

Developing Clean, Innovative Commercial Energy: *Will Proposed Federal Subsidies Hurt or Help?*

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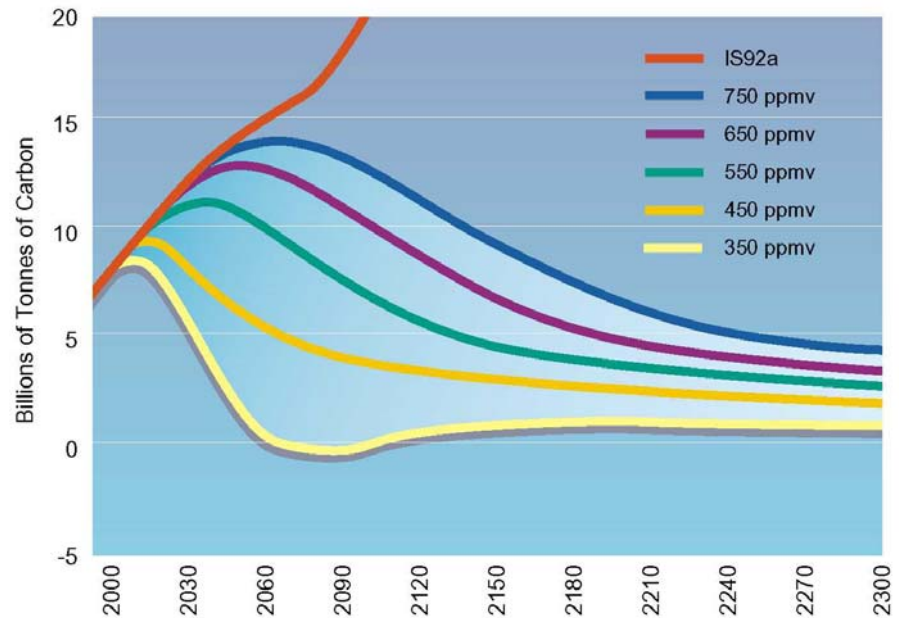


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Fundamental Technology Shifts Are Required to Achieve Climate Stabilization Goals

- Policy goals
 - Stabilize global temperature by stabilizing GHG *concentrations*
- Implications for emissions
 - Ultimately, net greenhouse gas emissions must fall to zero
- Implications for timing
 - New, affordable technologies must be developed in time to achieve stabilization goals
- R&D is critical need
 - Current technology and evolutionary improvements cannot achieve these goals at acceptable costs

Emissions Trajectories Consistent With Various Atmospheric CO₂ Concentration Ceilings



Source: Jae Edmonds, GTSP Phase II Update, Sept 2005

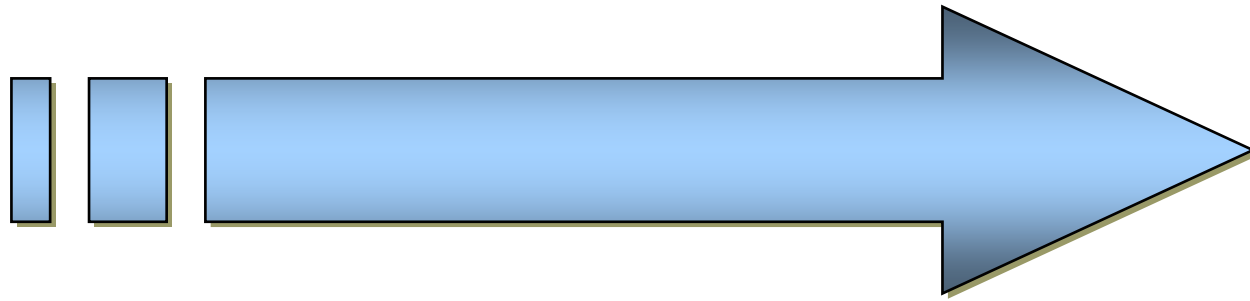
Need for “breakthrough technologies”
Zero net emissions -- tolerable cost -- global applicability

Near Term Opportunities for Action to Achieve Long Term Goals

- **There clearly is a need for policies to create incentives for this kind of R&D**
- **Putting “mandatory limits” on U.S. greenhouse gas emissions in the next decade will not bring forth the needed technology**
 - **Current caps don’t make R&D profitable – the expectation of future carbon prices does**
 - **Announcements of future caps or emission taxes sufficient to make R&D profitable are not credible**
- **Effective and immediate incentives for private sector R&D are necessary to achieve the required technological breakthroughs**
 - **Commitments to innovation incentives that are credible and irreversible**
 - **Incentives that direct private R&D into lines likely to produce climate benefits**
- **But current climate bills concentrate on funding for deployment of existing technologies, not R&D**



Design of R&D Incentives Requires Attention to the RDD&C Continuum



Research **Development** **Demonstration** **Commercial-**
Basic Applied (Prototype **ization**
Testing) (Operation or
Diffusion)

Non-Appropriable



Appropriated

Policy Expectations



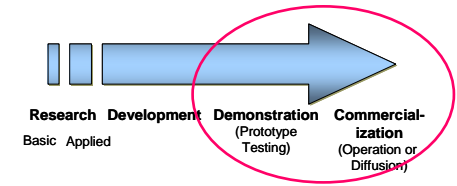
Policy Reality

Direct Incentives



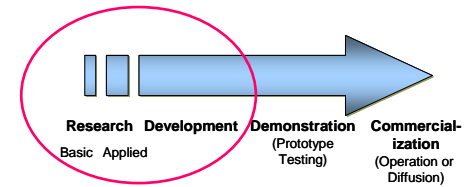
Carbon Prices

Deployment Can and Should Be Left to the Market



- **A direct government role in promoting deployment of technology is unnecessary and unhelpful**
 - Private investors can expect to capture the rewards of innovation
 - Picking technologies just increases the cost of reducing emissions
- **This is where government failures have been most prominent**
 - Government is necessarily “picking winners” at this stage
 - Large scale attracts earmarking and choice of projects with the most powerful political backers
 - The recent intervention of Congress into DOE’s attempt to cancel a FutureGen project is a telling example
- **Getting it off the shelf is the right role for carbon pricing**
 - But the required price will be much too high unless R&D produces breakthrough technologies *first*
 - *The price it takes to deploy a successful technology is far lower than the price required to motivate R&D to create it*

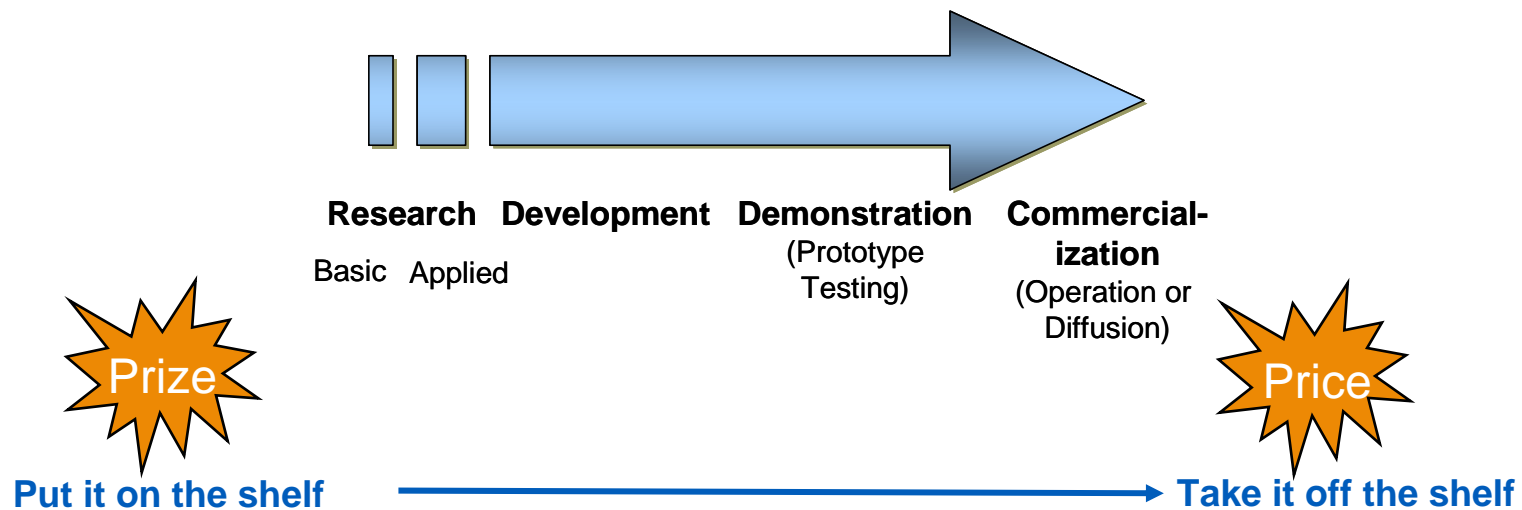
Incentives at the R&D Stage



- **A mix of direct funding for basic science and credible incentives for private sector R&D is required**
- **Both direct funding and incentives must**
 - Allow multiple approaches in early stages to maximize information
 - Tolerate and *expect* failures
 - Direct effort toward producing *climate* solutions
 - Determine how much funding is required to achieve results
- **Prizes are a potentially good fit with the R&D stage**
 - Let the researcher decide which approach is most likely to achieve goal
 - Generate multiple approaches that are directed toward the rewarded outcome
- **Difficult design questions remain**
 - How to identify “breakthrough” research outcomes that are climate related
 - How to keep Congress and the bureaucracy in their proper place

Roles for R&D Incentives and Carbon Pricing

- If announcements of future carbon prices are not sufficiently credible, irreversible up-front R&D incentives are needed
- Carbon pricing policies cannot put new technology “on the shelf” but they are effective for getting technology “off the shelf”
- Output-based incentives, such as prizes, have many advantages for getting technology “on the shelf”





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