



Competitive Generation Investment

On The Brink of Climate Change

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Market and Climate Policy

Trends in Power Generation: Top 10 Industry Dynamics



One year ago..

1. Consolidation – no more utility mega-mergers
2. Credit – comfortable at Junk
3. Locational Capacity Markets – get implemented
4. Reserve Margins – ever tighter
5. Summer Gas – withdrawals
6. TXU/NRG New Builds – avoiding the Seven Sins
7. PPAs – Not whether but how
8. Carbon
9. Backend Controls – the rising cost of remediation
10. Shareholder Activism in Power Sector

Today

1. Carbon
2. Carbon
3. Carbon
4. Carbon
5. Carbon
6. Carbon
7. Carbon
8. Carbon
9. Carbon
10. Carbon

A Once-in-a-Generation Paradigm Shift

Key questions

Can we

- Maintain reliability requirements?
 - Meet carbon emission reduction targets?
 - Keep the US and global economies vibrant?
 - Do this without a return to regulation?
 - And keep using coal?
-
- Yes

OK -- How ??

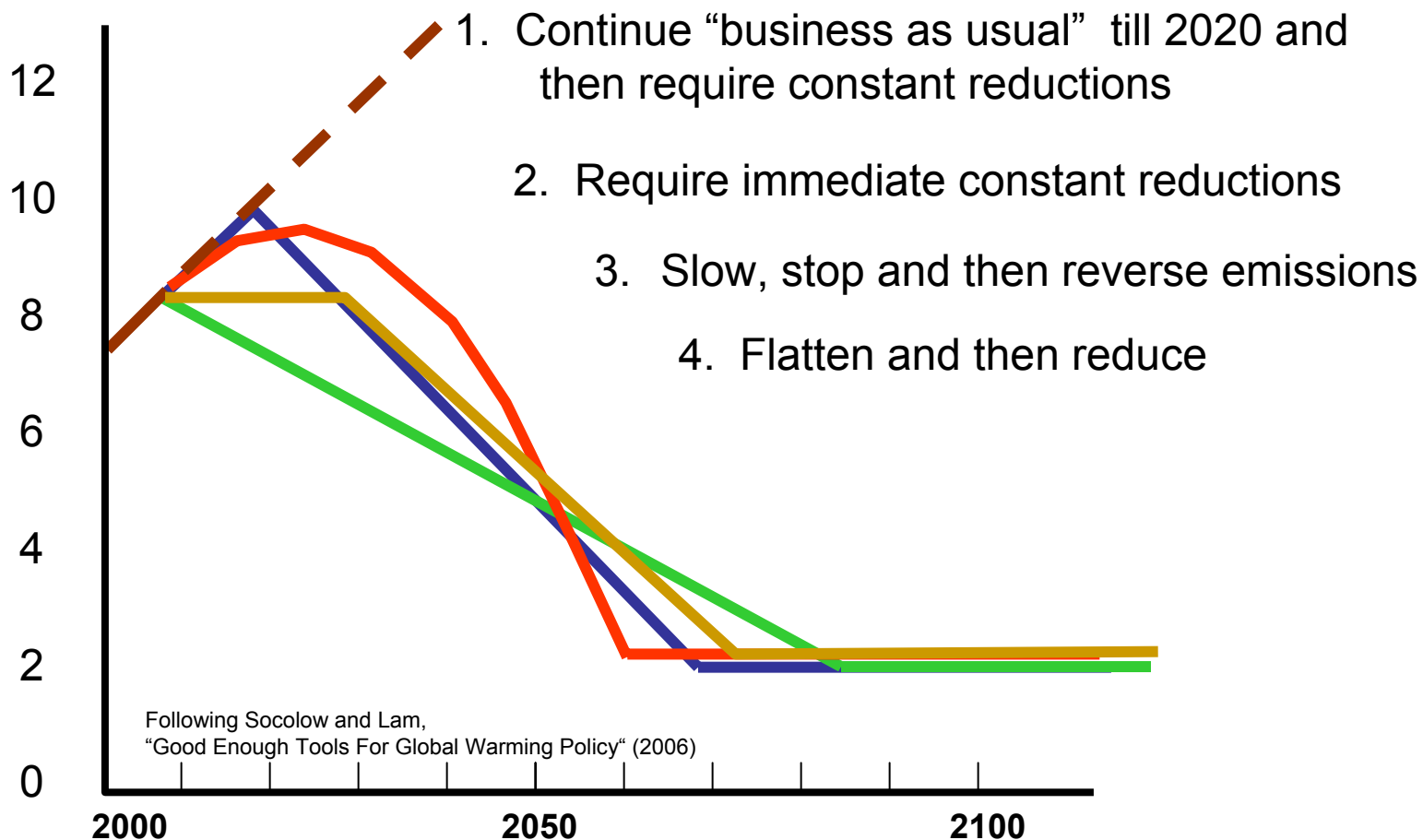
Policy - climate change science and risks clearer



- Climate change is real
- Human GHG emissions are beginning to contribute
- Serious damage to ecosystems and economies appears likely without concerted policies to keep GHG levels below key thresholds (450 - 500 ppm CO₂)

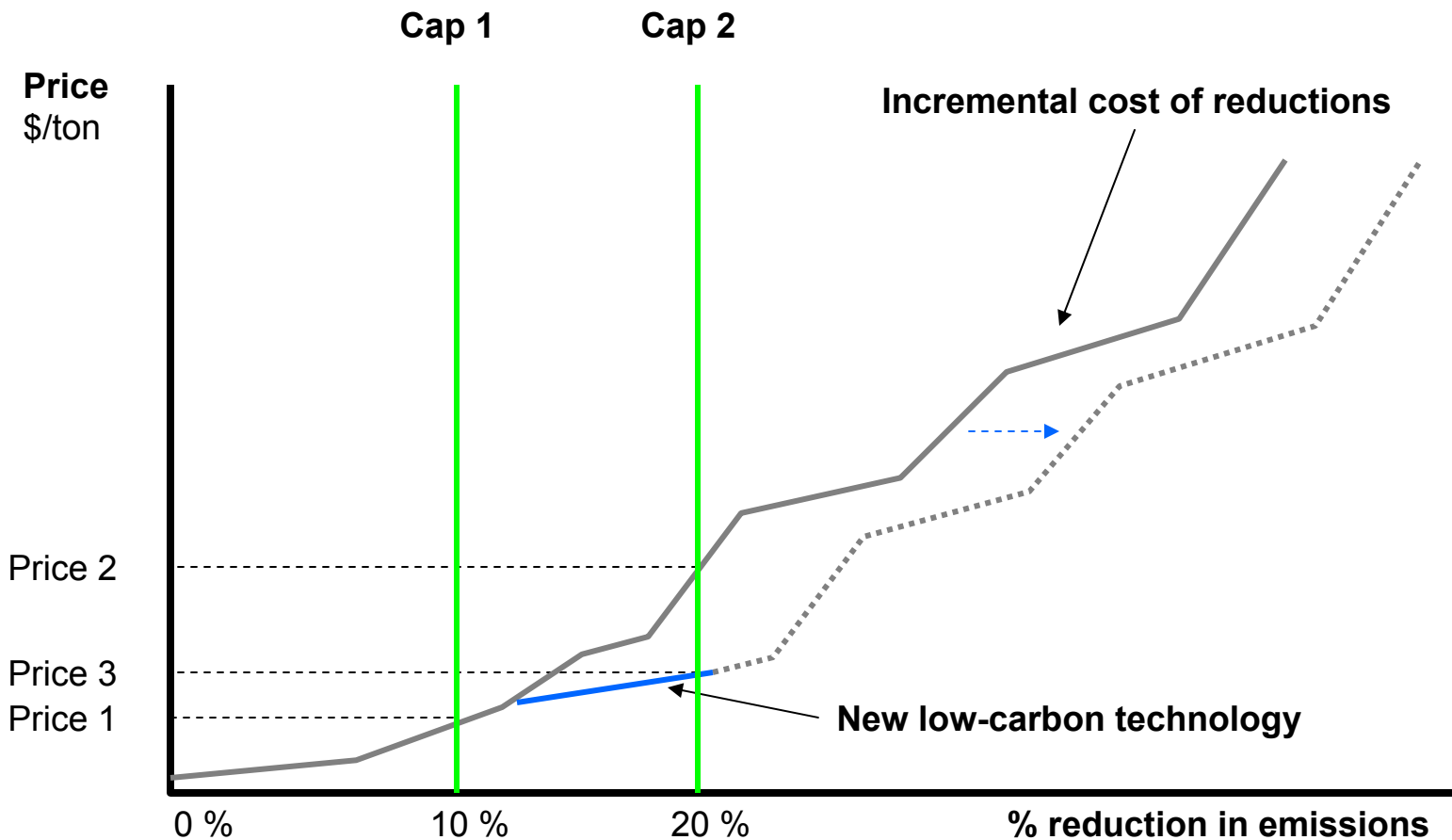
Policy – what path to ~ 450 PPM?

Carbon Emissions
Per Year (GT)



Rapid development of IGCC, CCS and nuclear will make (3) or (4) least costly to consumers and the economy -- here and abroad

Policy – what price and technology paths?

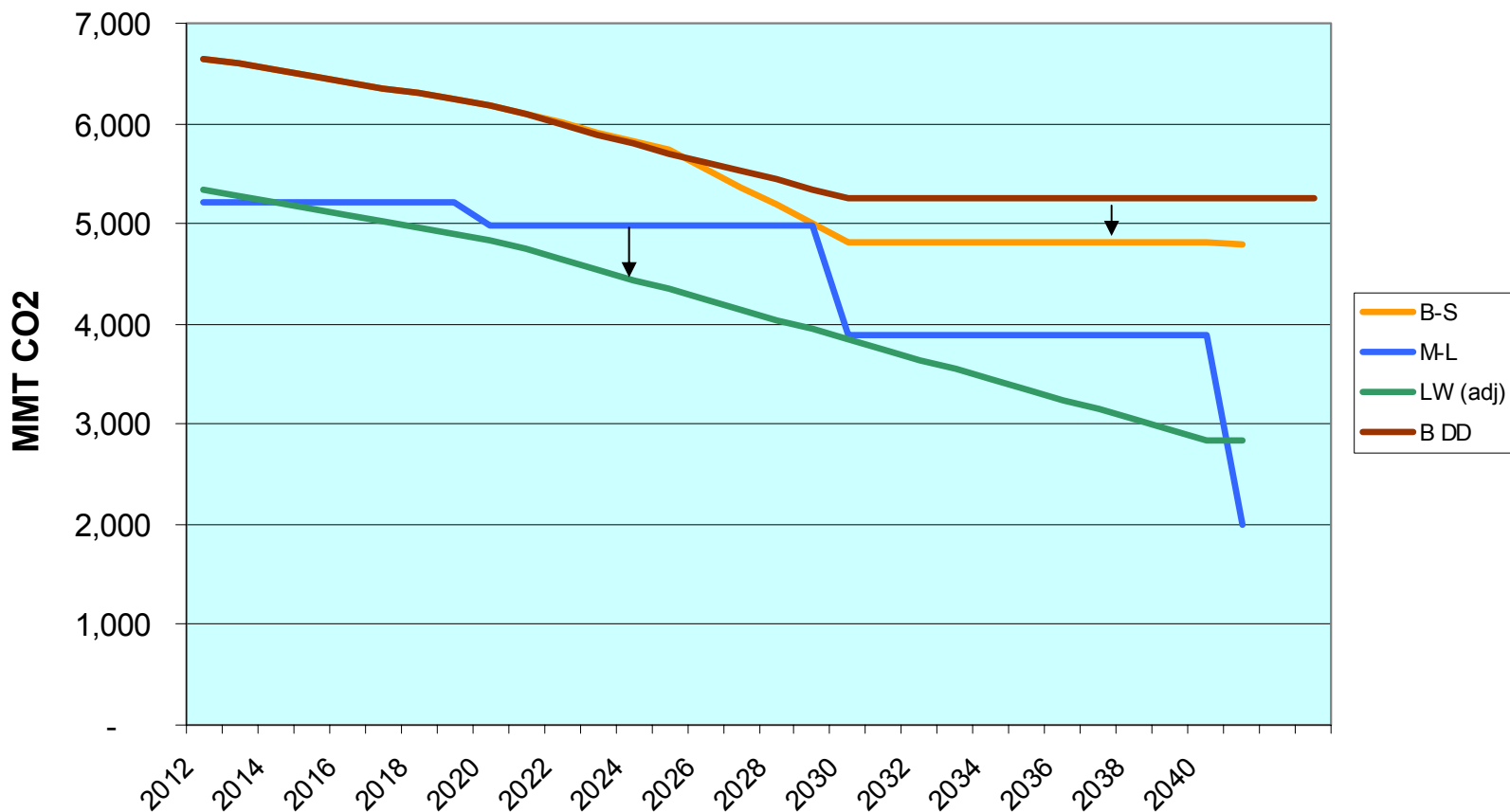


Low cost path features:

- Initial caps require only moderate reductions
- Strong policy support for jump-starting low and no carbon technology
- More aggressive caps as new low-carbon technology matures

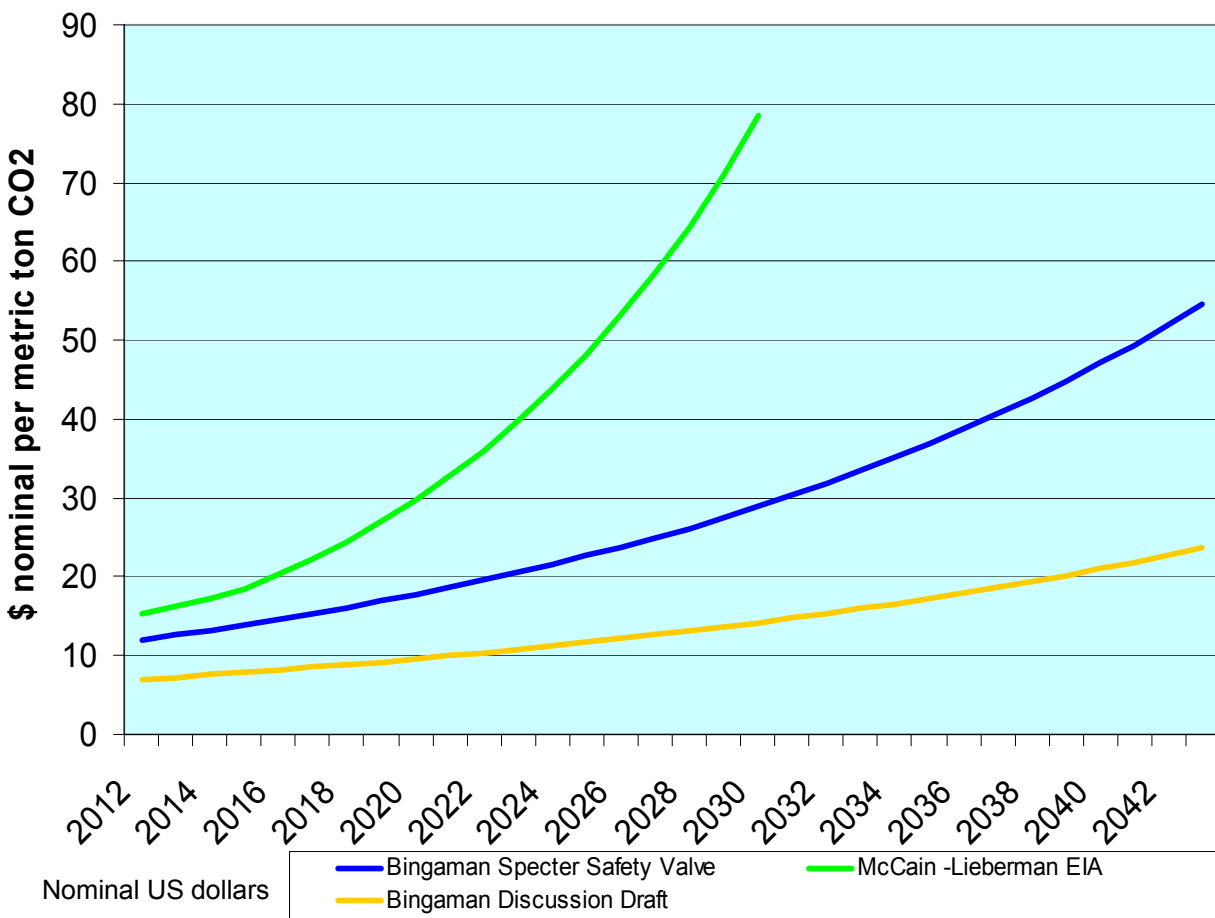
Emission cap paths in key bills

Comparison of Emission Caps of Bingaman - Specter, McCain - Lieberman, and Lieberman - Warner whitepaper



***The Senate debate appears to be moving towards more aggressive caps
The House debate is just beginning***

Potential carbon price paths



EIA forecasts of McCain Lieberman CO2 prices (green) may apply for Lieberman-Warner prices

B – S safety valve (blue) a proxy for CO2 prices

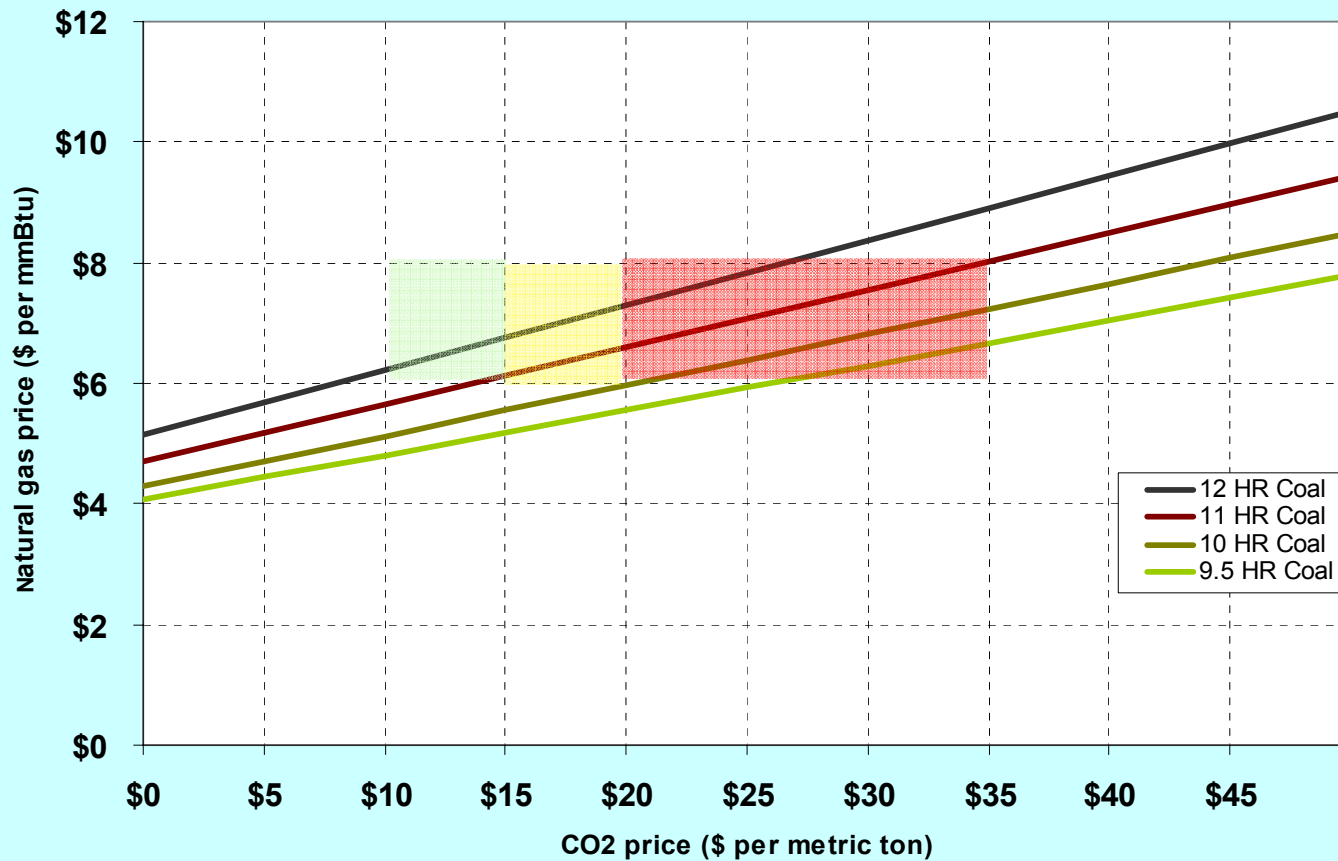
Bingaman discussion draft safety valve (orange) a proxy for prices from less aggressive cap

Potential indicators of the price trends that will emerge from US GHG policy

Power, gas and CO2 economics

Gas and Carbon Price Fuel Switching Curves

7 heat rate gas power will displace coal generation of various heat rates in dispatch order when gas prices are below each heat rate's switching curve



CO2 above \$20 likely to increase gas burn and price, push incremental coal back into merit order -- and limit CO2 reductions from existing resources¹⁰

New, low-carbon technology is the key

- Emission path to ~450 ppm requires avoiding ~ 7 GT of carbon emissions per year by 2050
- *Five-fold growth* in global nuclear fleet would avoid only 2 GT
- About that much will come from new coal under BAU projections
- Low carbon technology is not yet fully mature
 - IGCC with CCS is above market
 - GS not yet ready for widespread deployment
 - Nuclear is most promising but needs aggressive, competitive development and wider pipeline
- Moderate CO₂ price and targeted incentives for low carbon technology critically important
- Low cost CCS and GS for coal especially important

Competitive costs and widespread deployment in 2020's

Key elements of successful US climate policy



- National cap-and-trade program effective in 2012
- Gradual CO2 price escalation through 2020 to allow for commercial development of advanced technologies
 - Moderate GHG emission reductions through 2020
 - Aggressive emission reduction schedule 2020 - 2050
 - A moderate CO2 price “safety valve” until 2020
- Sufficient allowances allocated during transition to buffer emitters’ net CO2 compliance costs
- “Bonus allowances” for geologically sequestered carbon
- Auction of remaining allowances to support 5 - 10 early adoption demonstrations of coal with CCS and other advanced technologies
- Fast track permitting and liability limitation for CCS
- Full implementation and expansion of loan guarantees and other incentives provided in EAct '05 for nuclear

Consensus on these key issues is a real possibility

Generator investment strategy

- Consider carbon policy outcomes in analysis
- Look at each market's price signals
 - Fuel mix and costs
 - Forward curves and fundamental analysis
 - Market design
 - Fuel on margin
 - New entry/retirements
 - Customer needs
 - Manage heat rate, gas, carbon and load shape risk
- Diversify portfolio and reduce carbon risk
 - Proven technologies
 - Emerging technologies with policy support
- Manage development risk aggressively

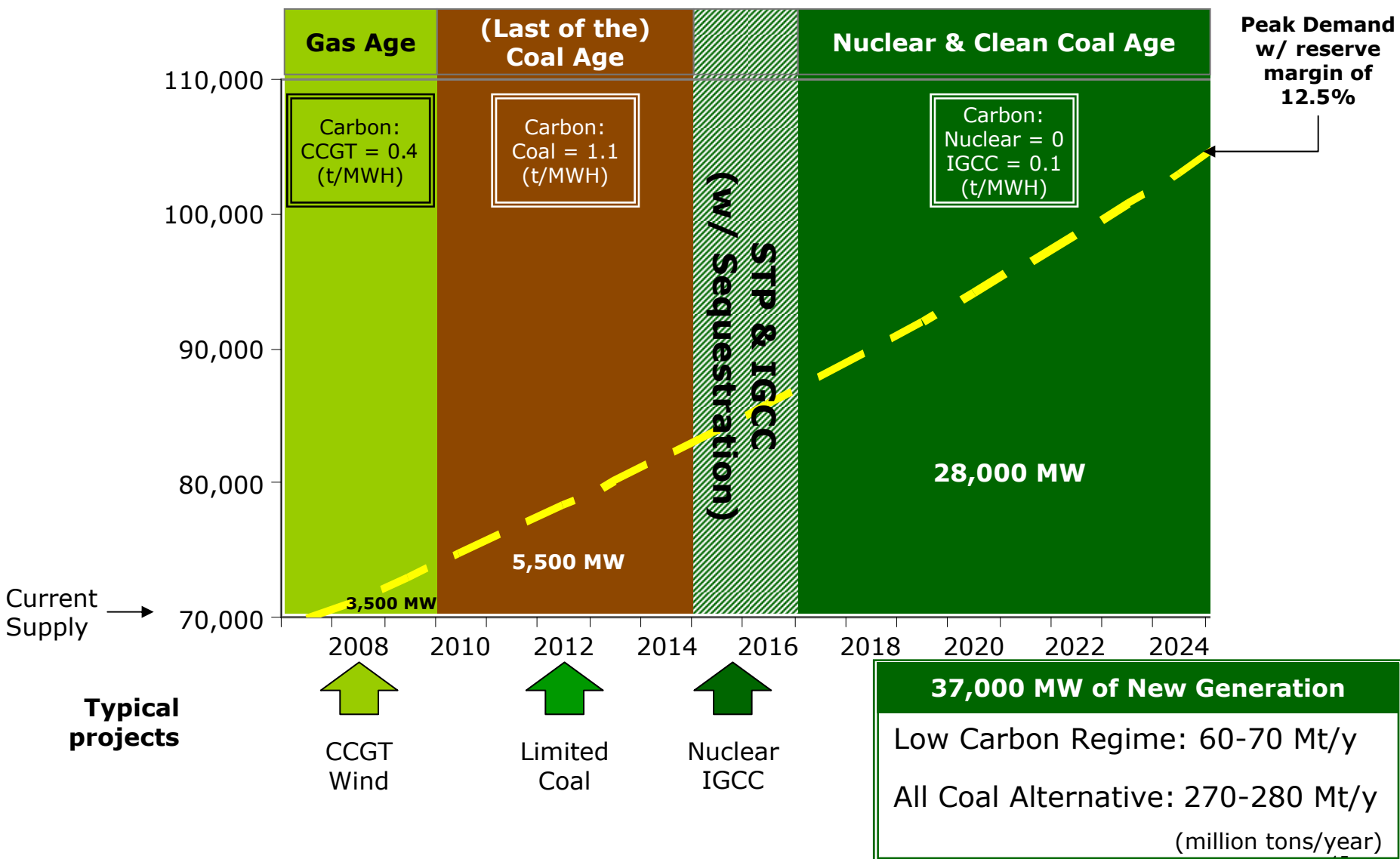
Competitive, market based approach identifies needs and efficient solutions

Managing nuclear development risks

Risk	Mitigant
1. Regulatory	<ul style="list-style-type: none"> ▪ EAct standby support ▪ Early filing
2. Merchant	<ul style="list-style-type: none"> ▪ Partners ▪ Long term offtake agreements ▪ EAct Production Tax Credits
3. Political	<ul style="list-style-type: none"> ▪ State legislative and official support ▪ Local community support
4. Financing	<ul style="list-style-type: none"> ▪ EAct loan guarantee program ▪ US/Japan Cooperation
5. Technology	<ul style="list-style-type: none"> ▪ Select AWBR -- on time, on budget, design certified, multiple units operational
6. Completion	<ul style="list-style-type: none"> ▪ Turnkey contract with experienced EPC provider

Classic project finance techniques mitigate new nuclear risk more effectively than expecting ratepayers to bear all risk

A realistic low cost, low carbon path for Texas



* Developed based on ERCOT 5-Year Capacity, Demand & Reserve (CDR) report of June 9, 2006.

It can be done

- Reduce carbon intensity and emissions
- Increase fuel diversity
- Baseload power when and where needed
- Strong incentives for efficient allocation of resources and risk

Especially with leadership in

- Climate change policy
- Efficient market design and operation
- Competitive markets and competing firms

Questions, comments and discussion