

Carbon and Energy Efficiency: the Marriage of Need and Potential

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2 billion villagers want a better life



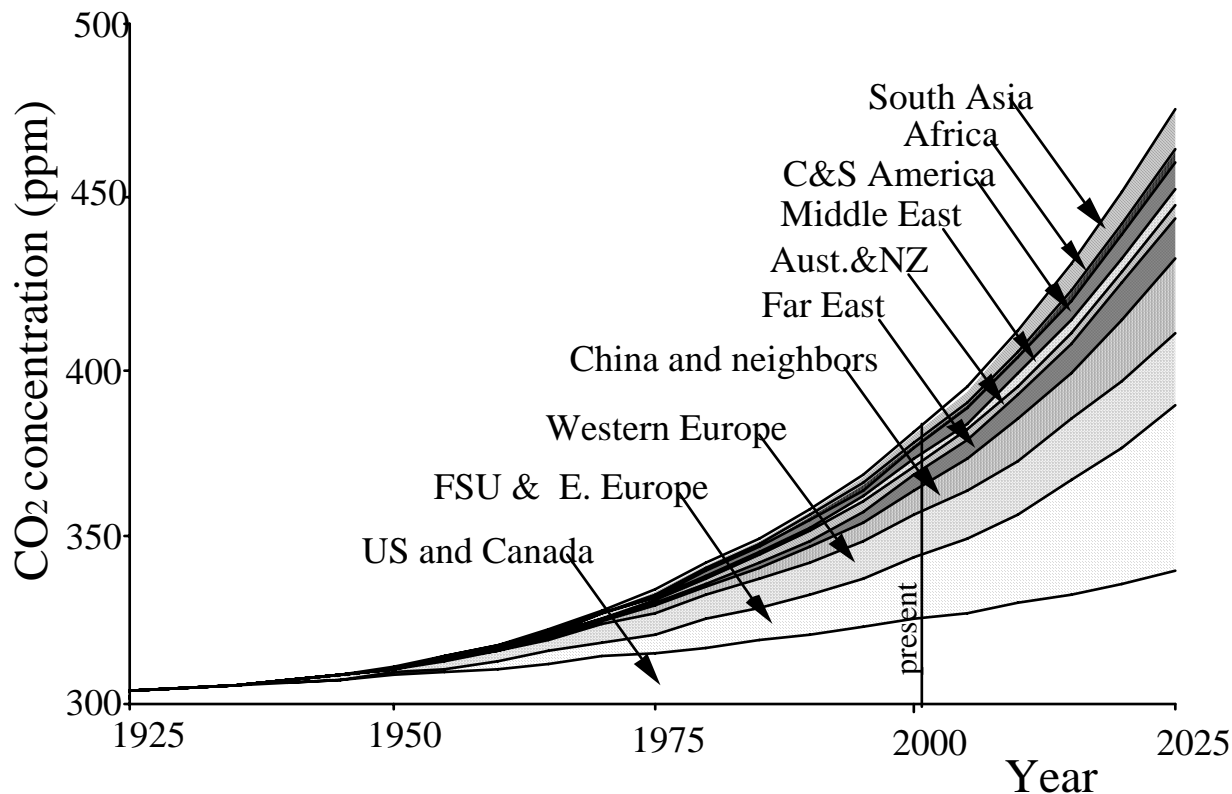


Electricity and coal in China

- China has the world's second-largest power grid:
 - ❖ 300,000 MW – growing 14% annually
 - ❖ US is ~700,000 MW – growing 2 to 3% annually
- Chinese electric grid is coal-based
 - ❖ China's grid is 75% coal
 - ❖ 1 large new coal plant every 6 days
 - ❖ 650,000 MW of new coal plant construction expected by 2030 (2/3rds new, 1/3 replacements for even worse historic facilities)

Why us?

...most of the CO₂ in the atmosphere will be from N. America and Europe for years to come.



Explanatory note: Despite rapid increases in the emissions from developing countries such as China that are anticipated in the coming decades, the U.S., Europe and Russia will continue to be the source of most of what is in the atmosphere for many decades because carbon dioxide has a long residence time in the atmosphere. The projections shown assume that the Russian economy recovers and resumes its past practices in energy use.

2006 plans: 154 plants, 93 GW, \$137 billion

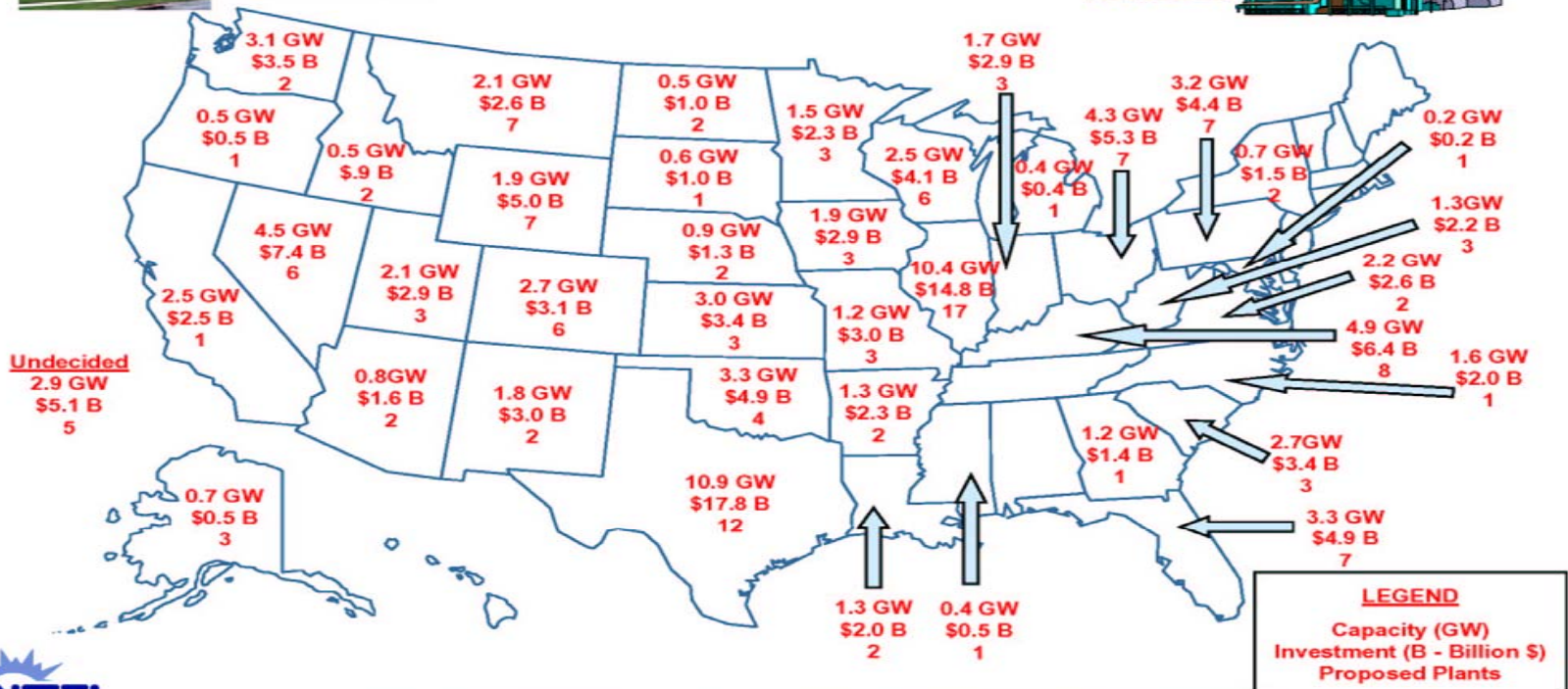
Coal's Resurgence in Electric Power Generation



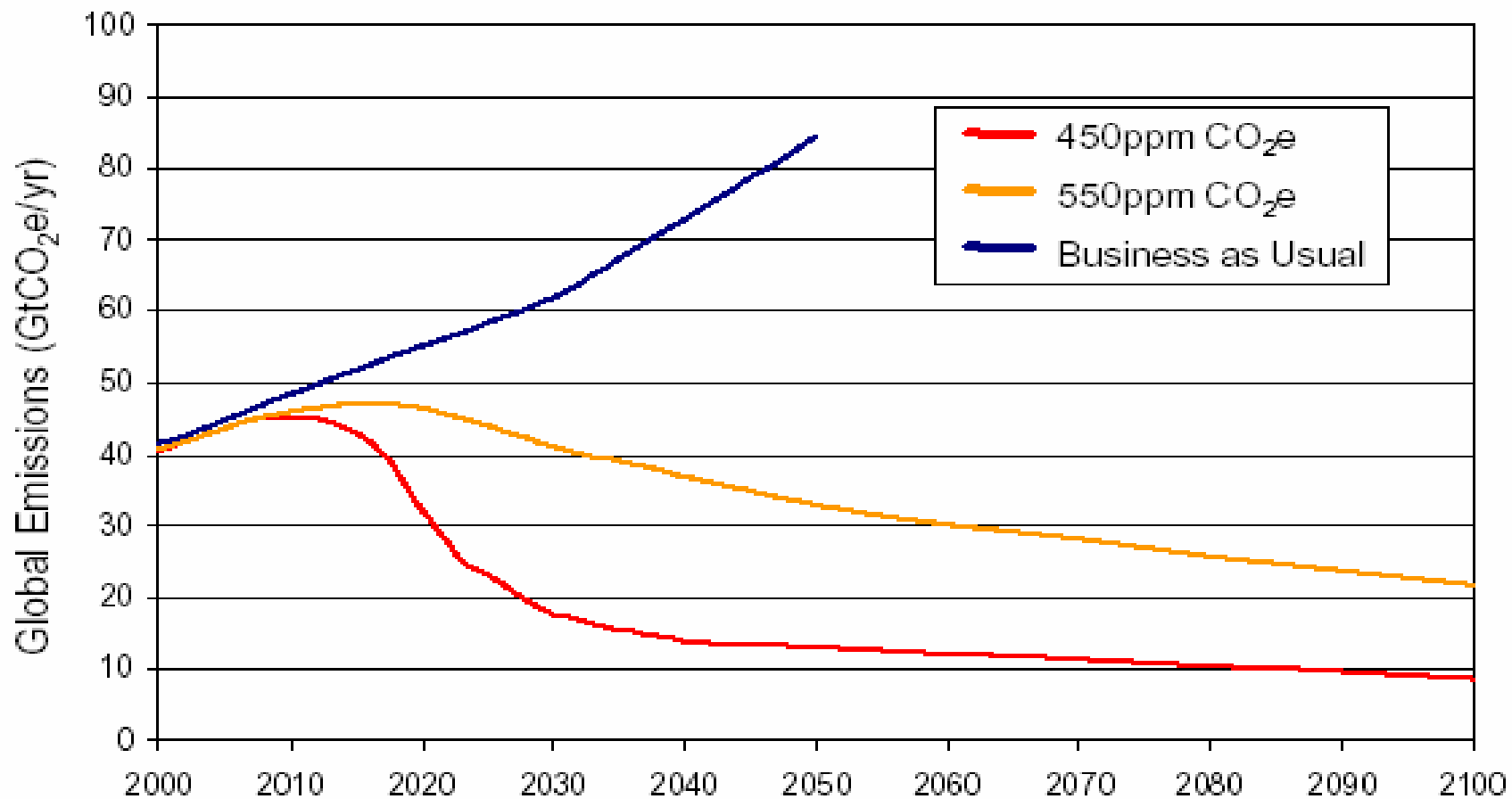
Equivalent Power
for
93 Million Homes

Proposed New Plants

154 Plants
93GW
\$ 137 Billion

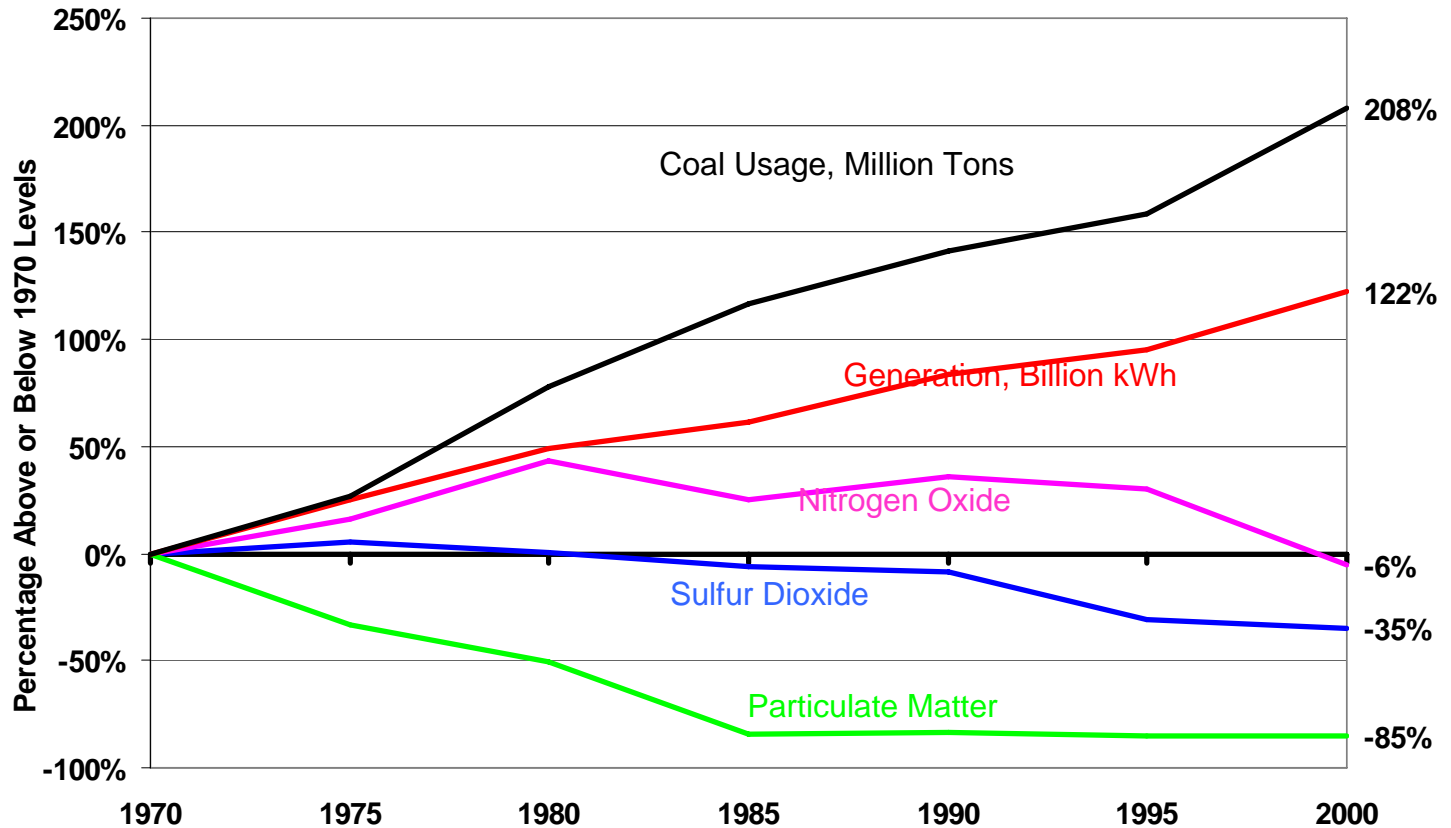


Emission paths to stabilization



Source: Stern Review (UK) October 2006

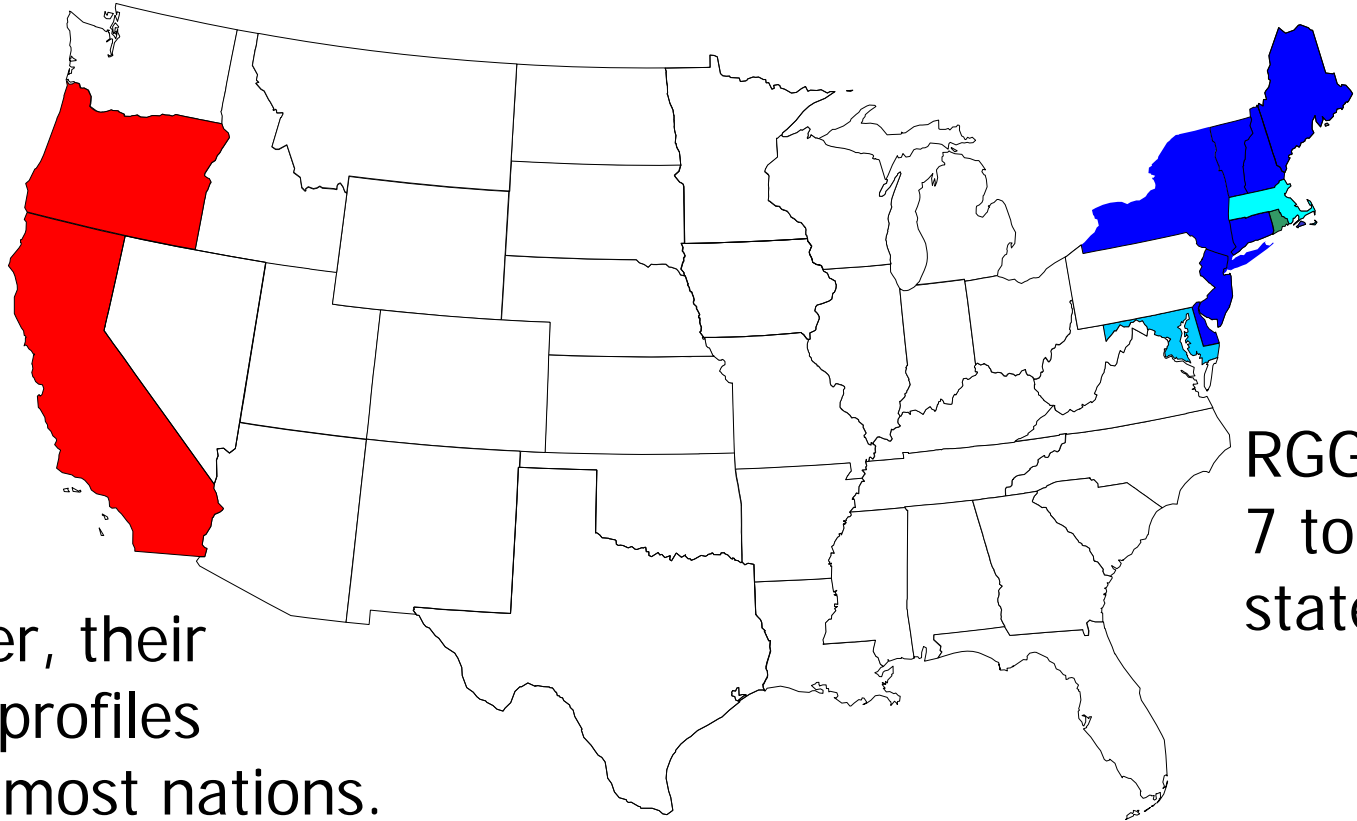
Emissions from Coal Generation Decreased by 1/3 While Coal Use Tripled (but which line is carbon?)



Source: U.S. EPA and Energy Information Administration.

State and regional power sector carbon caps

California
& Oregon



RGGI -
7 to 10
states

Together, their
carbon profiles
exceed most nations.



What is cap-and-trade?

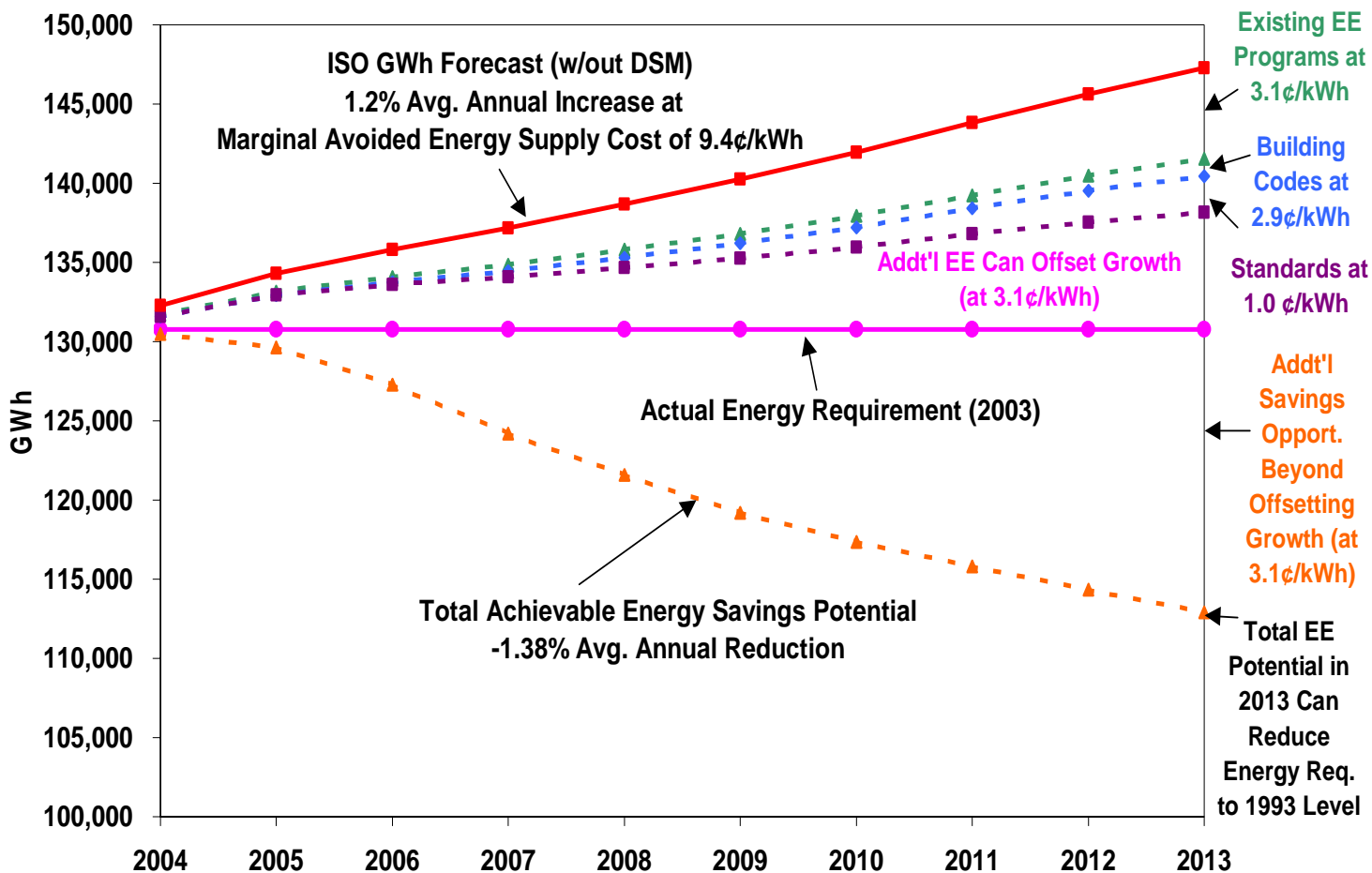
- Set a fixed limit on OVERALL emissions, not each single source, declining over time.
- Create a new kind of currency (tradable allowances) for quantities of emissions.
 - ❖ “Carbon credits are just another form of money”
- Require emitters (or consumers) to retire allowances to match “their” emissions in each time period.
- Sell or give out allowances
- Permit trades in an allowance market
- Examples: US acid rain and NO_x programs

The Northeast Regional Greenhouse Gas Initiative (RGGI)



- **7 states now in**
- **3 other states likely to join (MA, RI, MD)**
- **MOU signed by 7 Governors 12/05**
- **Model Rule now approved**
- **State-by-state adoption 2007+**
- **Launch 2009**
- **Cap, reduce 10% by 2019**

Efficiency in New England can reverse demand growth





Today's main points: Three lessons in cap-and-trade architecture

- 1. The Acid Rain program design – smokestack-based, free allocations based on historic emissions – is not the best design for a carbon cap/trade system for the power sector.
- 2. **Energy efficiency** is not a “collateral energy policy,” it is **the key to success** of power-sector carbon programs.
- 3. Cap-and-trade programs CAN be designed to provide **direct financial support** for efficiency services.



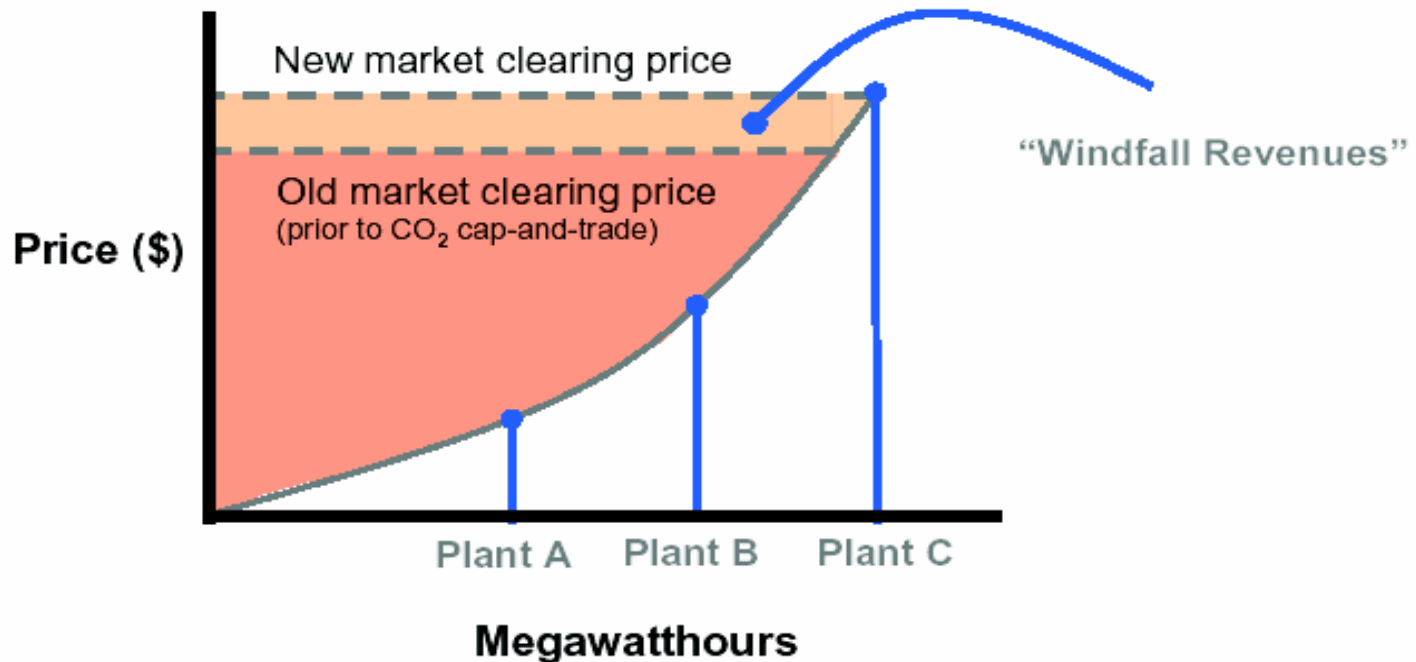
Architectural mistakes: Three wrong assumptions

- 1. Generators lose money under carbon cap and trade, so designers must give them allowances for free
- 2. Just manage pollution, price increases and demand elasticity will deliver needed efficiency
- 3. Initial allocation does not affect program cost to consumers

Reality #1 Most generators make money with free historic allocation

Theoretical representation of “windfall revenues”

A fossil unit on the margin increases the market clearing price (i.e., the price paid to all generating units dispatched) to reflect the cost of CO₂ compliance





What free % would make generators whole?


- (IF WE DECIDE TO COMPENSATE GENERATORS)
- CBO: “Producers would have to receive only a modest portion of the allowances to offset their costs from a cap on carbon emissions, because they would be expected to pass a large share of those costs on to consumers.”
- RGGI study (by RFF): Generators need less than 25% of allowances
- Goulder (Stanford): Generators could be made whole with just 13% free allowances
- UK Parliament: EUTS is creating windfall gains for generators in the UK; similar results in Germany, Netherlands



Reality #2: EE programs are more powerful than rate increases

- Economic theory: just raise the price of power
- DSM reality: **Programs** are needed to surmount market barriers to efficiency
- \$ spent through programs will deliver 5x the efficiency savings of \$ spent in higher prices
- Key conclusion: Build efficiency support into program architecture.
- BUT: Generators don't deliver efficiency
- Who has relationships with customers?

What does it cost to avoid a ton of electric carbon?*



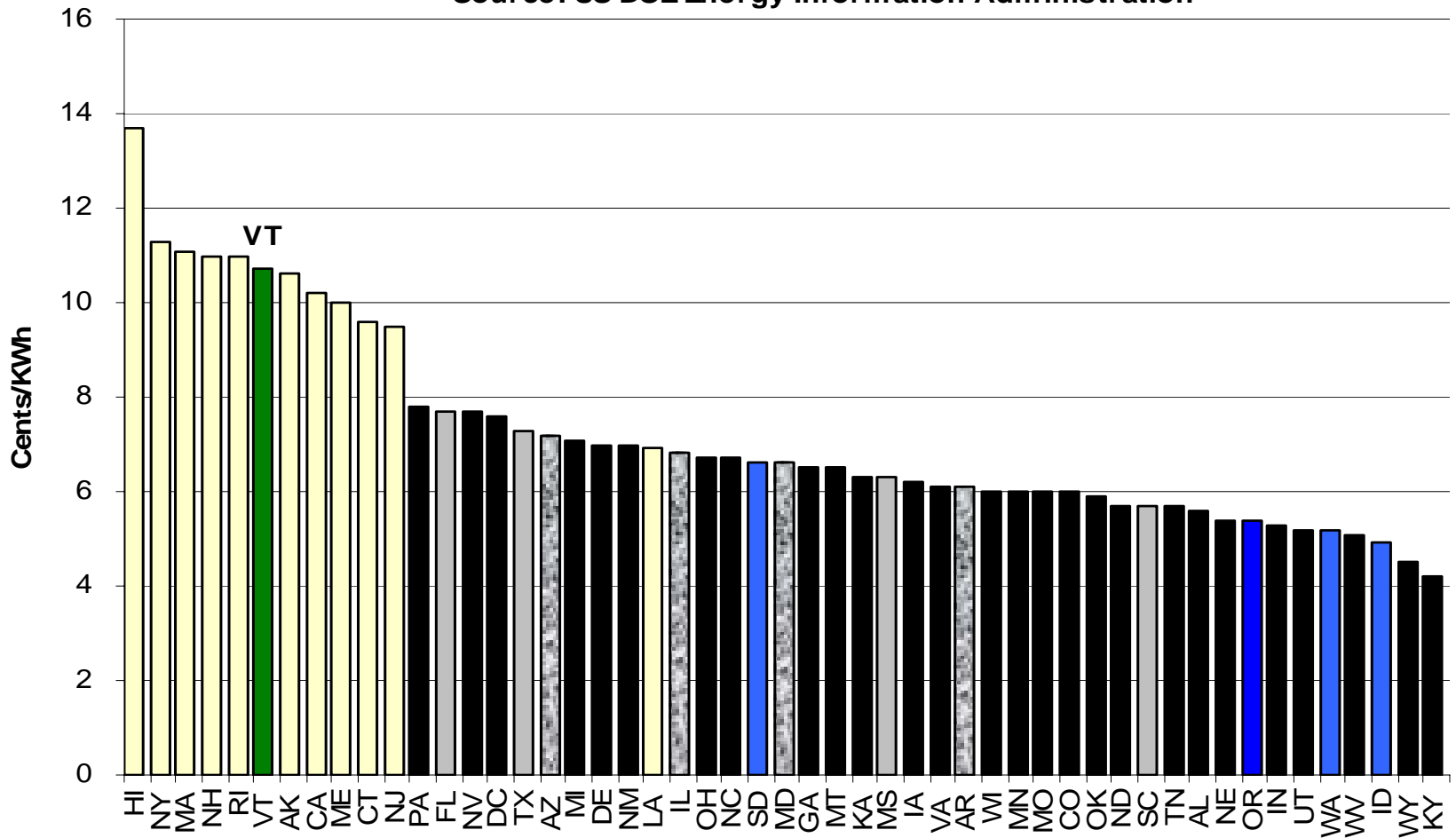
Resource option	Carbon intensity	Cost per MWH	Cost per ton avoided
Coal	.92/MWH	\$40	NA
Gas	.45/MWH	\$55+	\$30+
New Nuclear	big debate	\$70+ to ??	\$30 to +??
Wind	small	\$75	\$35
PV	small	\$180+	\$140+
Efficiency	small	\$30	(-\$10)

**Generation cost data (except nuclear) from EPRI ("Generation Technologies in a Carbon-constrained World," 2005, assuming gas at \$6MMbtu); EE data from Efficiency Vermont. For the point made here the precise numbers are not so important.*

Carbon cap states already have high rates – can't just add more gas

Total Average Cost per Kilowatthour
Average Rates 2001 -- Power Supply 2002

Source: US DOE Energy Information Administration



Reality #3: Carbon credit

allocation can mobilize efficiency



- Key point: **A carbon program that directly mobilizes end use efficiency will cost less and achieve more than one that focuses only on smokestacks.**
- Two possible techniques to reveal the carbon value of efficiency and renewables:
 - ❖ **Consumer allocation (RGGI region)**
 - ❖ **Load-side cap and trade (California and Oregon)**

RGGI answer:

The Consumer Allocation

- Allocate up to 100% of initial credits to consumer representatives (eg, distribution utilities, Efficiency Utility)
 - ❖ RGGI MOU - state minimum commitment is 25%
 - ❖ Most states will be higher – Vermont law is 100%; NJ, CT, NY all considering high %s
- Generators need to purchase allowances, recycling the windfall revenue BACK to consumers
- PUCs supervise use of the \$\$ for benefit of consumers
- **Best result: focus on investments that lower carbon (EE & RE)**
- Result: lower program cost, greater efficiency



Consumer allocation – Vermont is leading the way

- H 860 (passed by Vt House) : *In order to provide the maximum long-term benefit to Vermont electric consumers, particularly benefits that will result from accelerated and sustained investments in energy efficiency and other low-cost, low-carbon power system investments, the public service board ...shall establish a process to allocate **100 percent of** (Vermont's) tradable power sector carbon credits and the proceeds from the sale of those credits through allocation to one or more trustees acting on behalf of consumers*
- *1.2 million credits per year @ \$4.00/ton = >\$40 million for new efficiency and low-carbon generation between 2009 and 2019.*
- *Regionwide, even a 50% consumer allocation could raise \$250 million per year.*

What happens if we double efficiency spending in RGGI?



Extensive modeling for RGGI found:

- Carbon credit prices drop 25%
- Need for new fossil capacity drops 33%
- Customer bills drop 5% to 12%



West Coast approach: Load-Side Cap & Trade

Basic rule: LSEs must have credits to cover the emissions associated with their sales to retail customers? Steps:

1. Measure historic emissions associated with electricity *serving the state* (or region) –
 - ❖ All sources, wherever located -- both in-state and imports
2. Set “hard” emissions caps to lower impact in stages
3. Distribute allowances (“carbon credits”) to LSEs
4. LSEs spend credits as needed to match their portfolio of sources
 - can sell excess credits from RE & EE choices
5. Gains: (a) no leakage problem (b) no generator windfall (c) EE and RE earn carbon value automatically



Conclusions

- **Efficiency is the key** to low-cost power sector carbon reduction, so
- Cap-and-trade programs offer a **new opportunity for EE businesses**
- **Consumer allocation** avoids generator windfall and provides a revenue source for efficiency and renewables:
 - ❖ In RGGI, 50% consumer allocation could add \$250 million (=+50%) to regional EE budgets
- **Load-side cap** adds carbon value to EE
- **Congress** will be acting too – will national legislation support efficiency?



For more information...

“Another Option for Power Sector Carbon Cap and Trade Systems – Allocating to Load”

“Addressing Leakage in a Cap-and-Trade System: Treating Imports as a Source”

“Why Carbon Allocation Matters – Issues for Energy Regulators”

Richard Cowart, Regulatory Assistance Project – Memos for the Regional Greenhouse Gas Initiative (RGGI)

--Posted at www.raonline.org

Email questions to RAPCowart@aol.com

