



Climate Change Policy Investment and Coal

A Coordinated Policy
To Work in the Real World

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Key power sector investment drivers

- Shrinking reserve margins and climbing power prices
- Historic high US natural gas prices, but below global price
- Ample coal supply, in US as well as China and India
- Certainty of a US price on carbon, uncertainty as to when or how high
- Increasing power supply costs for all technologies
- Tremendous uncertainty about cost of CCS generation and about permitting
- Except for climate concerns, coal would be the technology of choice in US as in China and India
- High and uncertain CCS costs limit investment in CCS without government risk and cost support
- Climate change policy will be the key driver for CCS deployment
 - Resolve uncertainty
 - Provide incentives and funding source
 - Create effective permit process

Key policy details will be the most important driver of all

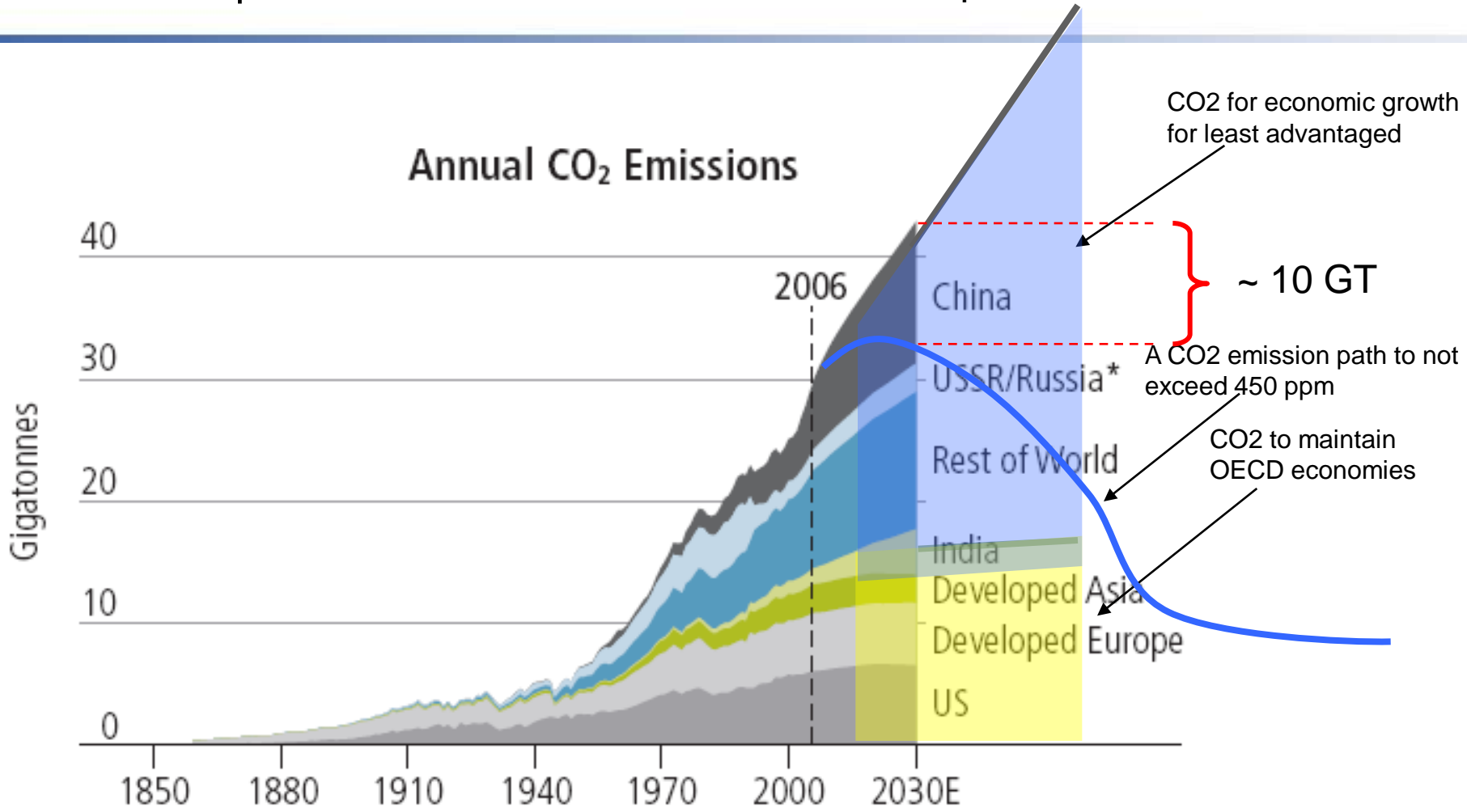
Emerging policy based on growing scientific consensus:



- 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 threshold levels (~ 450 ppm CO₂)

Cap and trade is superior to a tax in avoiding this threshold

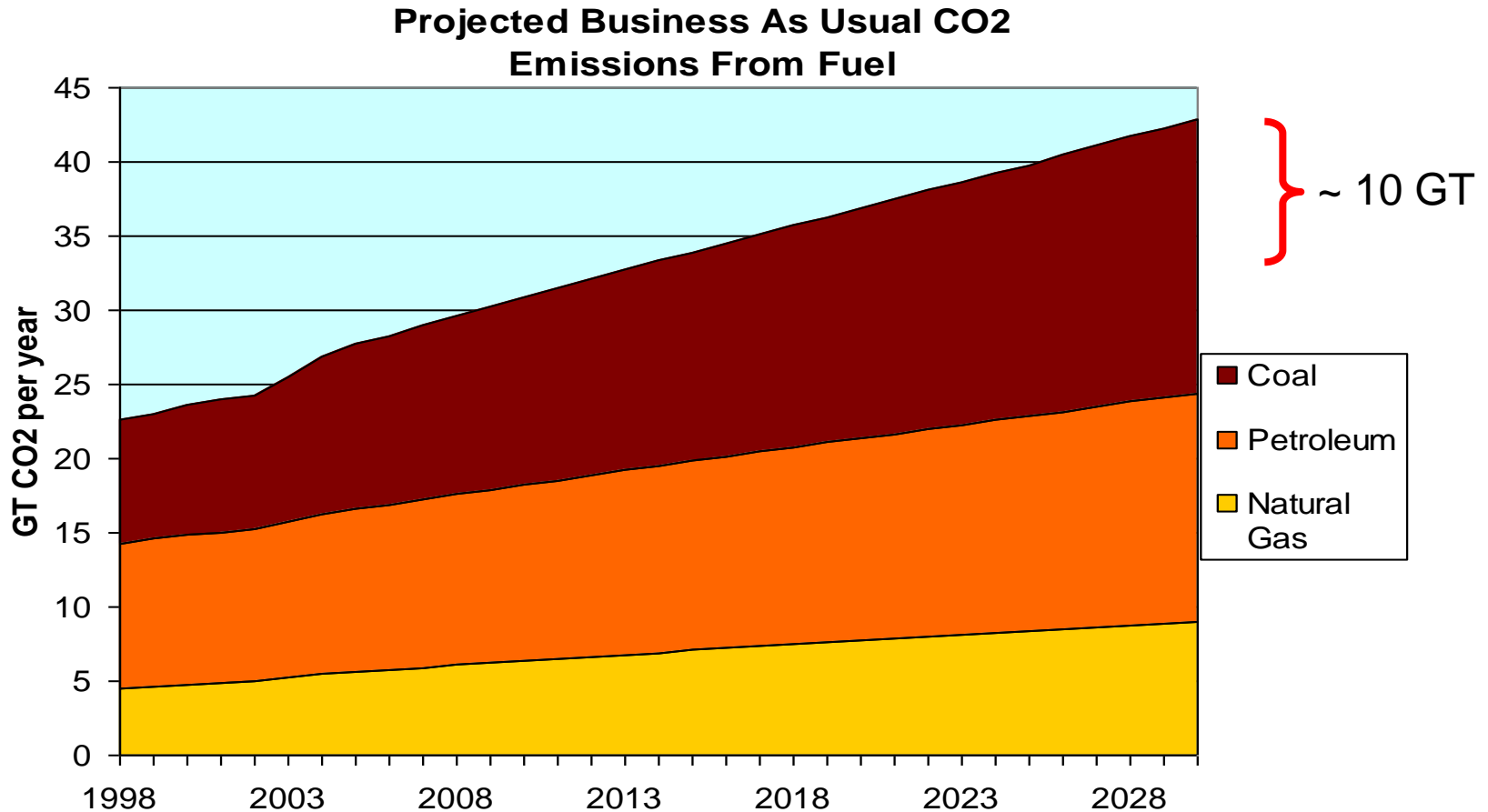
Global development or a stable climate ... an unacceptable choice



Source: CDIAC, EIA and AllianceBernstein

Technology transformation is the only way to achieve a truly livable world

Technology focus on CO2 from coal and oil

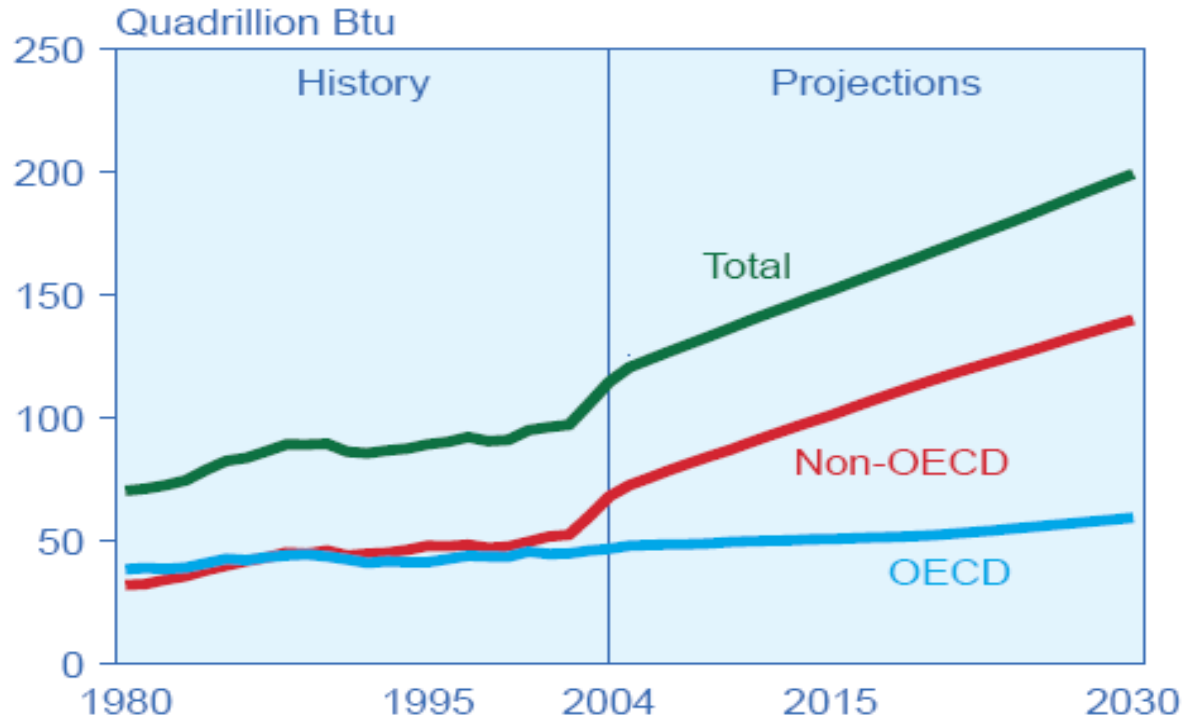


Source: US EIA International Energy Outlook 2007, NRG

Global CO2 from coal and oil could easily double by 2030

Mostly from growth in the developing world

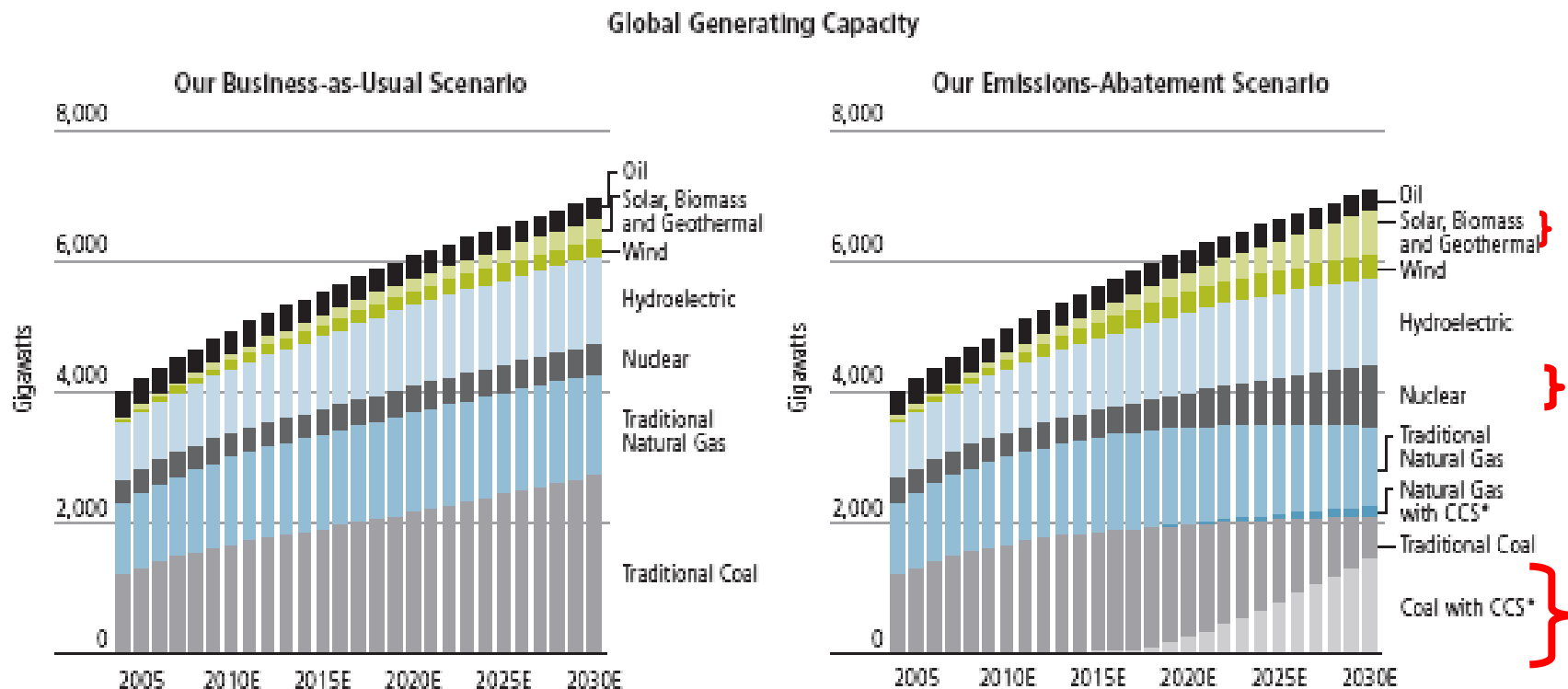
Figure 54. World Coal Consumption by Region, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, *System for the Analysis of Global Energy Markets* (2007).

Low carbon technologies must be able to compete on price globally

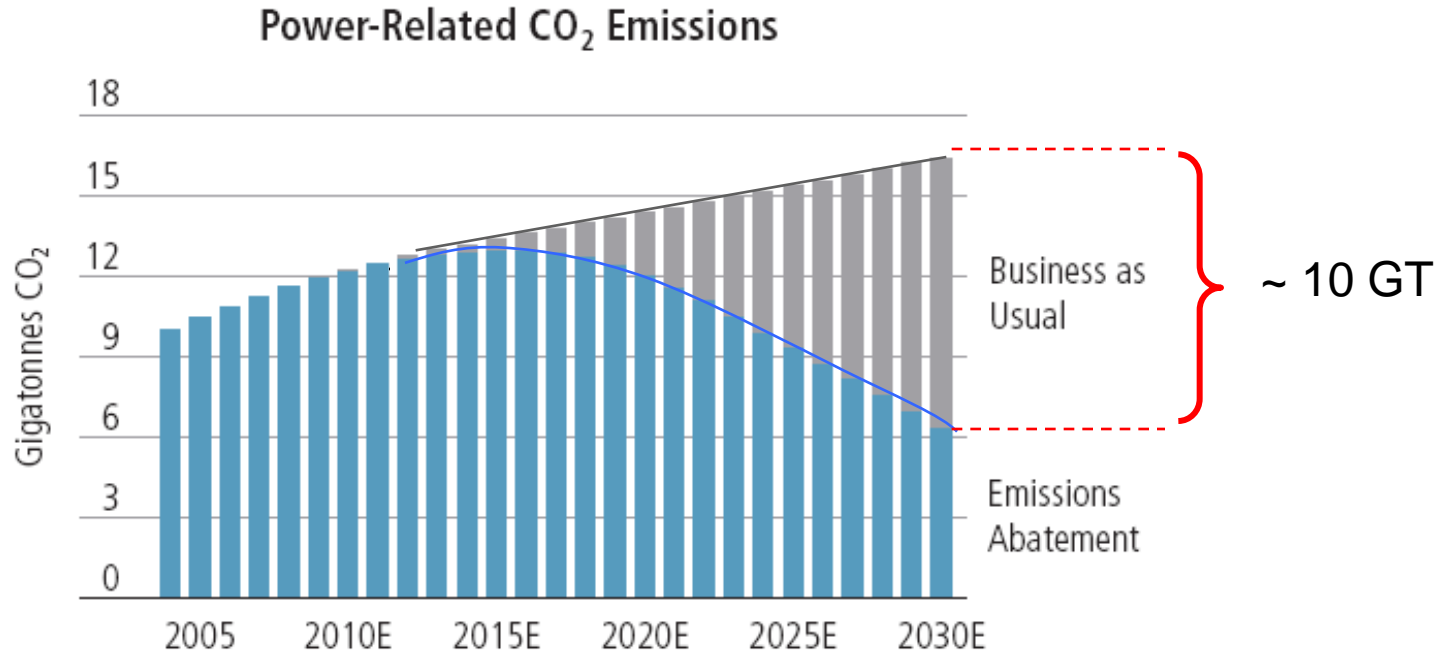
CCS for coal is the key source of low CO2 power



* Carbon capture and storage
 Source: EIA, IEA and AllianceBernstein

Nuclear and renewable sources play important supporting roles

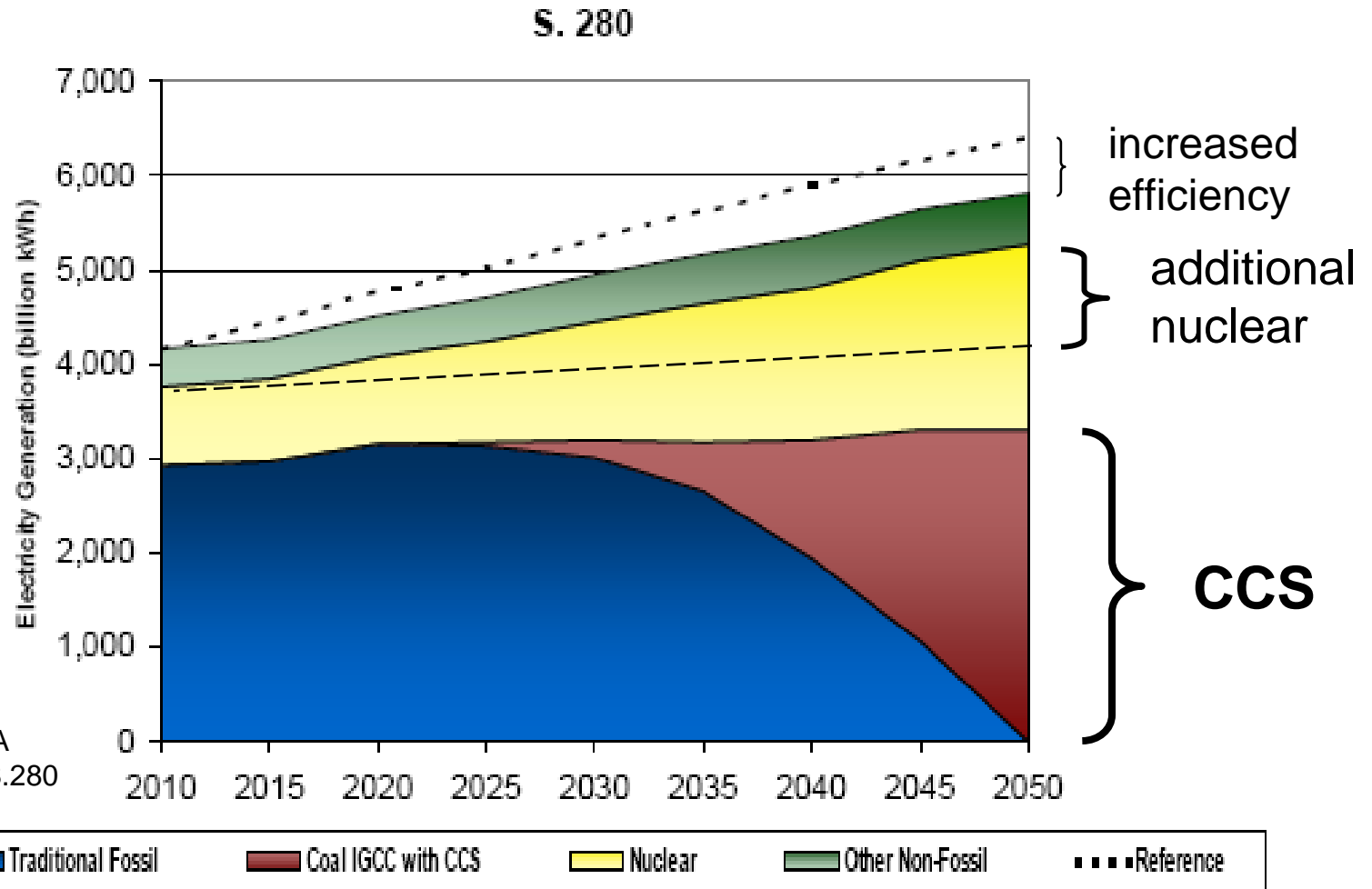
And the entire global power sector must engage



Source: EIA, IEA and AllianceBernstein

The power sector could contribute most reductions needed by 2030

US climate change policy can lead the way



The keys are a US price on carbon and rapid cost reductions for CCS

Key elements of a successful US policy

1. Cap and trade program consistent with avoiding exceeding ~450 ppm threshold by mid century
 - Science sets the threshold, market sets the price, lawmakers design the market/regulatory system
2. Moderate early emissions reductions and price
3. Aggressive emission reductions and full market pricing of carbon when low and no carbon technology is ready for widespread deployment
4. Mix of auction and allocation through transition, with auction revenues supporting low and no carbon RD&D
5. Strong public-private partnerships with funding and risk sharing for low and no carbon technology development

Low and no-carbon technologies are the 'anchor tenants' of our future economy

Why?

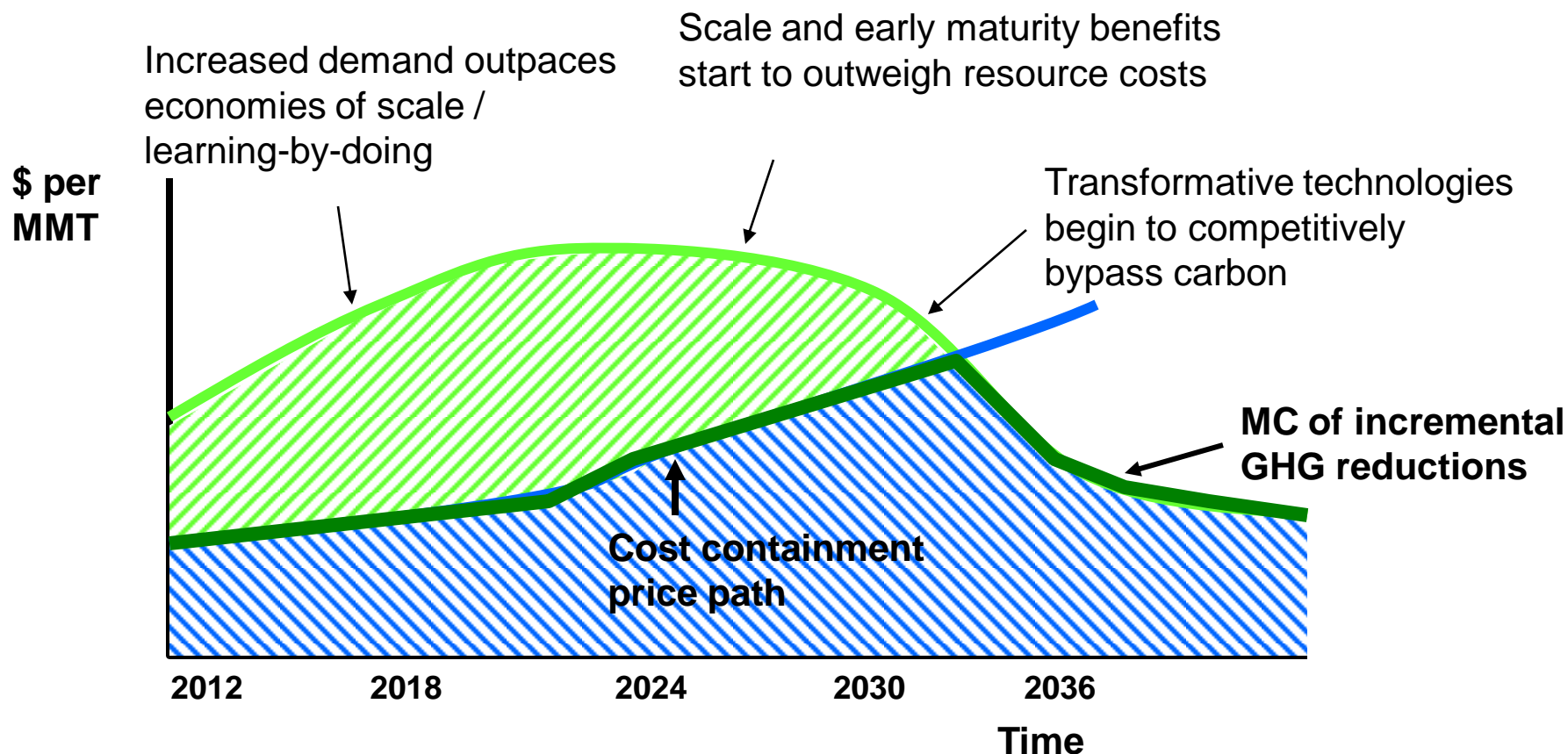
- Key technologies face “chicken and egg” problem of low production, high costs, and uncertain performance
 - Can’t deploy high cost technology
 - Large # of orders needed to reduce costs
- Key institutions have not developed to support emerging business needs

How?

- Increase demand and supply by providing risk and cost sharing for 10 or more successful early deployment of CCS
 - Don’t try to pick winners
 - Quickly achieve economies of scale and “learning by doing”
 - Ensure competitive supply of key low carbon technologies
- Rapid development of federal and state regulatory / property rights / long term management framework for geological sequestration of CO₂

Solve the chicken and egg problem by incubating enough eggs

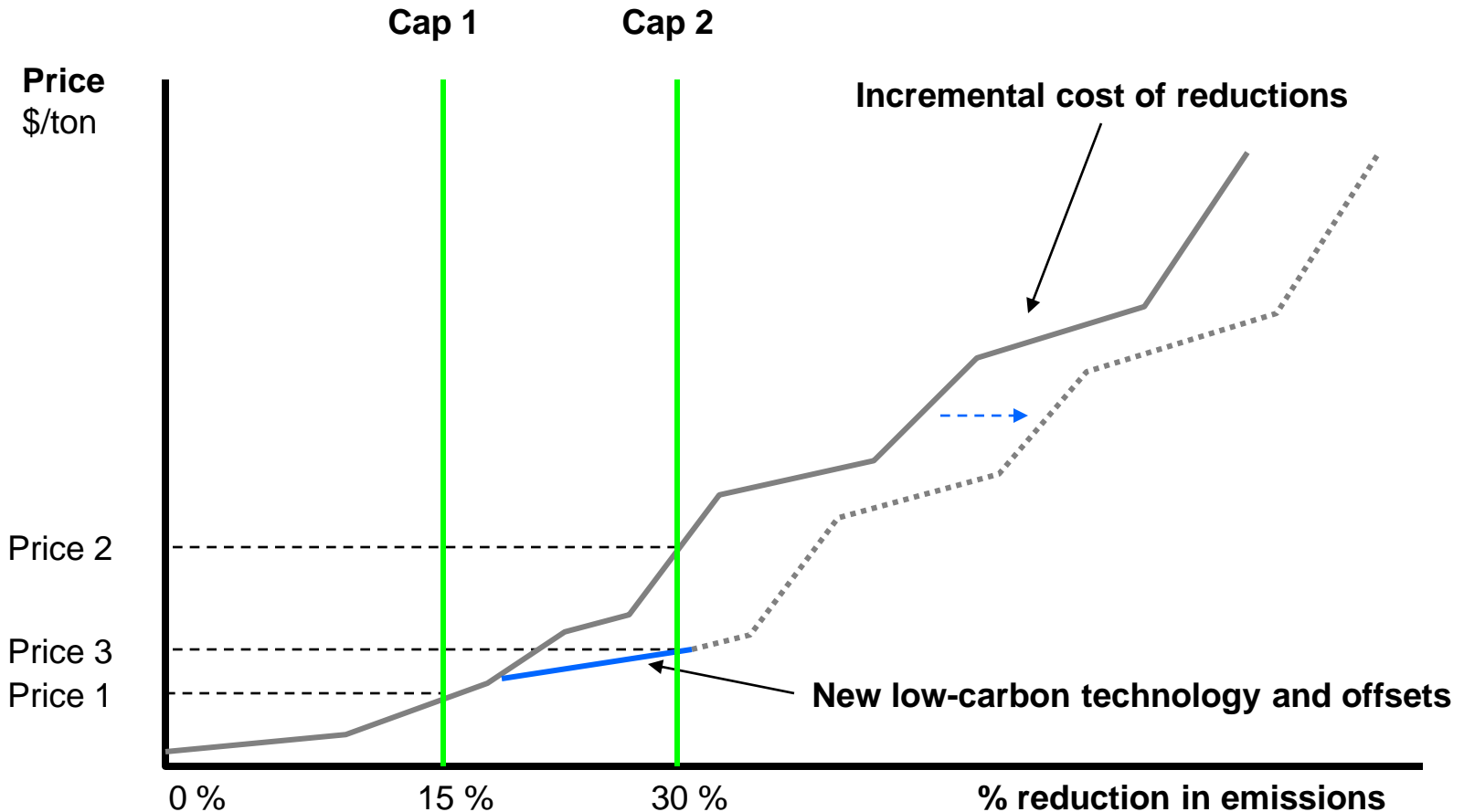
Use auction revenues and bonus allowances to supplement moderate carbon price



- Avoided carbon costs (blue) help “pull” development and deployment
- Targeted incentives and allowances (green) provide additional “push” while technology matures

Combined effect maximizes technology transformation and minimizes economic shocks (e.g., extreme early fuel switching from coal to gas)

Jump-starting new technology helps reduce cost of cap and trade system



Low cost path features:

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

Generator investment strategy

- Anticipate and help guide policy outcomes
- Consider carbon policy outcomes in investment decisions
- 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 approach identifies needs and provides efficient solutions