



Energy Efficiency: A Capital Offense

Comments to MIT NESCAUM Symposium

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Presentation Summary

- To reduce CO₂ emissions, focus on the main sources – generation of electricity and thermal energy
- Generation efficiency could be doubled by using energy twice, but changing existing plants is a capital offense under the CAA.
- Environmental regulatory methodology, including Waxman Markey, ignores efficiency and makes old plants immortal
- To induce a modern heat and power system (like Denmark, Netherlands, Finland), reward clean generation (lower criteria pollutants and/or lower CO₂ per unit of output) and penalize dirty generation.
 - Output based standards are key
 - Expected benefits; 20% reduction of U.S. CO₂ and \$80 to \$100 billion per year savings.

The Energy/Carbon Story

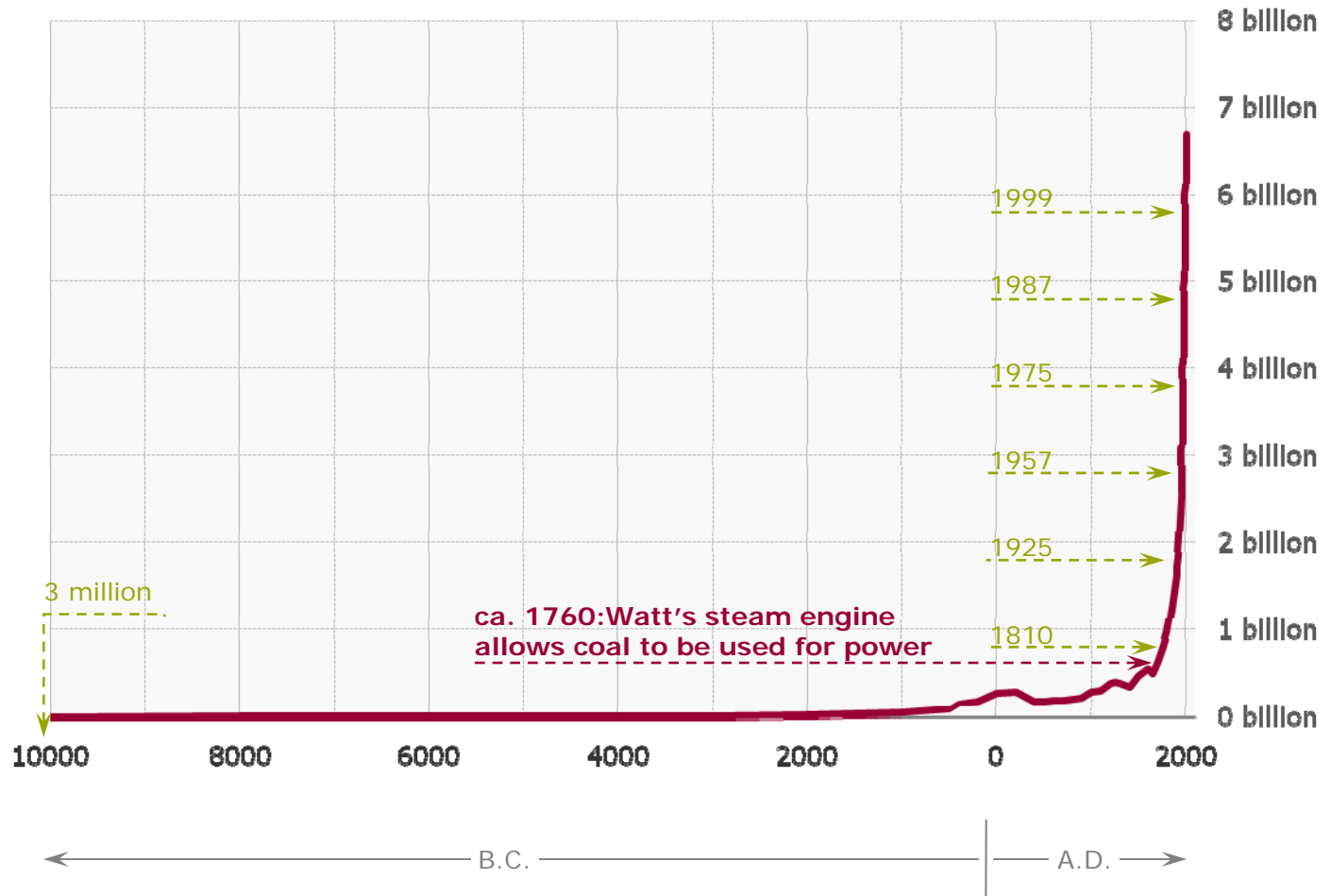
The Generation Story

Recommendations

The history of access to energy services

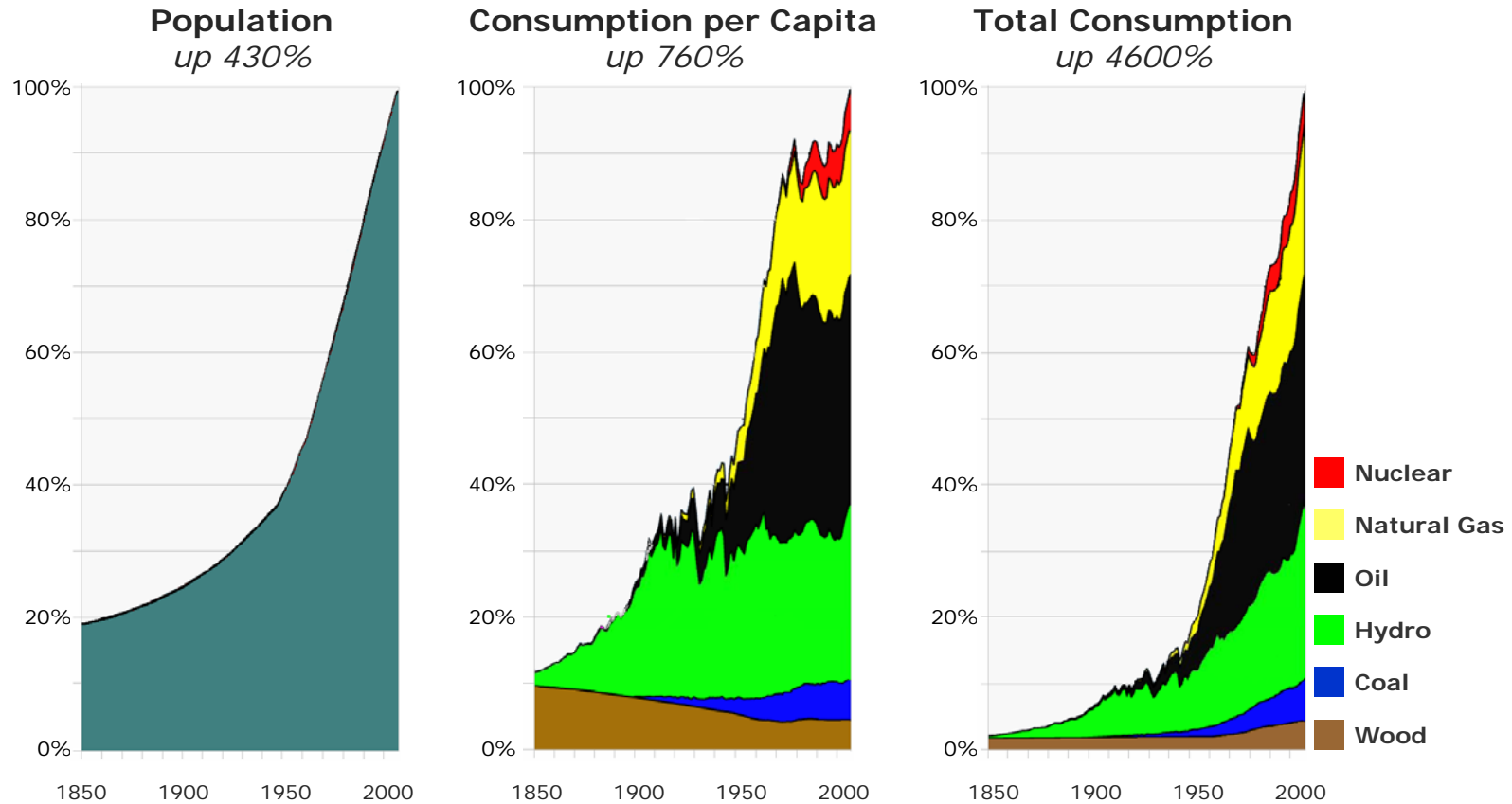
- Our standard of living depends on access to energy services:
 - Heat, power, mechanical energy
- Until recently, *homo sapiens* depended only on metabolic energy:
 - 100,000 years ago: Fire tamed
 - 10,000 years ago: Animals domesticated
 - 5,000 years ago: Power from wind
 - 2,000 years ago: Power from water
- Recent use of 'Ancient Sunlight' – fossil fuel:
 - 1760: First significant use of coal
 - 1859: Oil discovered
 - 1885: Natural gas first used
- Access to energy services allowed population to explode

World population has grown dramatically



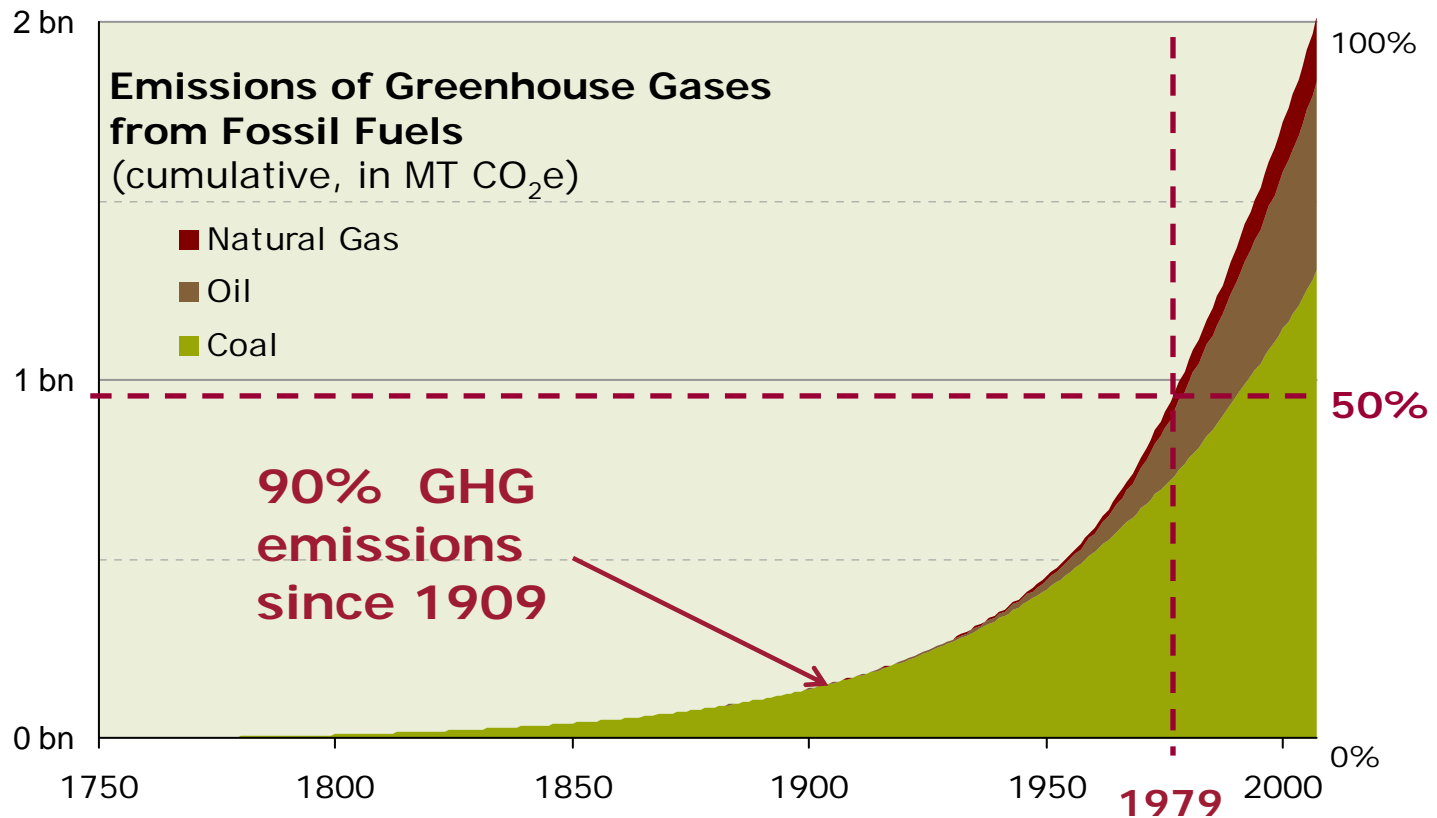
Source: various authors cited by the U.S. Bureau of Census

Increases in world population and energy consumption 1850-2007



Source: Arulf Grubler (1998), BP Statistical Review of World Energy (2008), US Bureau of Census (2008)

Ninety percent of human greenhouse gas emissions during the past century



Source: RED calculations based on data from BP Statistical Review and J. David Hughes, Geological Survey of Canada (ret.)

The Energy/Carbon Story

The Generation Story

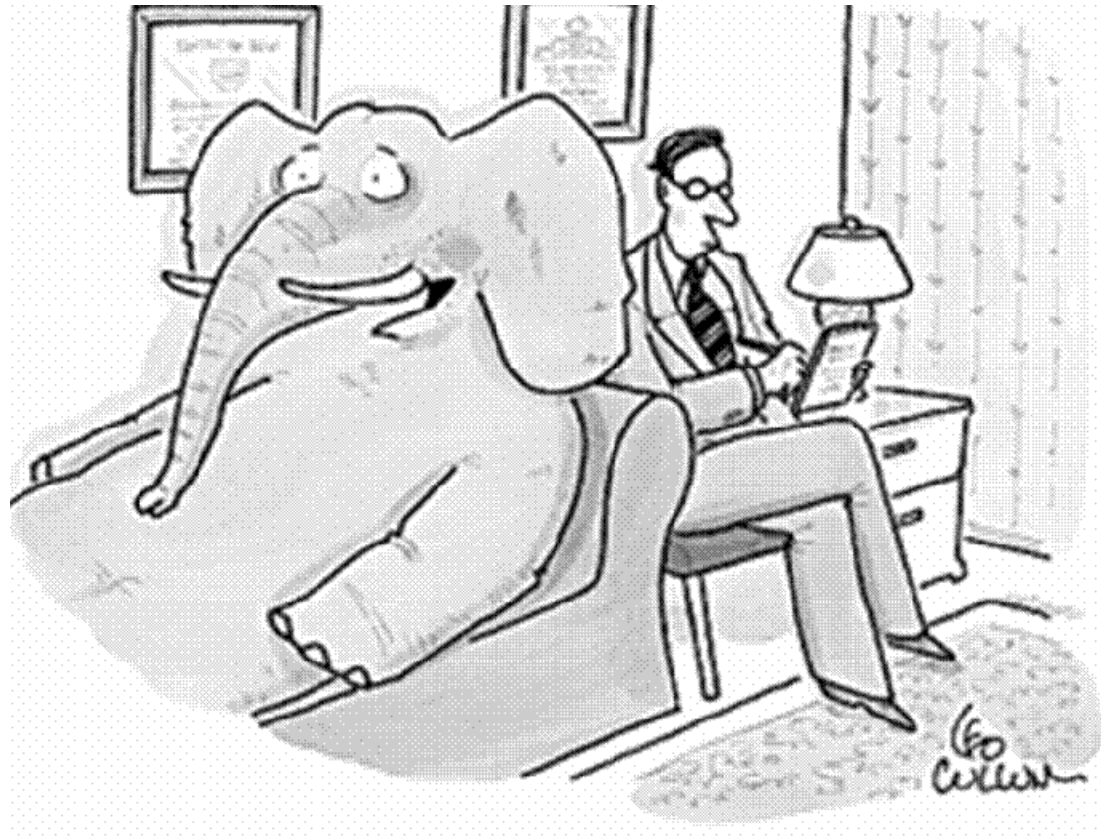
Recommendations



Looking for CO₂ in all the wrong places

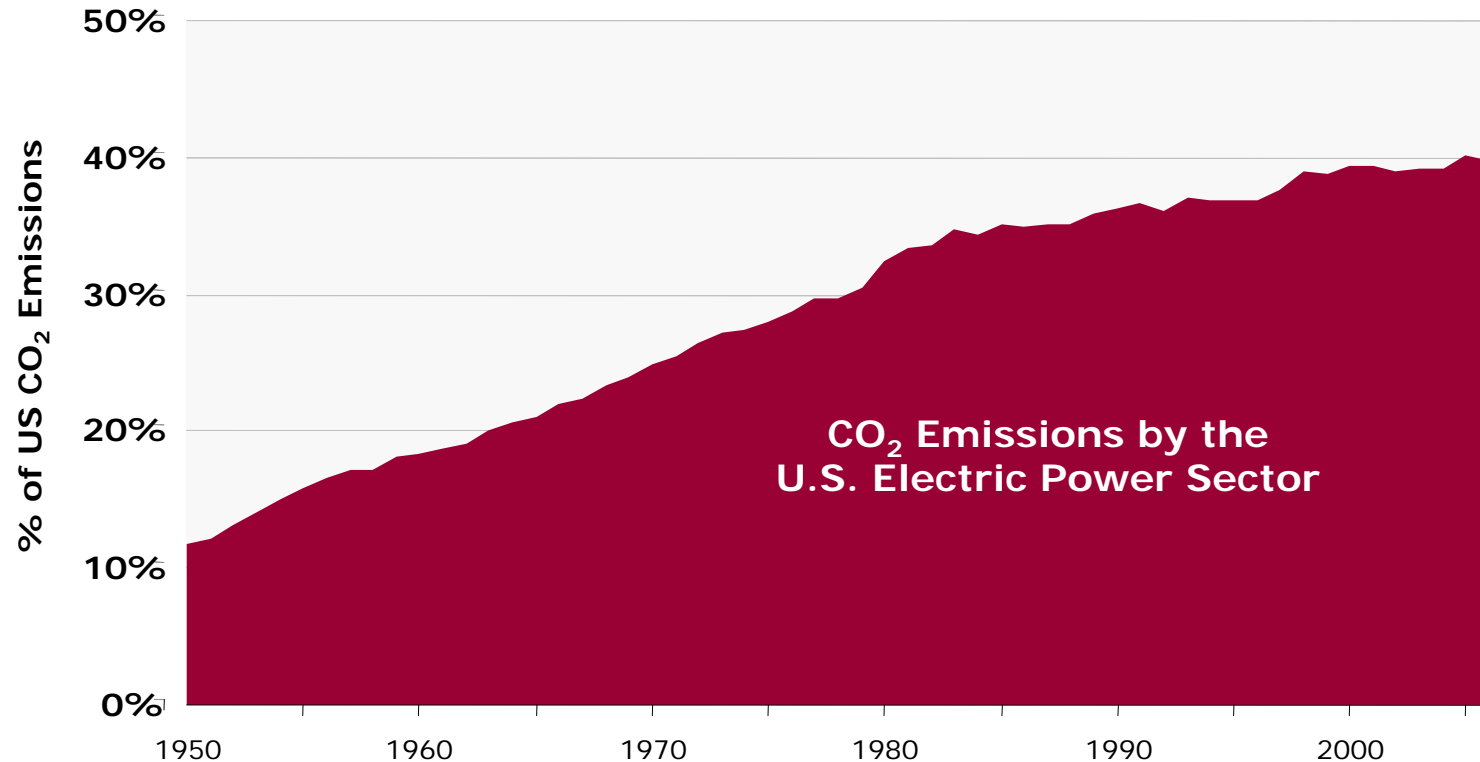
- Analysts slice the world into transportation, residential, commercial, and industrial and then look for ways to reduce CO₂
- Others put blind faith in technology, call for more R&D, without first understanding fifty years of stagnant generation efficiency
- Most pundits ask government to mandate/induce their specific path – CCS, wind, solar, bio fuel, wave power, etc. – rather than providing equal rewards to all clean generation and letting markets pick winners
- **Electricity generation inefficiency is the elephant in the room**

Generation inefficiency – the elephant in the room



*"I'm right there in the room
and no one even acknowledges me"*

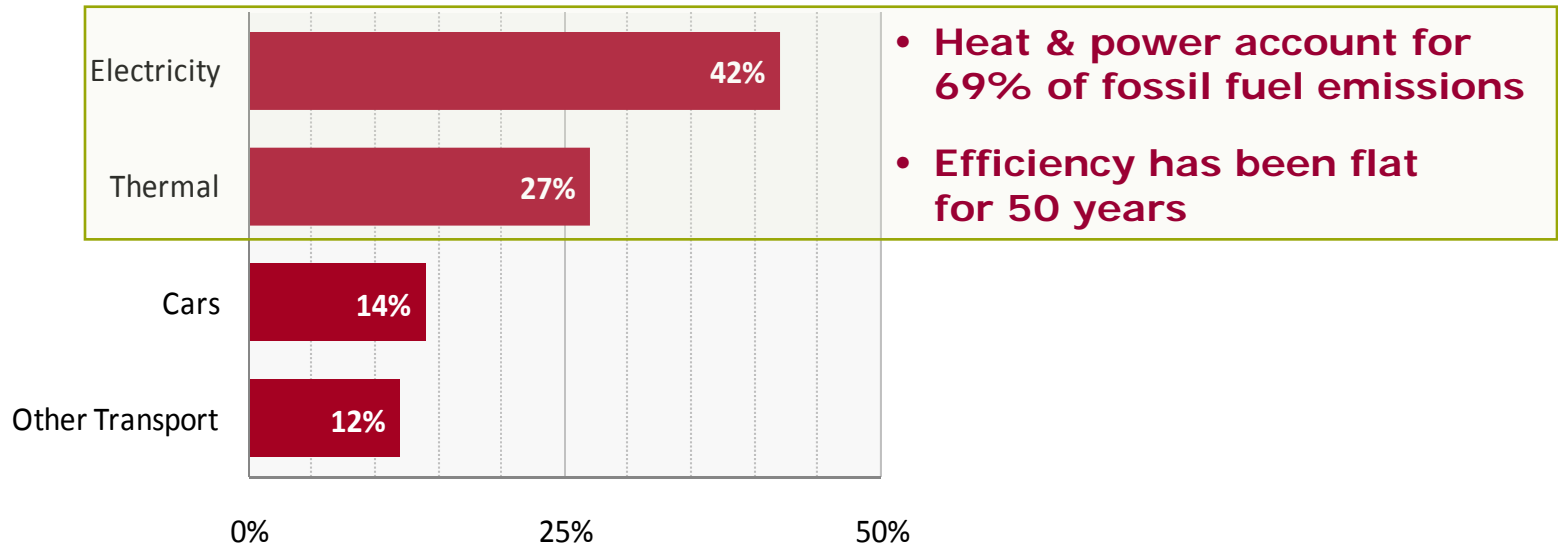
Electricity generation is the largest source of CO₂ emissions



Source: RED calculations based on data from *Emissions of Greenhouse Gases in the United States 2007*; *State Energy Data Report*; and *Annual Energy Review*.

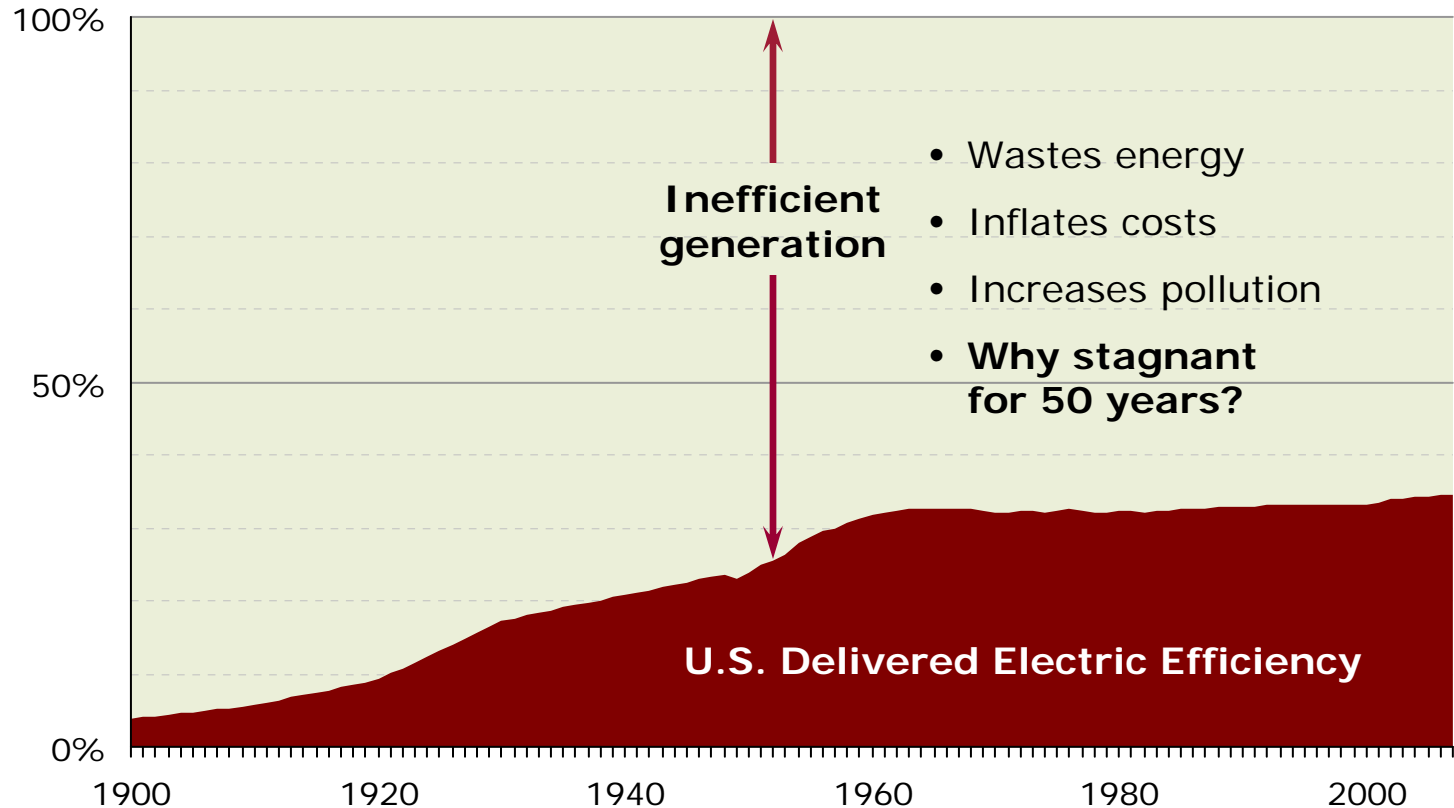
Inefficient heat and power emits two-thirds of CO₂

Emissions of U.S. CO₂ from Fossil Fuels



Source: RED calculations based on data from the U.S. Energy Information Agency and the U.S. Department of Transport

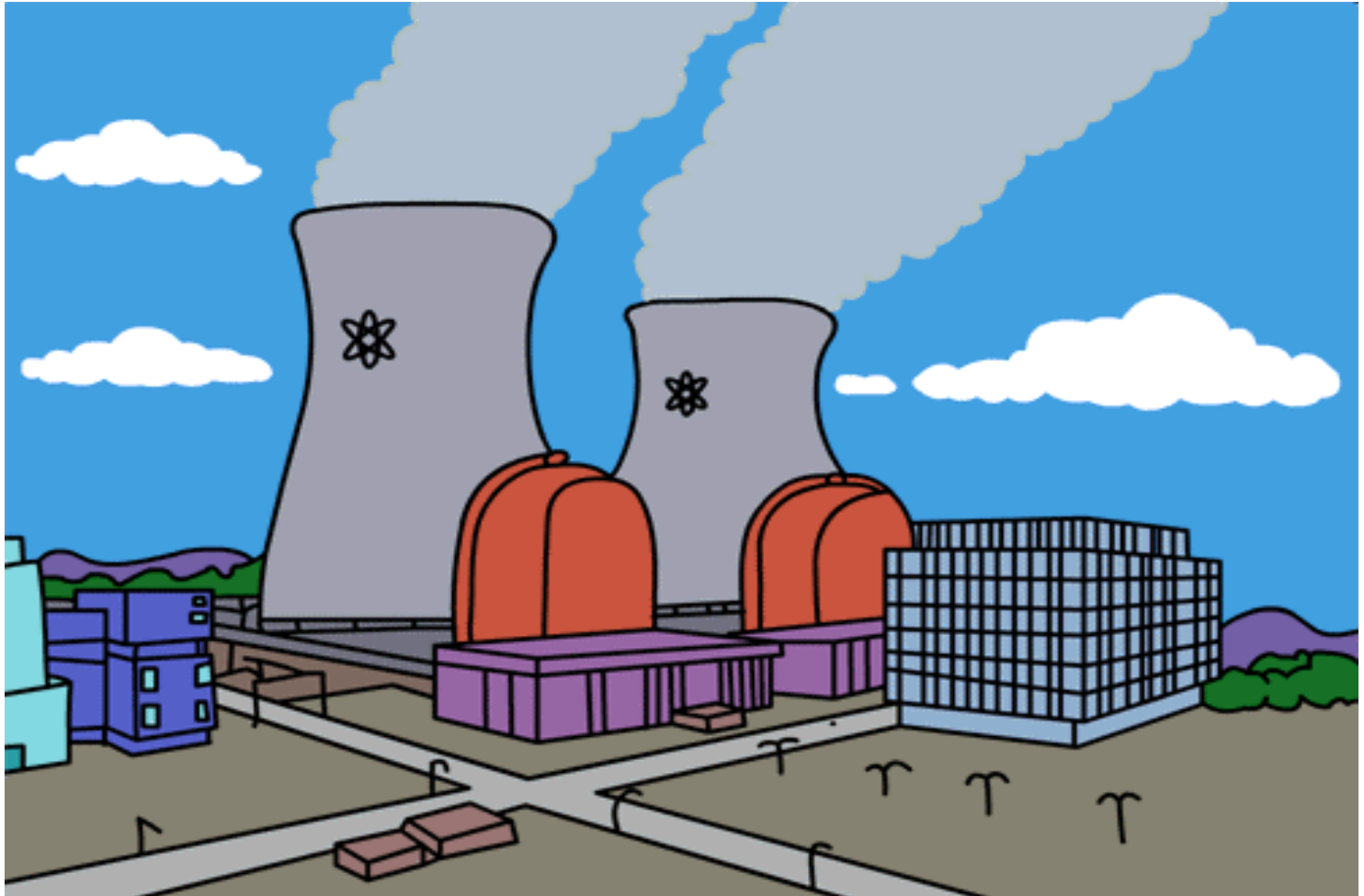
US electricity generation is inefficient



Source: U.S. Energy Information Agency

Homer Simpson's power plant

Springfield, ?



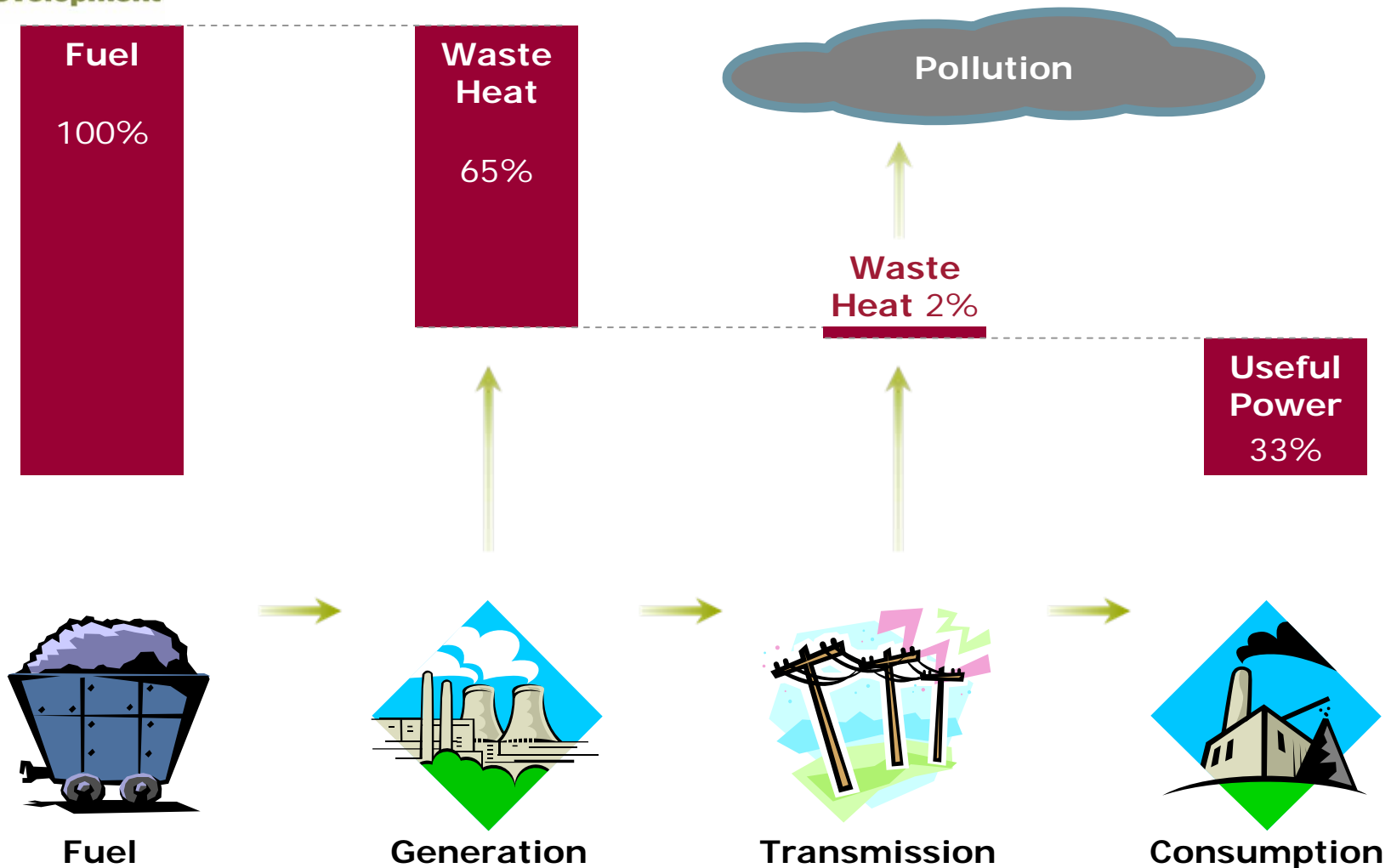
Electricity generation plant

Craig, CO

*Two-thirds of
the energy
generated
is released
into the
atmosphere*

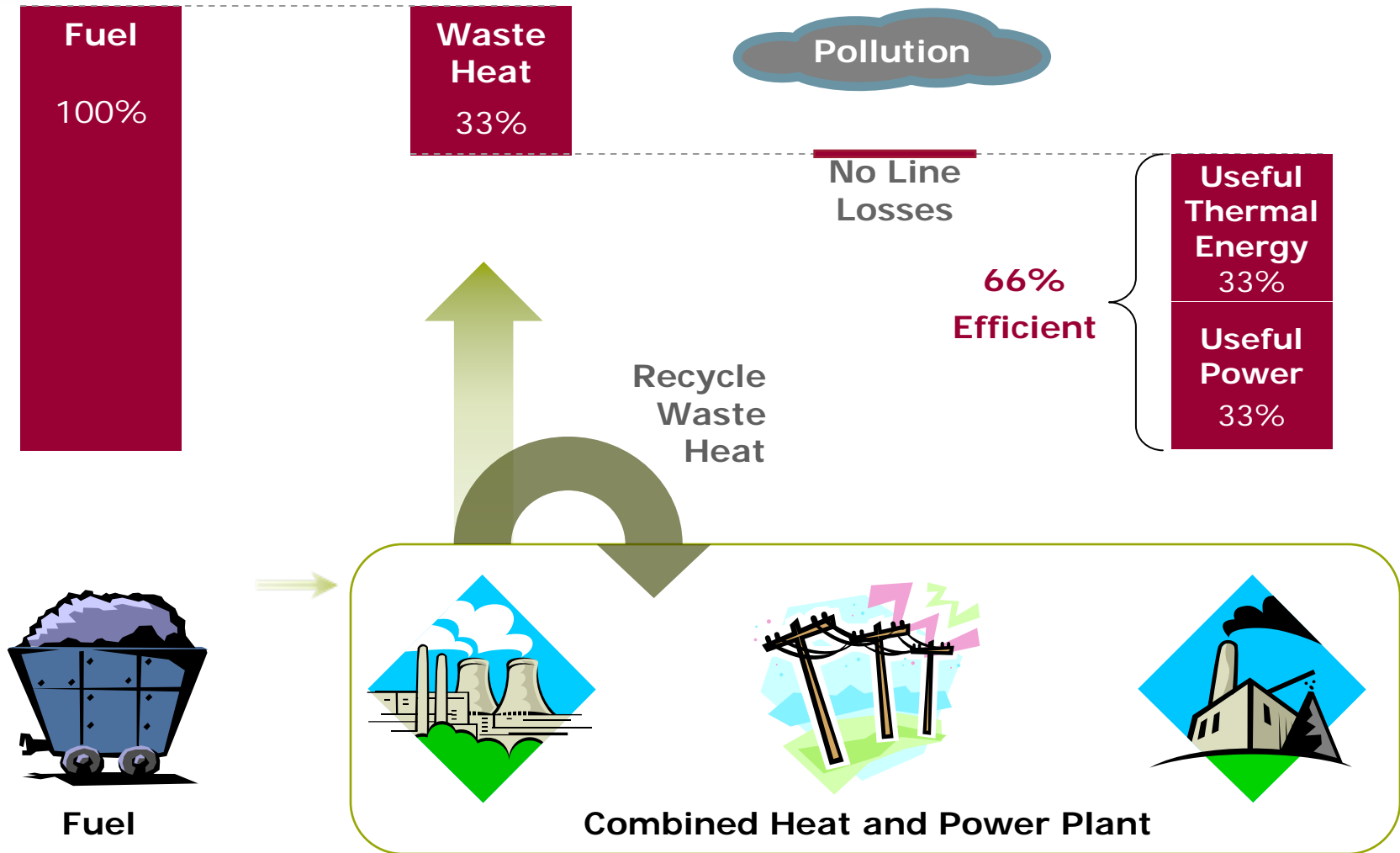


Conventional electricity generation 1960 (& 2009)

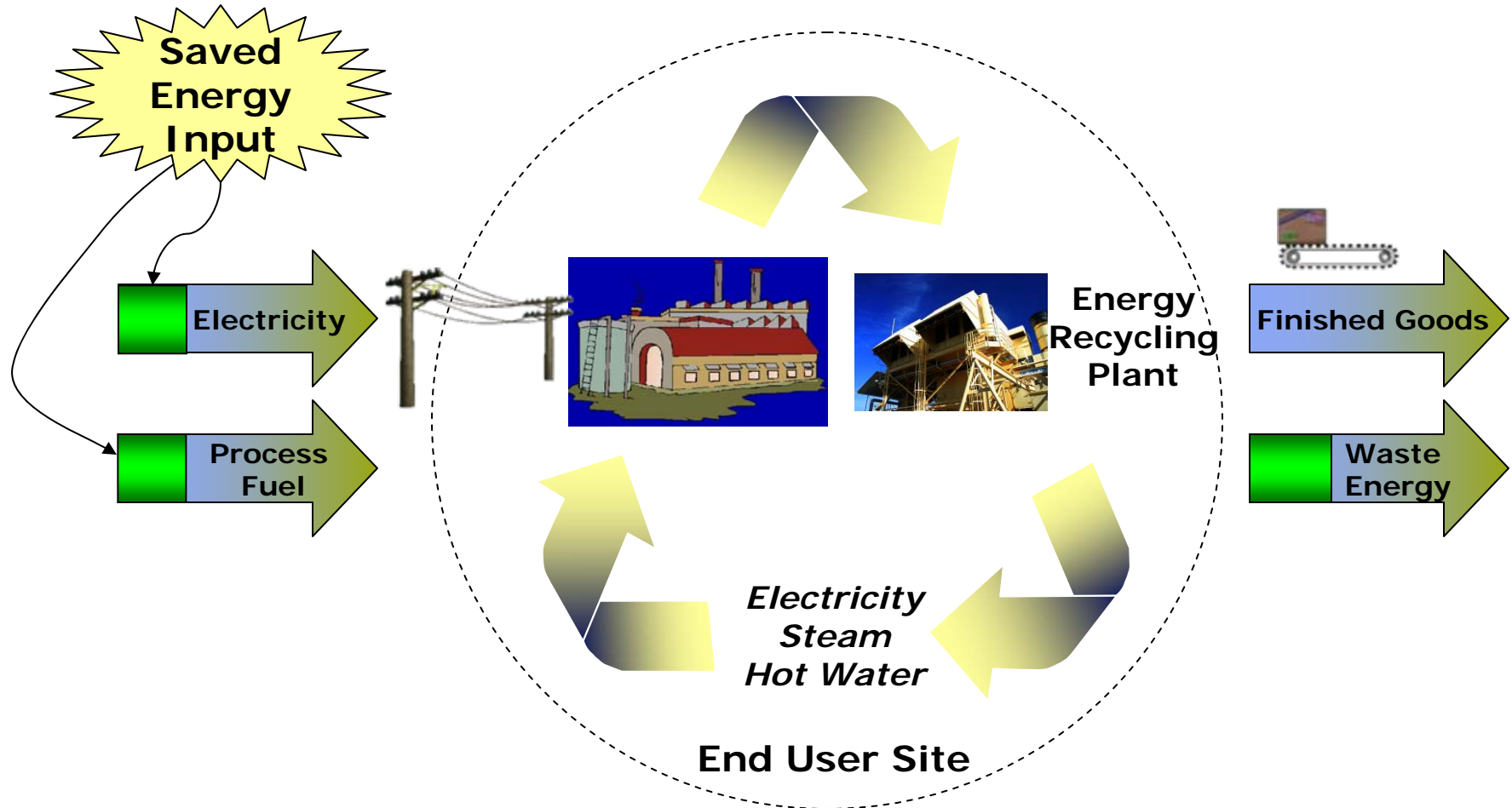


Use energy twice

Local generation producing heat and power



Recycling industrial waste energy: Cost effective clean energy



Recycling industrial waste energy

Cokenergy Mittal Steel, Northern Indiana

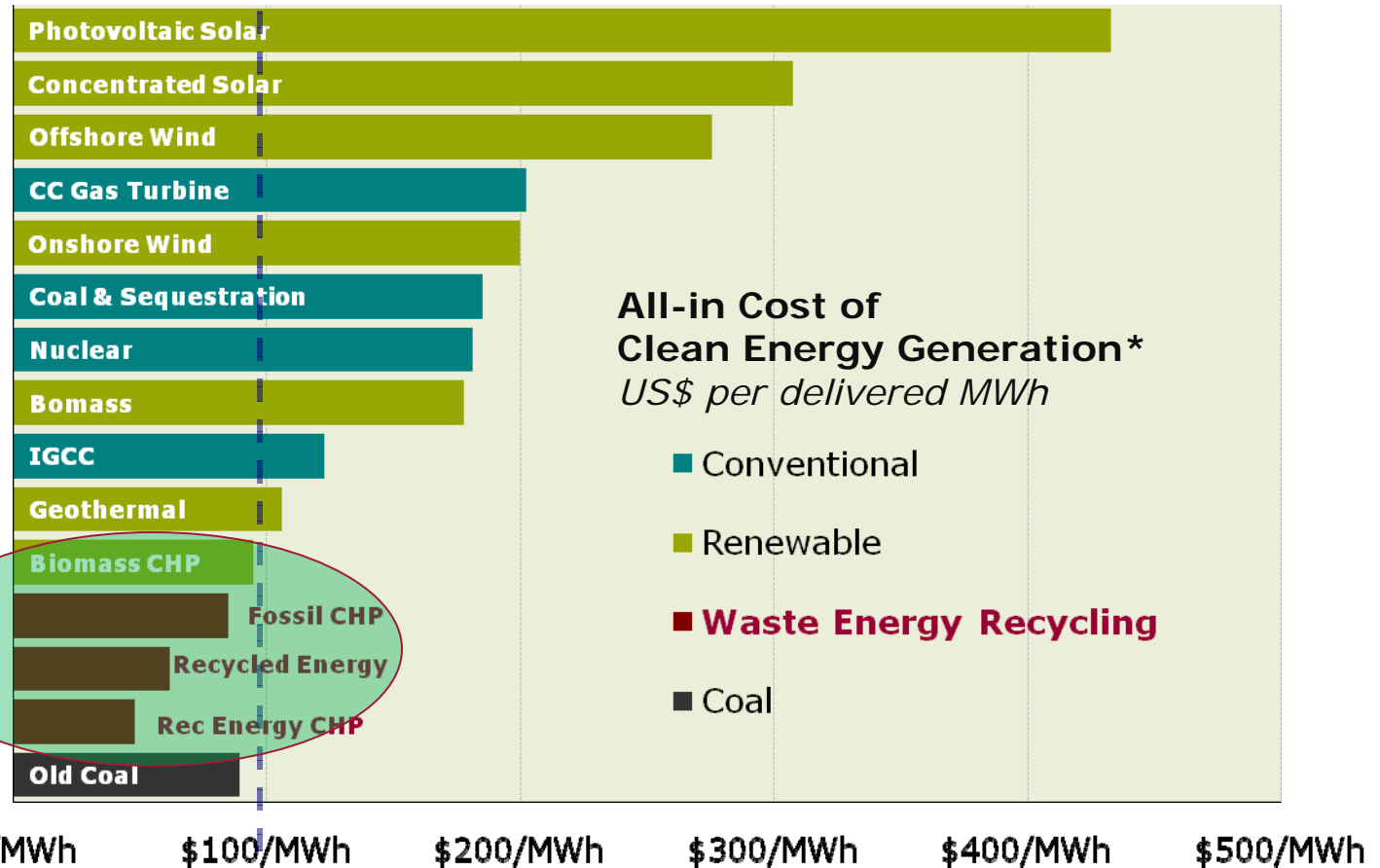
*Produces as
much clean
energy each
year as all
grid-connected
photo-voltaic
solar generation
produced in
2004*



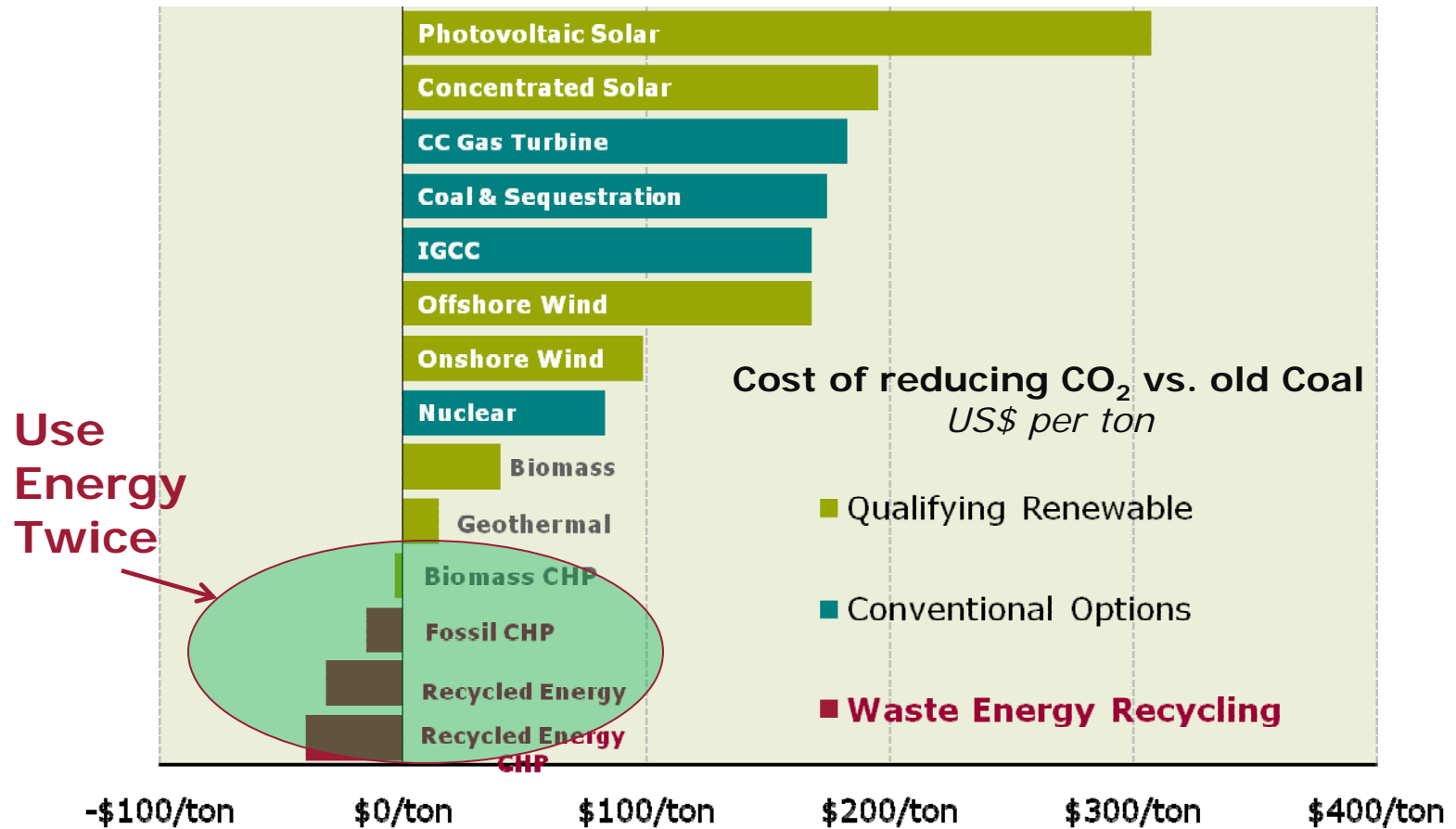
Waste energy recycling is cost-effective

Average 2008 Retail Cost

**Use
Energy
Twice**



Only waste energy recycling makes CO₂ reduction profitable to society

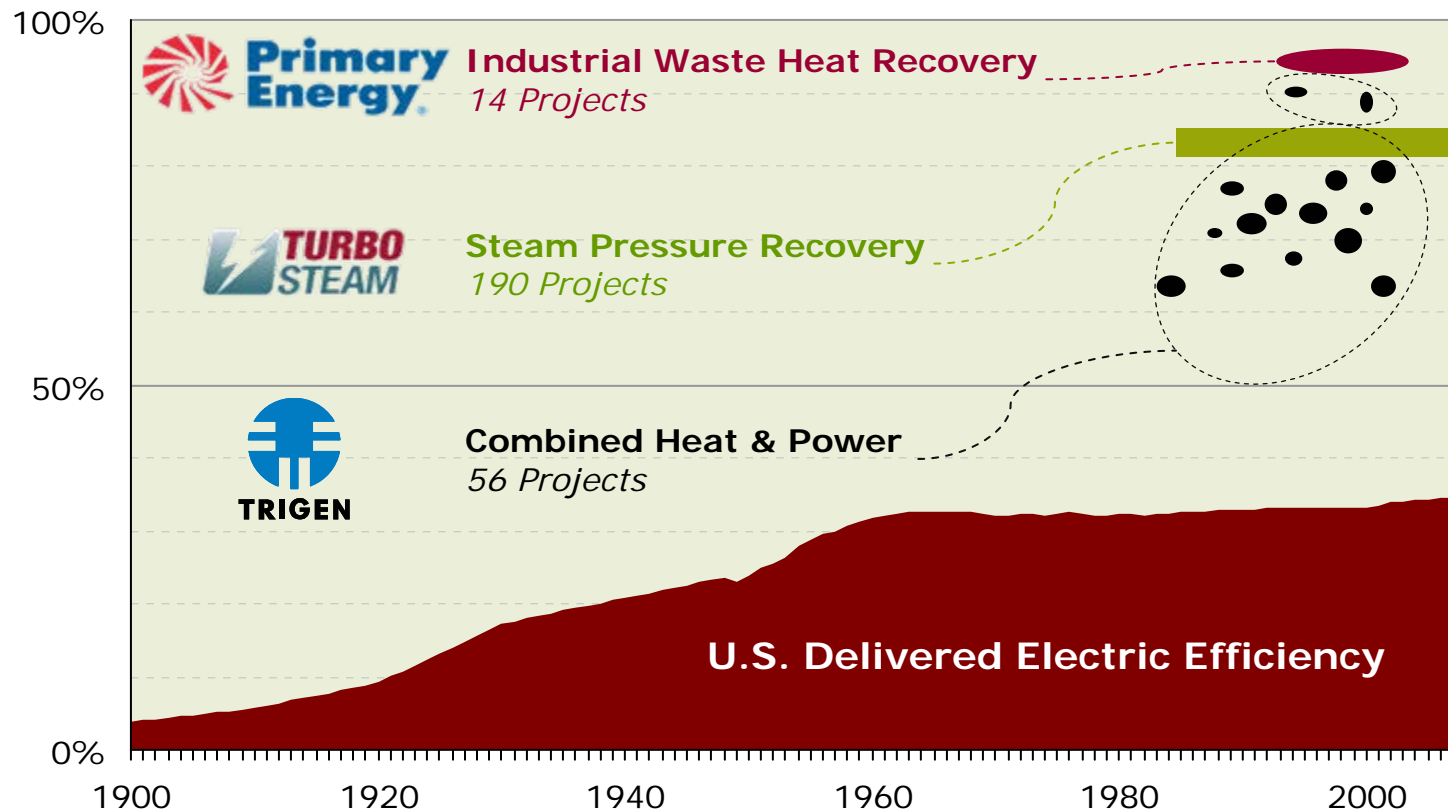




The potential to use energy twice

- EPA study identifies 64,000 MW potential to recycle waste energy in 16 industries
- DOE study identifies 135,000 MW potential for fueled CHP that replaces thermal generation with waste heat from new electricity generation
- World Alliance for Decentralized Energy (WADE) study found potential to reduce U.S. CO₂ by 20% and save \$80 to \$100 billion per year

We have proven this thesis with 200 projects (\$2.0 billion) with double conventional efficiency



Policy observations

- *All currently profitable low-carbon options involve recycling waste energy to increase efficiency*
- But; the CAA treats investments in generation efficiency as a 'Major Modification' and allows EPA to void the operating permit.
 - Most existing electrical and thermal generation plants cannot economically meet current BACT
 - Capital punishment may or may not deter crime, but it certainly deters investments in generation efficiency.
- Penalizing all carbon emissions (Waxman Markey) will further slow construction of new more efficient generation
 - Old inefficient plants with free allowances are cheaper to operate than new efficient plants that must buy allowances

The Energy/Carbon Story

The Generation Story

Recommendations



Recommendation #1

- EPA treat efficiency improvements as 'pollution control devices' ending threat of capital punishment
 - Use authority to regulate CO₂, treat any 5% or greater reduction of carbon per unit of output as a pollution control device.
 - This can be done administratively, without new legislation
 - Will stimulate deployment of efficiency technology, including using presently wasted energy
 - Will also reduce criteria pollutants
 - Changes will lower cost of manufacturing, preserving and increasing jobs while lowering pollution



Recommendation #2

- Move to output based standards, rewarding clean generation, penalizing dirty generation
 - Calculate average pollutant per unit of output for entire country; for example pounds of NOx per MWh of electricity and per MMBtu of thermal energy from all generation
 - Give each heat and/or power generation plant an allowance equal to the U.S. average of each pollutant, per unit of output
 - Lower the allowances per schedule, and further lower to reflect all growth in total production of heat and power
 - Require each generator to produce allowances equal to their annual pollutant output
 - Dirty plants purchase allowances from clean plants
 - **This approach will make 'efficiency the fuel of the future'**

Recommendation #3

- Replace most of Waxman Markey with a CO₂ output standard, as in prior recommendation for criteria pollutants
 - Give all heat and power generators an allowance of the 2008 average CO₂ per unit of output.
 - Lower the allowances every year to achieve same 17% reduction or more by 2020, and correct for any increase of heat and power output
 - Eliminate all other awarding of allowances
 - No immediate rise in average cost. Each allowance purchase by high-carbon plant is a sale by a low-carbon plant.
 - Utilities will sell permits from their nuclear and other low carbon plants to their coal plants, minimizing impact per utility
 - Market forces will be unleashed to deploy every conceivable method of lowering CO₂ per unit of output

Conclusions

- Using energy twice could cut CO2 by 20% while saving \$80 to \$100 billion per year, but:
 - Current environmental regulation ignores efficiency
- Changes to existing thermal or electric generating plant are a capital offense, potentially costing the operator the right to operate
- Modify regulations to reward efficiency and penalize inefficiency, to make **'efficiency the fuel of the future'**.
- Willie Sutton robbed banks because that was where the money was. **To profitably lower CO2 emissions, we must change the way the world generates electric and thermal energy.**



Thank you