Nuclear Power and Climate Change

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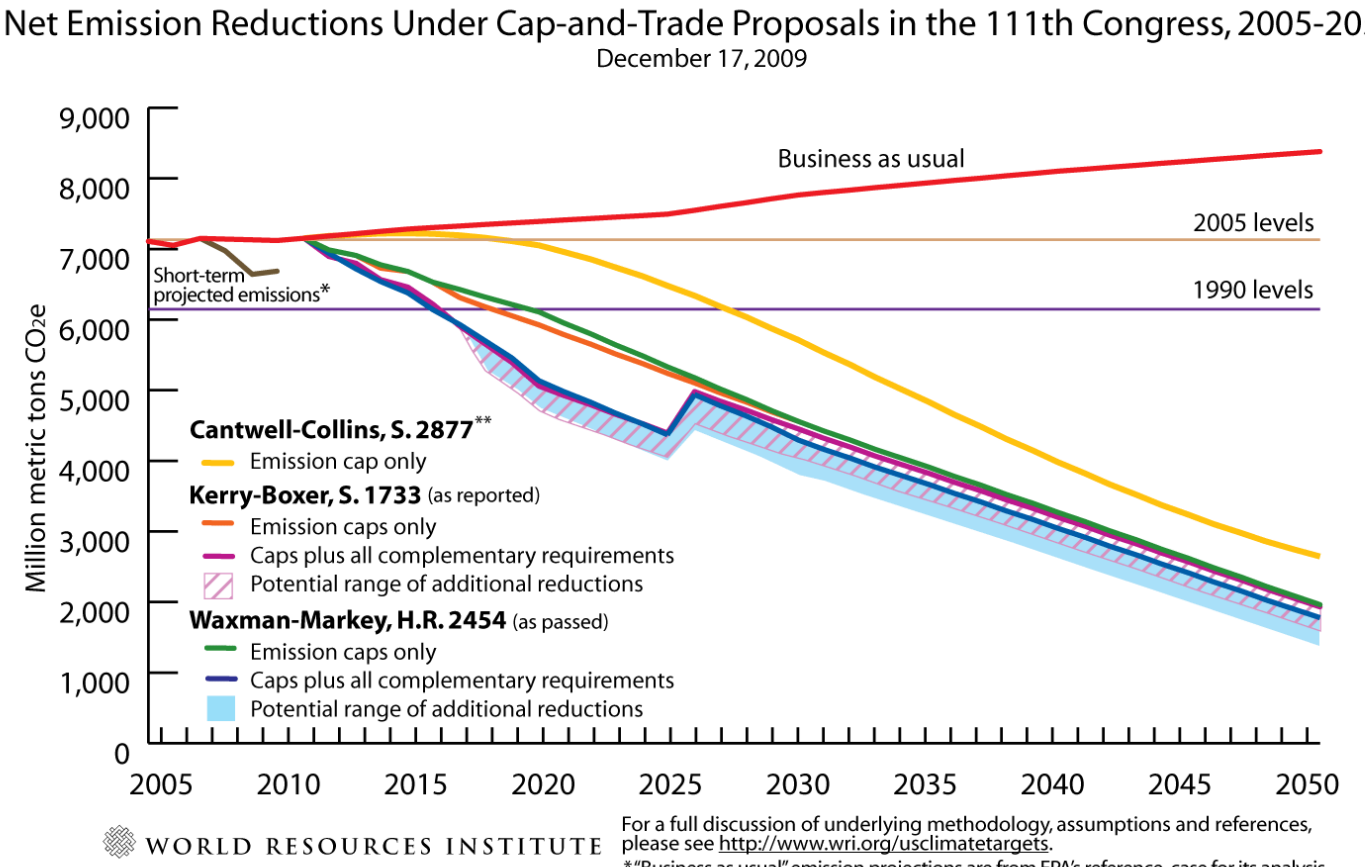
The Goal



For a full discussion of underlying methodology, assumptions and references, please see http://www.wri.org/usclimatetargets.

*"Business as usual" emission projections are from EPA's reference case for its analysis of the Waxman-Markey bill. "Short-term projected emissions" represent EIA's most recent estimates of emissions for 2008-2010.

** Cantwell-Collins sets economy-wide reduction targets beginning with a 20 percent reduction from 2005 levels by 2020. However, additional action by Congress would be required before these targets could be met. Reduction estimates do not include emissions above the cap that could occur due to the safety-valve.

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What Role Can Nuclear Power Play

- **MIT and Princeton studies suggest that in order to make a significant contribution to reducing world CO_2 emissions, 1,000 new reactors will have to be built by 2050 – that's 2 new reactors coming on line each month.**
- **A study by the Institute for Energy and Environmental Research suggests that between 1,900 and 3,000 reactors would be needed to maintain global CO_2 emissions at year 2000 levels. That would be one new reactor almost every week.**

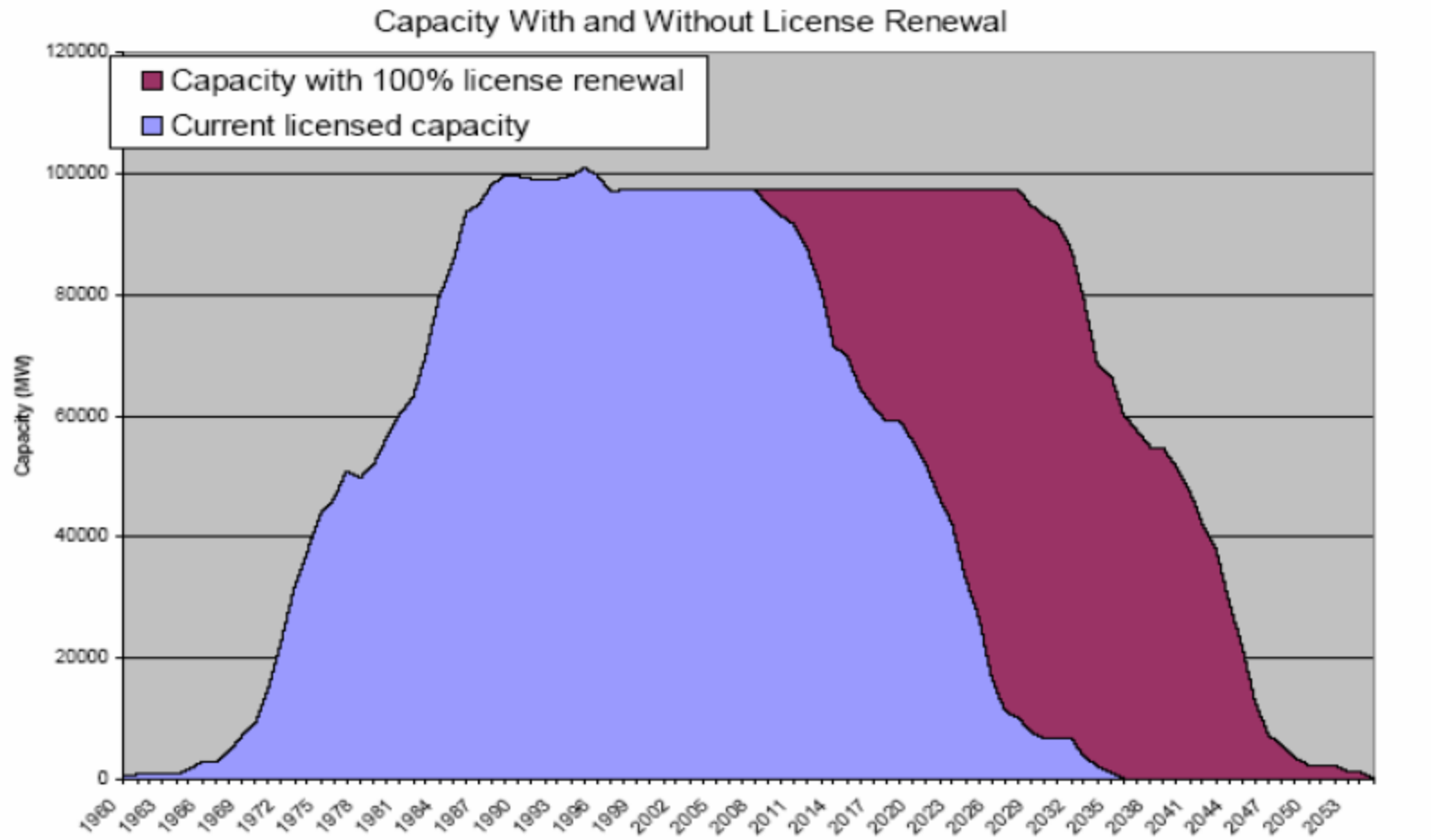
What Role Can Nuclear Power Play (2)

The 15 Wedges (Scientific American, 9/06)

What Role Can Nuclear Power Play (3)

- **US share of a Pacala-Socolow nuclear wedge would be about 300 GW by 2054**
- **All existing plants would have to be replaced**
- **Would mean about 250 new nuclear plants at 1,200 MW per unit**
- **Would cost about $2.5 trillion dollars (in current dollars) at an average cost of about $10 billion per plant**

Holding the Nuclear Share



What Role Can Nuclear Power Play (4)

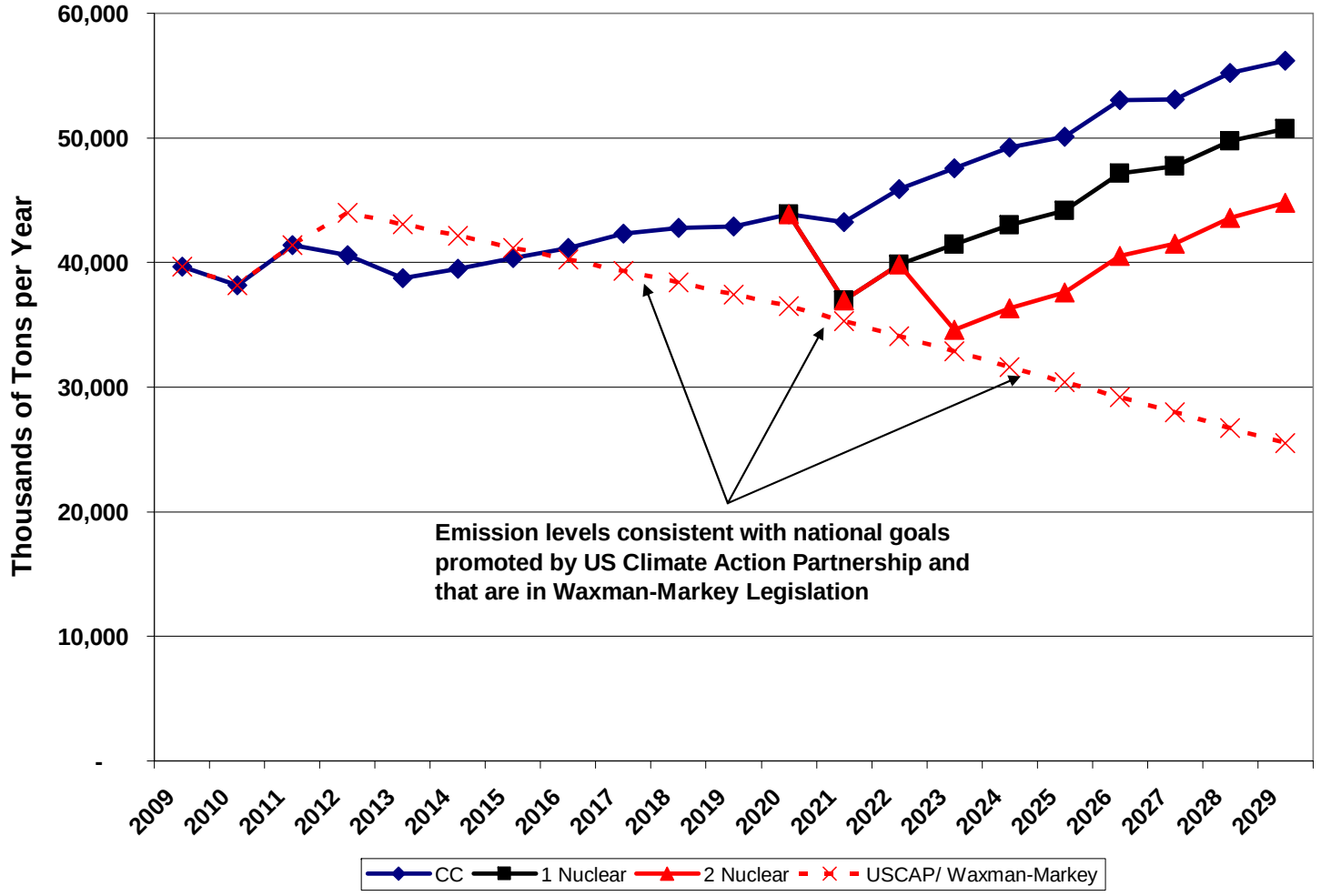
- **A recent assessment for the Council of Foreign Relations has concluded that:**

  As a practical matter, building reactors at this rapid pace would initially tend to drive up unit costs and, thus, scare off investors. For example, there are currently only a few companies in the world that can make reactor-quality steel, concrete, and other vital parts. Moreover, a rush to build would aggravate existing shortages of skilled workers to construct the reactors, qualified engineers to run the power plants, and inspectors to ensure safe operations.

  AND

  In the foreseeable future, nuclear energy is not a major part of the solution to further countering global warming or energy insecurity. Expanding nuclear energy use to make a relatively modest contribution to combating climate change would require constructing nuclear plants at a rate so rapid as to create shortages in building materials, trained personnel, and safety controls.

What Will New Nuclear Do?



Deja Vue – All Over Again?

- **Atomic Energy originally promoted as "too cheap to meter"**
- **But existing generation of nuclear units became so expensive:**
  - **Owners experienced severe financial problems**
  - **Many plants cancelled**
  - **Many cost disallowances and settlements in lieu of disallowances**
  - **Plants sold/divested at far below book value – ratepayers bore hundreds of millions of stranded costs**

U.S. Nuclear Industry Construction Cost Experience (1)

- **The nuclear plants operating in U.S. today were built in the 1960s-1980s.**
- **Data compiled by U.S. Department of Energy reveals that originally estimated cost of 75 of today's nuclear units was $45 billion in 1990 dollars.**
- **Actual cost of the 75 units was $145 billion, also in 1990 dollars.**
- **$100 billion cost overrun was more than 200 percent above the initial cost estimates.**
- **$100 billion overrun does not include escalation and interest.**

U.S. Nuclear Industry Construction Cost Experience (2)

Year Construction Started	Estimated Overnight Cost (1990$)	Actual Overnight Cost (1990$)	Actual vs. Estimated Cost
1966-67	$560/kW	$1,170/kW	209%
1968-69	$679/kW	$2,000/kW	294%
1970-71	$760/kW	$2,650/kW	348%
1972-73	$1,117/kW	$3,555/kW	318%
1974-75	$1,156/kW	$4,410/kW	381%
1976-77	$1,493/kW	$4,008/kW	269%

U.S. Nuclear Industry Construction Cost Experience (3)

- **But even this DOE study understates cost overruns because (1) it does not include all of the overruns at all of the 75 units and (2) it does not include some of the most expensive plants – e.g. Comanche Peak, South Texas, Seabrook, Vogtle.**
- **For example, cost of the two unit Vogtle plant in Georgia increased from $660 million to $8.7 billion in nominal dollars – a 1200 percent overrun.**

Investments in New Nuclear Plants Remain Very Risky

- **Industry originally optimistically estimated that new generation of nuclear plants can be built at lower cost -- for $1,200 - $2,000 per KW. This meant $2-$3 billion construction cost for a new nuclear plant.**
- **These optimistic cost estimates based on new plant designs that have not actually been built in the US and on changes in the US regulatory process.**
- **Actual experience from building new nuclear plant overseas suggests cost will be much higher and construction will take longer.**
- **At same time, due to earlier overruns, the nuclear industry has a serious credibility issue concerning the reliability of nuclear construction cost estimates.**

Investments in New Nuclear Plants Remain Very Risky (2)

- **Now estimated cost of new nuclear plants has grown to as much as $9-15 billion per unit.**
- **Work has been halted on new nuclear units in Florida because rate increase requests denied in whole or in large part.**
- **Part owner of two proposed nuclear units in Texas has sued the majority owner for misleading statements and withholding key information.**

Investments in New Nuclear Plants Remain Very Risky (3)

- **Capital markets remain unwilling to invest in new nuclear units without federal and state incentives and guarantees.**
- **States allowing pre-approval of recovery for engineering and site evaluations.**
- **States allowing construction work in progress in rate base – utilities recover earnings on plants before they enter service.**
- **Federal loan guarantees – even $54 billion will only help fund a limited number of new plants.**

The Consequences of Rapid Expansion of Nuclear Power (1)

- **Expansion of nuclear power would exacerbate waste and nuclear proliferation concerns.**
- **New nuclear power plants would increase the need for new permanent fuel repositories unless reprocessing of spent reactor fuel is attempted. There are currently no permanent waste repositories anywhere in the world.**
- **But reprocessing is more expensive and could not handle all existing spent fuel wastes and new wastes that would be created by the new plants unless there were a significant number of reprocessing plants around the country and new reprocessing technologies are developed.**
- **However, the new reprocessing technologies now being developed have not been proven beyond laboratory bench tests at about 1/1,000,000 scale.**

The Consequences of Rapid Expansion of Nuclear Power (2)

- **Use of reprocessing to facilitate expansion of nuclear industry also would create more pure plutonium or other weapons grade materials that could be used by terrorists**