

## Summary: Renewables v. Fossil Fuels



## Current Paradigm

- Before Fossil Fuels and the Grid
  - energy production was colocated with energy use
  - renewables were used wherever possible and practical
  - industry was centralized where power was available
  - efficiency was very important (but the machines were typically very low efficiency compared to today's)
- Conservation/efficiency is and always will be cheaper than producing new energy, but there is no free lunch
- Fossil Fuels and the Grid have led to
  - a distributed population and industry
  - high capital cost, large-scale, fairly efficient power plants
  - energy production is out of sight and out of mind

## Paradigm Shift

- Renewables are not very good at meeting the “base load”
  - intermittent, variable, linked to natural cycles, not societal demand for electricity
  - resources are vast and widespread, but exploitable resources are limited
  - no single source can completely replace fossil fuels
- Renewables + Efficiency cannot replace our current electrical power (or transportation fuel) infrastructure
- But they can meet growth and gradually diminish our need for fossil fuels
- To reduce enviro. impact, we must reduce fossil fuel use

- A robust grid enables renewables, but realities of the grid also limit renewables
- Long-term contracts limit restructuring
- Renewables can be further enabled with improvements in energy storage technology and with “total energy” applications that can use power whenever it is available in any amount (e.g. production of H<sub>2</sub>; water pumps)
- Energetically, it is always favorable to use energy near the point of production
- So we must undergo another paradigm transition
  - energy production co-located with energy use
  - energy production centralized; electric and fuel grids
  - mixed; co-locate when possible + efficient grid

## How Can You Help?

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