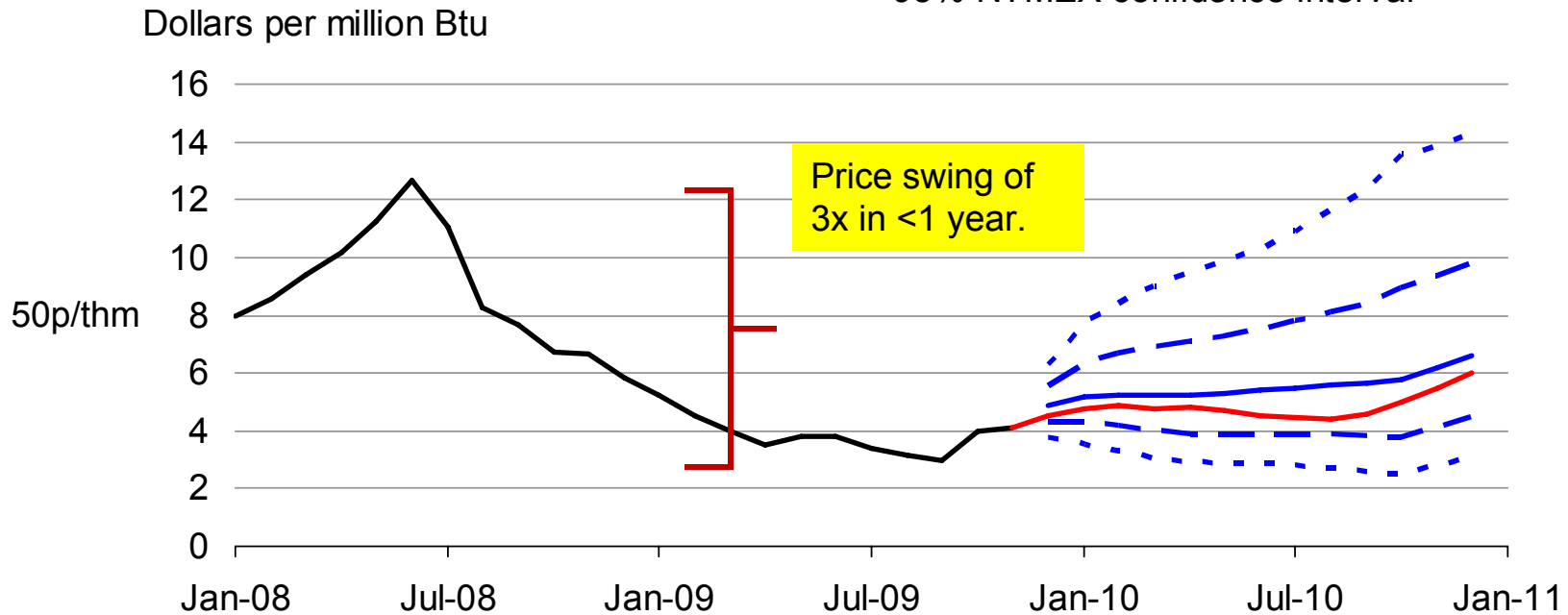


Source:  
ADPaterson

## Gas Price Outlook Remains Uncertain (volatile)

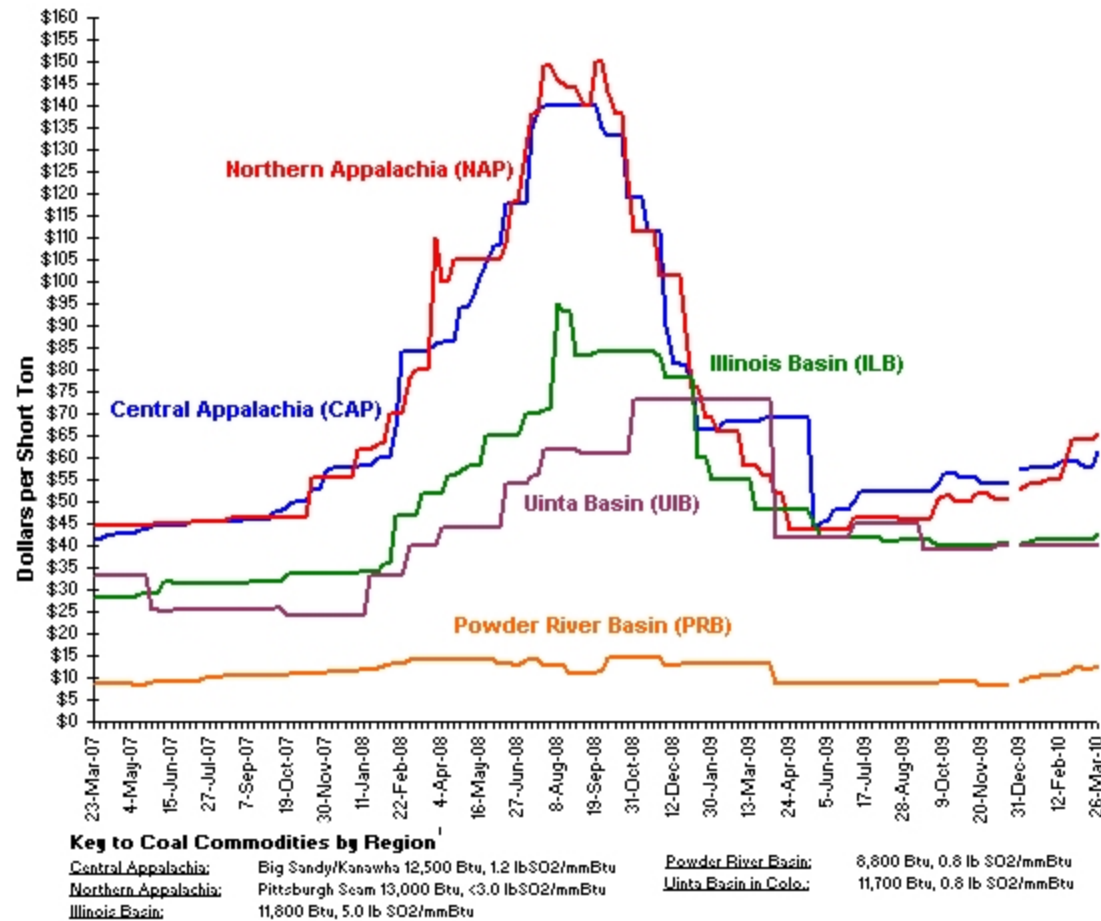
EIA:

- Henry Hub spot
- STEO Henry Hub forecast
- NYMEX futures prices
- - - 68% NYMEX confidence interval
- · · 95% NYMEX confidence interval



# Coal Prices Affected by Oil, Gas Price Volatility

EIA:



## Overview of Business Case Critical Risks

Some of the risks vary based on the market and policy differences by region; other risks are common across regions.

#	Risk Type	Business Case Risk Description	EU	N.Am	Asia
1	Tech	Capital costs (+ parasitic load) with CCS run too high relative to competing baseload	High	High	High
2	Policy	Electricity rate regulation fails to offer dispatch preference or incentives for CCS	High	High	High
3	Mkt / Fin	Credit financing constraints result in difficult terms (more equity, short debt tenor)	High	High	Med
4	Policy	Uncertain regulation on CO2 emissions results in low economic value for CCS	Low	High	High
5	Mkt / Fin	Natural gas prices remain lower making coal with CCS uneconomic	Med	High	Med
6	Policy	Incentives for CCS operations (allowances, tax credits) are inadequate for costs	Med	Med	High
7	Mkt / Fin	Volatility of (or lack of) carbon allowance prices hinders financing	Med	High	Low
8	Policy	Water use regulations threaten coal plant operations with CCS (shutdowns)	Med	Med	Med
9	Policy	Lack of clarity about liability for long-term stewardship of CCS hinders financing	Low	High	Low
10	Mkt / Fin	Long-term demand growth fails to justify investment in baseload units	High	Low	Low
11	Tech	Technical performance problems lead to excessive repairs and downtime	Med	Med	Low
12	Policy	Older coal units are allowed to run longer posing competitive challenges	Low	Med	Low
13	Mkt / Fin	Imported coal prices rise or see more volatility raising costs	Med	Low	Low
14	Tech	Transport of CO2 proves too costly or logistically difficult	Med	Low	Low
15	Policy	Lack of public recognition or acceptance of value of CCS hinders permitting	Med	Low	Low
16	Tech	Injection and storage encounters operating problems triggering higher costs	Med	Low	Low
17	Mkt / Fin	Interest rates rise threatening financing terms and costs	Low	Low	Low

## CCS Alliance

Fall 2009

# ***U.S. Risk Ratings on CCS – Update 2009***

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- **Concerns about capital costs remain high, primarily because of parasitic load.**
- **Low NGas prices (<\$6/MBtu) since late 2008 pose larger competitive problems.**
- **Subsidies are needed to overcome higher costs, but that is not enough.**  
(e.g., “Boucher bill” proposes to pay for subsidies with a wires charge on coal, fossil fuels)
- **Regulatory uncertainties pose “show stopper” risks for deployment of CCS:**
  - U.S. EPA regulatory rules (UIC) on CCS are not defined, but are in process.
  - The outlook for GHG/carbon emission legislation is more uncertain *despite* passage of the House bill... in other words; more questions about rule-making were raised !
  - But, without a cap of some form, utility commissioners face little prudence to consider CCS.
  - State regulations are not clear enough yet to fully resolve CCS cost and liability issues.
  - Incentives (tax credits, loans, allowances) are not enough to offset higher CCS costs.
  - A tightening of water regulations does not appear to pose much of a risk currently.
- **“First mover” risks are prohibitive for owner utilities, bondholders, or PUCs; and engineering firms cannot economically offer enough warranty (or “wrap”) to cover risks. Few owners want to finance early CCS demos and plants.**
- **Respondents expect that CCS equipment will work, and do not see CO<sub>2</sub> transport as a showstopper issue, nor do they see a CCS site failure as likely.**
- **Clarity is needed on CCS liability to close financing – perhaps a “showstopper”.**
- **Increases in coal prices or transport costs were not rated high risks.**

## Mitigation Mechanisms for Critical Commercial Risks

Risk-based mechanisms entail less federal budget impact, covering more projects.

Mechanisms provide A) a subsidy or B) risk assumption:

### A. Traditional “Cost-based” Mechanisms: Subsidies for higher cost technologies early

In Place?

- ✓ 1. Government grants (reduces capital costs and equity requirements) or government preferred equity
- ✓ 2. R&D, Demonstration plants (reduces technical risk, early risks)
- ? 3. Rate subsidies (carbon allowances, feed-in tariffs, tax credits)

### B. Progressive “Risk-based” Mechanisms: Negotiated between the public – private sectors

- ✓ 1. Loans or guarantees (repayment forbearance helps with downtime)
- ✓ 2. Permitting or dispatch preference or rate regulation
- ? 3. CCS Liability Regime / insurance

## Mitigation Mechanisms vs. Critical Commercial Risks

Governments wield a variety of tools or mechanisms for mitigating critical risks. Subsidies cost the treasury more, whereas, permitting preferences or liability coverage may address other risks more directly. In North America some mechanisms are carried out at the state level (e.g., rate boosts or permitting) more than at the federal level.

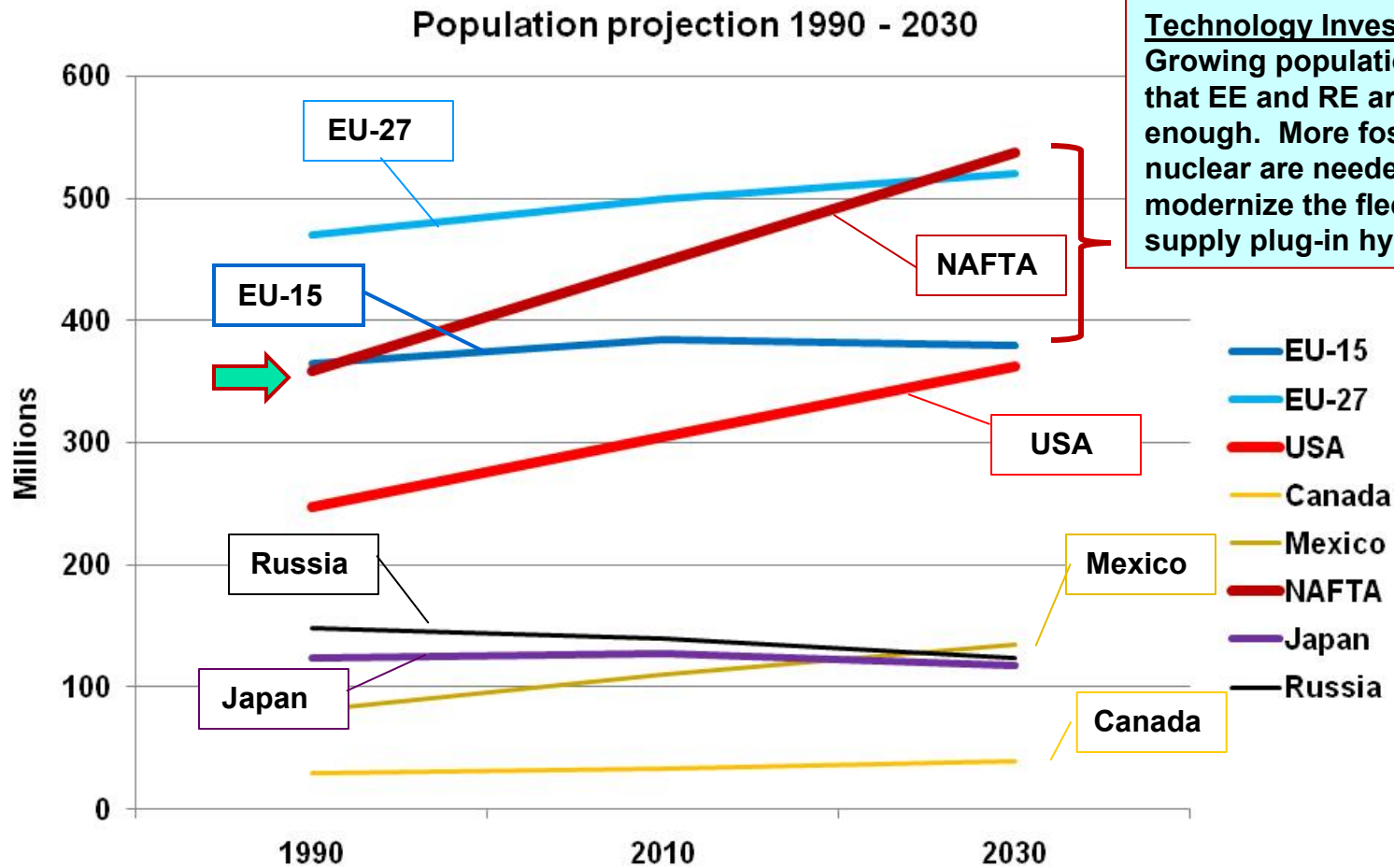
		Level of coverage: High = √√√; Medium = √√; Low = √						
XX Uncertainties remain about applicability or execution of the mechanism		Government policies and mechanisms for mitigation						
Cost or Risk Exposure to Government Budget ==>		High	Med	Med	Med	Low	Low	
#	Business Case Risk Description	Grants (or Govt equity)	R&D, Demo Funds	Govt Loans	Rate boost	Permit Pref	Liability Coverage	Mitigated ?
1	Capital costs (+ parasitic load) with CCS run too high relative to competing baseload	√√√	√√	√√	√√	√√	√√	Well
2	Electricity rate regulation fails to offer dispatch preference or incentives for CCS	√√	√√	√√	√√√	√√√	√	Well
3	Credit financing constraints result in difficult terms (more equity, short debt tenor)	√√√	√√	√√√	√√	√	√	Well
4	Uncertain regulation on CO2 emissions results in low economic value for CCS	√√√	√	√√	XX	XX	XX	Weak
5	Natural gas prices remain lower making coal with CCS uneconomic	√√	√	√	√√	√	√	Least
6	Incentives for CCS operations (allowances, tax credits) are inadequate for costs	√√√	√	√√	√√	√√	√√	Well
7	Volatility of (or lack of) carbon allowance prices hinders financing	√√√	√	√√	XXX	√√	√	Well
8	Water use regulations threaten CCS site operations (shutdowns)	√	√√	√	√	XXX	XX	Some
9	Lack of clarity about liability for long-term stewardship of CCS hinders financing	√	√√	√	√	√√	XXX	Less
10	Long-term demand growth fails to justify investment in baseload units	√√	√√	√	√√	√√	√	Some
11	Technical performance problems lead to excessive repairs and downtime	√	√√	√√	√	√	√	Some
12	Older coal units are allowed to run longer posing competitive challenges	√√	√	√	√	XX	√	Less
13	Coal prices rise or see more volatility, reducing profit	√	√	√	√√√	√	√	Less
14	Transport of CO2 proves too costly or logistically difficult	√√	√√	√	√√√	XX	XX	Some
15	Lack of public recognition or acceptance of value of CCS hinders permitting	√	√√	√	√	XXX	XX	Some
16	Injection and storage encounters operating problems, triggering higher costs	√	√√√	√	√	√	XX	Some
17	Interest rates rise, threatening financing terms and costs	√√√	√	√√√	√√	√√	√√	Well

## ***Policy Response Uncertainties (in supply and demand)***

- **Renewables will not offset new demand, let alone replace old capacity.**
- **End-use energy efficiency will be difficult because consumers don't tolerate price increases well and change behavior slowly (in NAFTA).**
- **Transmission costs and resistance will hinder renewables somewhat.**
- **Biomass power and fuels face local and regional supply challenges.**
- **Off-shore wind is proving more expensive and riskier.**
- **Not all the nuclear needed for carbon savings can be built physically.**
- **“Electricity competition” (or liberalization) basically failed in North America at the retail level with the merchant power bankruptcies.**
- **Access to U.S. shale gas bounty faces some regulatory hurdles.**
- **Will Russia make investments needed to deliver gas to EU (or to Asia) ?**
- **Rotating the vehicle fleet takes 30+ years; consumer acceptance is difficult to gauge. Retooling takes decades and auto makers face substantial credit constraints to manufacture plug-in hybrids.**
- **Urban planning and new traffic infrastructure will take two generations.**
- **State and federal financing capacities are under severe strain.**

## Population Growth a Key Factor in Policy Differences

Population growth in the NAFTA region is robustly rising, while EU-15, Japan, and Russia are not growing.



## *Do we need a GHG Bill? EPAAct, EISA, ARRA*

- **TRANSPORTATION**
  - ✓ Renewable Fuels Std at 36b gallons by 2022, with cellulosic
  - ✓ Upgraded CAFÉ on engines in the EISA bill... (but automakers in financial turmoil)
  - ✓ Transportation projects spending package possible in 2010 (~\$300B)
- **ENERGY INVESTMENT**
  - ✓ DOE Loan Guarantee Program from EPAAct '05, expanded in ARRA
  - ✓ DOE LGs now bigger than DOE... >\$120B, all fuel sources
  - ✓ ARRA spending on Energy at 2x-3x previous budgets (~\$50B over three years)
  - ✓ ARRA tax credits through 2016, plus Treasury grants
  - ✓ 30 states have RES which is a steadier driver than cap and trade + RGGI
  - ✓ Rate base still available in the Southeast, Midwest on electricity tariffs
- **RESIDENTIAL / COMMERCIAL**
  - ✓ Expanded building and appliance standards, but huge base of retrofits
  - ✓ National EE Action Plan with states... (but natural gas is cheap again)
- **Will the commodities (oil, gas, metals) roller coaster continue ?**
- **Wild card: is fuel supply secure, or more volatility, higher prices ahead ?**

# Carbon Price Signals... but to which “Market” ?

... Capital markets can be more effective than Consumer markets

Annual  
Global  
Market  
Size

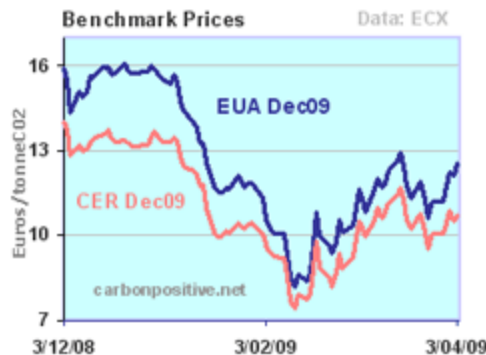
\$2.0T

## Most volatile

- **Fuels market** (global for oil; regional for gas)
- **Electricity “market”** (regional by nature; regulated in part)  
... and demand responds poorly to price; supply is restricted.
- **Carbon market (immature)**

<\$0.1T

Volatile  
carbon  
prices



## Less volatile... and large enough to

*handle the financing load*

- **Bond / Capital market** (national, global... mature)  
... and volatile electricity and carbon prices chill lending.

\$35T+  
(U.S.)  
\$100T+  
globally

**Aim price signals at capital investment vs. consumption.**

**Energy consumption is an essential good / service; it responds poorly to price.**

**Modernization is a direct path, requiring debt investment.**

## **Workshop Results Updated by Financing RT**

### **Draft Recommendations from CSLF “Bridging Gaps” Workshop (Sept. 2009):**

- 1. Develop project implementation partnerships with Industry**
- 2. Encourage “first movers” by moderating investment risks**
- 3. Provide adequate public funding (to meet emissions goals)**
- 4. Accelerate progress on storage regulation, characterization and pipeline infrastructure**
- 5. Conduct community outreach (on benefits / risks)**
- 6. Work with Industry to promote best practices, knowledge sharing and regulatory framework development**
- 7. Support demonstration projects in developing countries**

### **Recommendations seen through lens of CSLF Finance Roundtables (2010):**

- 1. CCS is not economic; public – private investment /partnerships are essential**
- 2. Public and private sector must negotiate risk-sharing, such as for long-term liability**
- 3. Public funding can take many forms: loans, tax credits, grants, capacity pmts**
- 4. Regulatory clarity, characterization and infrastructure must be in place to mobilize investment at commercial-scale**
- 5. Community outreach is not only on risks, but benefits, like regional development**
- 6. Experience with CCS *across* industries can promote best practices, knowledge sharing and regulatory insights**
- 7. Projects in developing countries can enhance engineering, system experience**