

**Commentary on Presentations by
Edenhofer, Clay/Roop, and Laitner
in the Symposium on
Extreme Energy Efficiency**

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Addendum on how much efficiency we need

- Dr. Edenhofer's opening remarks reminded me of something I should have said in connection with my "thought experiment" on the relation between the rate of efficiency improvement and needed growth in carbon-free energy:
 - My numbers corresponded to stabilizing CO₂ at 550 ppmv. But it's increasingly apparent that this target is too weak to avoid "dangerous anthropogenic interference". If the goal is to avoid exceeding 2°C above pre-industrial, CO₂ must be held to 400-450 ppmv.
 - All else equal, that means the C-free energy requirements for any given rate of efficiency improvement in the 21st century go up.
 - On the other hand, my economic-growth baseline was IS92a, which some analysts think too high. If global economic growth is assumed to be lower than that, this reduces the needs for C-free energy from those shown in my table.

How are we going to get there?

- Dr. Edenhofer noted that models of the costs of reducing GHG emissions generally overstate those costs by failing to account adequately for induced technological innovation and for learning.
 - I agree.
 - In addition, some distinguished economists (e.g., Harvard's Dale Jorgenson) argue that conventional analyses don't adequately reflect benefits for economic growth that will result if revenues from C taxes or permit sales are used to reduce other taxes.
 - It's also the case that the typical portrayals of costs in terms of lost GDP are less alarming than they look at first sight. For example, the statement that US GDP might be 3% lower in 2050 under carbon constraints than under BAU only means that Americans would need to wait until 2051.5 to be as rich as they otherwise would have been in 2050.

How are we going to get there? (continued)

- The analysis by Clay, Kaarsberg, Hopson, & Roop reinforced the proposition that the more realism and relevant detail one adds to energy/economic models, the larger are the predicted positive impacts of advanced technologies on energy intensity & carbon intensity and the lower the net costs (or the larger the net benefits) to the economy of implementing those technologies.
- The paper by Laitner underlined once more the “extreme” technical potential for increased energy efficiency available across every sector of the economy, while reinforcing earlier contentions about how much of this potential we must capture in order to address the global climate-change challenge.

How are we going to get there? (continued)

TAKE-AWAY MESSAGE ON WHAT TO WORK FOR NOW

- A price on carbon emissions, either as a carbon tax or a cap-and-trade approach, SOON.
- A significant ramp-up in CAFÉ standards (because initial C price will be below the real cost of emissions and will not reflect the oil-dependence externality).
- Extension & expansion of tax incentives for private-sector energy RD&D.
- A doubling of Federal investments in ERD&D, emphasizing end-use efficiency and low- & no-carbon supply.
- A companion program to subsidize accelerated deployment of the most attractive options emerging from demo.
- A tripling of Federal investments in international cooperation on ERD3.

See www.energycommission.org.