



Energy Efficiency Overview

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Authors of Energy Efficiency Papers

- Gilbert E. Metcalf, Tufts University
 - Energy Efficiency Overview
- Richard Newell
 - Energy Efficiency Challenges and Policies
- Vivian Loftness, Carnegie Mellon University
 - Improving Building Energy Efficiency in the U.S.: Technologies and Policies for 2010 to 2050
- Lynn Price and Ernst Worrell, LBNL
 - Improving Industrial Energy Efficiency in the U.S.: Technologies and Policies for 2010 to 2050
 - [Dr Mark Levine attending this 10-50 workshop]



Overview

- Good News
 - Enormous technological potential for energy efficiency
 - Energy use responds to prices, standards and other policies
- Bad News
 - Necessary interventions (price increases, new standards, etc.) might have to be substantial
- Discussion
 - Key policy tools and implications

Figure 1: U. S. Energy Consumption

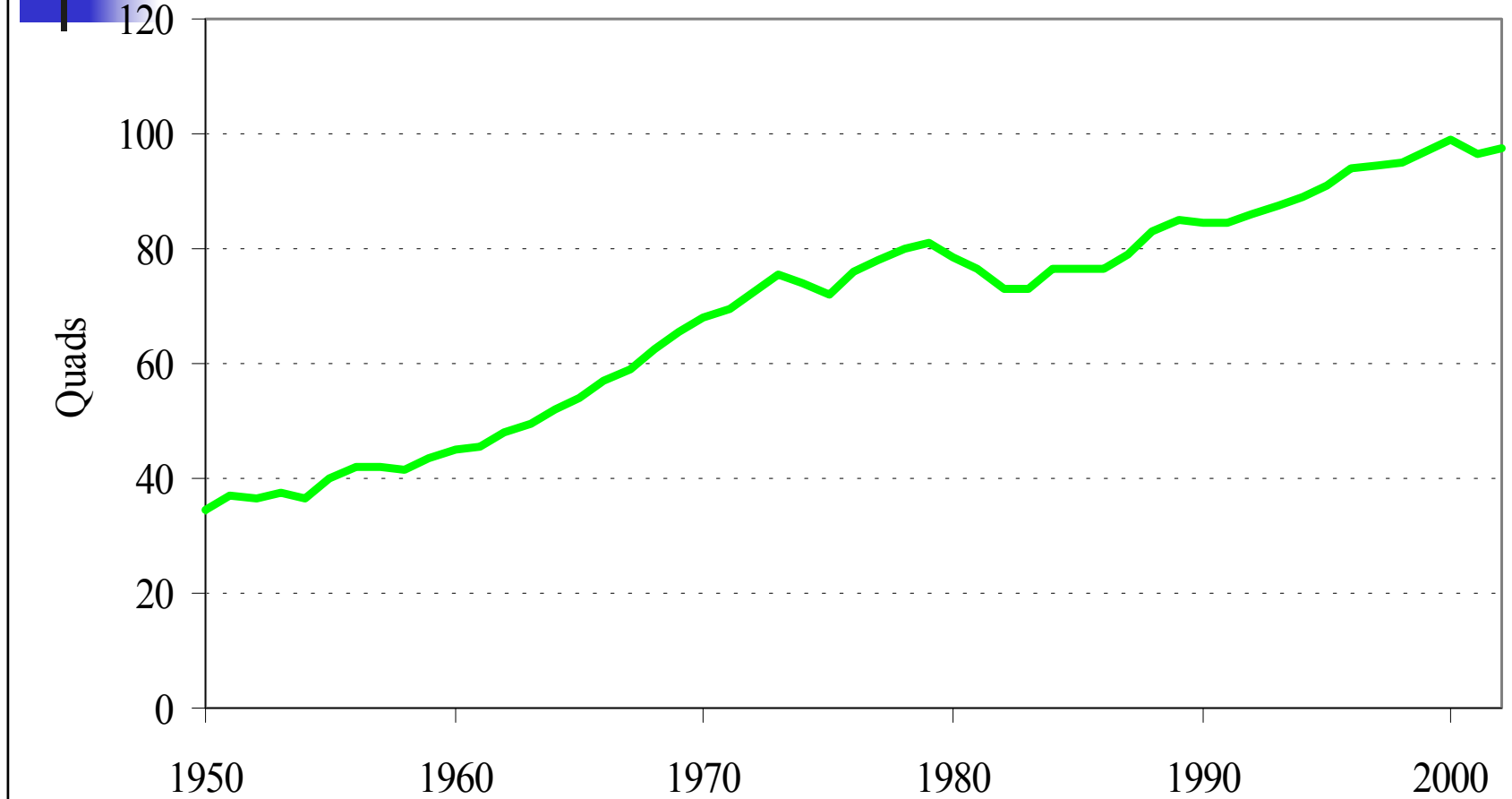
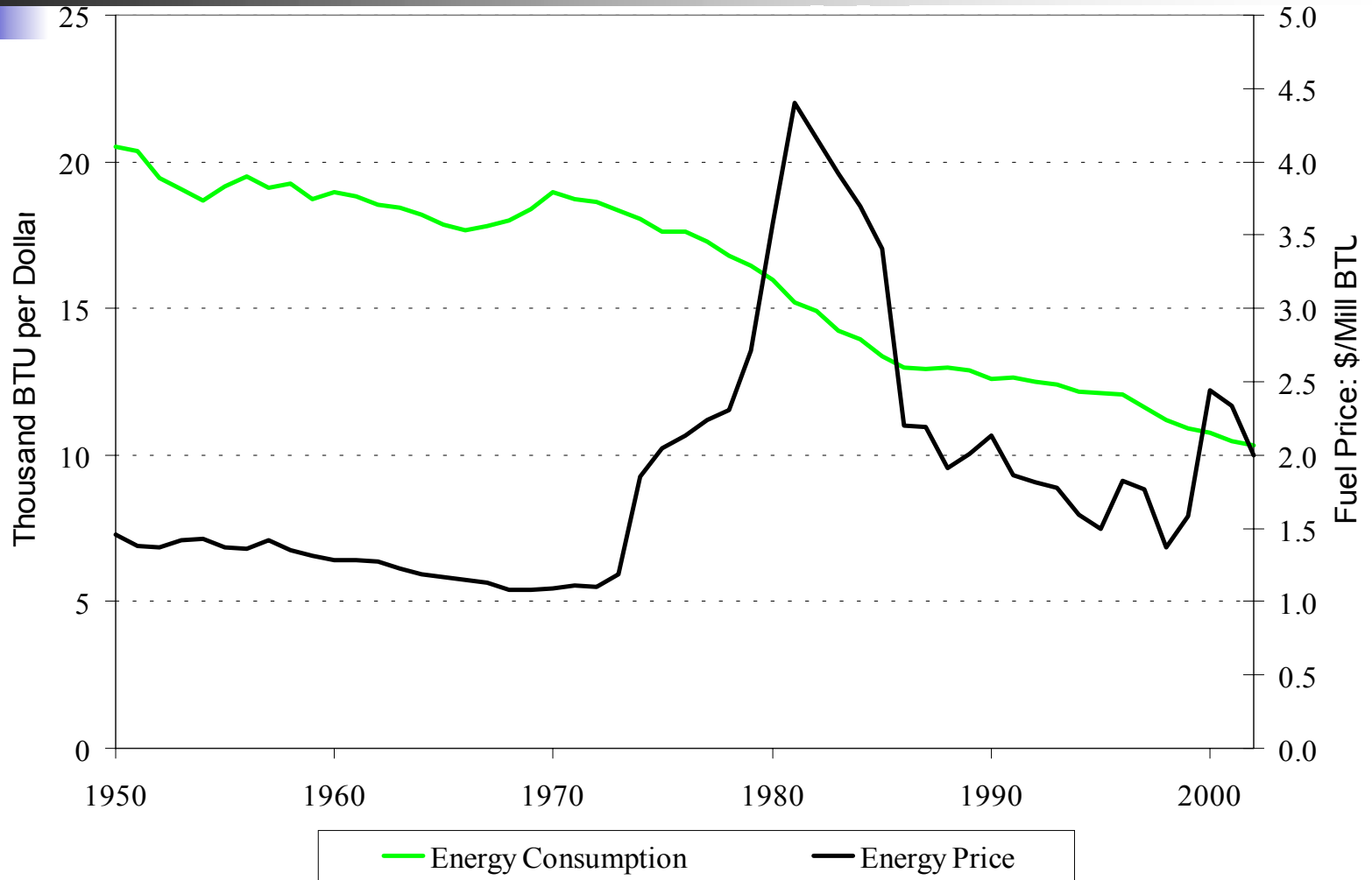


Figure 2: U. S. Energy Consumption per GDP and Real Energy Prices





Possibilities for Energy Efficiency (1)

- Potential in industrial sector (Price and Worrell)
 - **Short term:** With adoption of commercially proven cost-effective technologies and measures, most industries can reduce their energy intensity by 20% or more (Interlaboratory Working Group, 2000)
 - **Long term:** Potential energy-efficiency improvements range between 30 and 65% in the major industrial sectors, 43% for nitric acid production, 34 to 50% for iron and steel production, and 50 to 70% for paper production (ATLAS, 2003)



Possibilities for Energy Efficiency (2)

- Potential in buildings sector (Loftness)
 - **Short term:** Four appliance standards (clothes washers, fluorescent light ballasts, water heaters & central air conditioners) are projected to save consumers \$10 billion in energy costs by 2010 (US Climate Action Report 2002).
 - **Long term:** Cooling buildings accounts for 6% of U.S. energy use - effective use of white roofs, pervious paving & shade trees could yield a 10% reduction. Lighting buildings accounts for 10% of U.S. energy use - effective use of natural conditioning with well designed windows, window controls & lighting system interfaces, could yield a 50% reduction



Gains Come at a Cost

- Energy Paradox
 - Economists and technologists have long debated the potential for low-cost energy efficiency improvements
 - Seeming anomaly that consumers pass up attractive energy efficiency investments with *ex ante* high rates of return
- The view from economists (Newell)
 - Issues include: risk, price fluctuations, and sunk costs
 - Upfront subsidies can have powerful impacts (stronger than price increases), but they only affect new capital adoption and not utilization of existing capital



Diffusion of Energy Efficiency

- Three steps (and their feedbacks) are key to realize the benefits of new technologies
- Invention
 - Government R&D, R&D subsidies, patent protection, other policy options...
- Innovation
 - R&D subsidies, government procurement, other policy options...
- Diffusion
 - Pricing of externalities (e.g., emissions trading), standards, information, other policy options...



Policy Options

- Short-Term
 - More stringent standards (CAFE)
 - Pilot programs (Chicago Climate Exchange)
 - Investment tax credits
 - R&D
- Medium-Term
 - Mandatory tradable permits program
 - Carbon taxes
- Long-Term
 - Induced innovation bringing new technologies on-line



Conclusions

- Aggressive steps will be required to spur large-scale efficiency improvements
 - To reduce consumption (short run)
 - To induce technological innovation (long run)
- Price based instruments necessary
 - Taxes: politically unpopular
 - Tradable permits: politically more palatable
- Standards, R&D incentives, and other policy options will play an important role
- Technology improvements will be key