

Abstract for an Invited Paper  
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### **Advanced Energy Efficiency and Distributed Renewables**

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The US now wrings twice the GDP from each unit of energy that it did in 1975. Reduced energy intensity since then now provides more than twice as much service as burning oil does. Yet still more efficient end-use of energy – explained more fully in a companion workshop offered at 1245 – is the largest, fastest, cheapest, most benign, least understood, and least harnessed energy resource available. For example, existing technologies could save half of 2000 US oil and gas and three-fourths of US electricity, at lower cost than producing and delivering that energy from existing facilities. Saving half the oil through efficiency and replacing the other half with saved natural gas and advanced biofuels would cost an average of only \$15/barrel and could eliminate US oil use by the 2040s, led by business for profit. Efficiency techniques and ways to combine and apply them continue to improve faster than they're applied, so the "efficiency resource" is becoming ever larger and cheaper. As for electricity, "micropower" (distributed renewables plus low-carbon cogeneration) is growing so quickly that by 2005 it provided a sixth of the world's electricity and a third of its new electricity, and was adding annually 4x the capacity and 11x the capacity added by nuclear power, which it surpassed in capacity in 2002 and in output in 2006. Together, micropower and "negawatts" (saved electricity) now provide upwards half the world's new electrical services, due to their far lower cost and lower financial risk than the central thermal power stations that still dominate policy discussions. For oil and electricity, each of which adds about two-fifths of the world's energy-related carbon dioxide emissions, efficiency plus competitive alternative supplies can stabilize the earth's climate at a profit, as well as solving the oil and (largely) the nuclear proliferation problems. Conversely, costlier and slower options, notably nuclear power, would displace less carbon emission per dollar and per year, thus worsening climate change compared with best-buys-first investments.