Commentary on Presentations by Bassett, Brown, and Rosenfeld in the Symposium on Extreme Energy Efficiency

John P. Holdren
Heinz Professor & Director
Program on Science, Technology, & Public Policy
John F. Kennedy School of Government
HARVARD UNIVERSITY

2005 Annual Meeting of the
American Association for the Advancement of Science
Washington, DC • 21 February 2005

The big questions (and answers)

- What do we mean by “extreme”?

  Kaarsberg, Bassett: Thinking “outside the box”.

  Holdren: The challenge to efficiency is extreme, which is why thinking outside the box is required.

- How much <u>technical efficiency potential</u> is there and where is it to be found?

  Bassett, Brown, Rosenfeld: Huge, growing, everywhere.

  Holdren: I agree.

- How much of the potential do we <u>need</u> to exploit?

  Holdren: Addressed in the rest of this commentary.

- How are we going to <u>make it happen</u>?

  Edenhofer, Clay/Roop, Laitner (coming next).

How much of the potential do we need to exploit?

MOTIVATIONS THAT DETERMINE THE “NEED”

- Saving money – demand side (savings on energy bills exceed investments needed to achieve the savings)
- Saving money – supply side (reduced pressure to expand supply allows foregoing costliest options, worst sites)
- Reducing air pollution, water pollution, habitat destruction, accident risks, & waste-management burdens from supply options
- Reducing greenhouse-gas emissions from the energy-supply sector.

All of these are worthy motivations, but the most demanding is the last. It defines how much we need (& means that the incentive structure for efficiency must reflect this driver).

Increase in C-free energy needed to stabilize atmospheric CO_2 below 550 ppm_v

To avoid a doubling of preindustrial CO_2, conventional fossil primary energy must not exceed 500 EJ in 2050 and 350 EJ in 2100. Starting from 350 EJ of conventional fossil fuel in 2000 and BAU rates of change in world GDP and energy intensity, it follows that EJ/yr of C-free energy needed in 2050 and 2100, compared to 100 EJ/yr actual in 2000, are…

	2000	2050	2100
C-free energy under BAU	100	600	1500
...if E/GDP falls 1.5%/yr	100	350	800
...if E/GCP falls 2.0%/yr	100	180	350