

NSE

Nuclear Science and Engineering

science : systems : society

RENEWABLE AND NUCLEAR ENERGY-BASED MITIGATION OF CLIMATE CHANGE: SUBSTITUTION FOR FOSSIL FUEL USAGE

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POTENTIAL DOE NUCLEAR – RENEWABLE HYBRID MISSIONS

- Near-term mission (1): Integration of renewables and baseload generation into decreasing-carbon energy economy, the main emphasis of the current workshop, and a major US electricity priority
- Ultimate long-term mission (2): use of renewables and nuclear generation in replacement of global fossil fuel consumption, the dominant US and global energy priority needing a long-term development strategy

FOR MISSION 2 DOE LEADERSHIP IS NEEDED, FOR THE US AND GLOBALLY

- A New, Vital Mission – Climate Change Mitigation
 - Abundant, cheap fossil fuels will continue to drive climate change unless restrained and replaced in a practical fashion
 - Market intervention (e.g., carbon tax) and new, large-scale climate change-focused technologies are needed
 - The market is unlikely to provide them when needed, this is a governmental mission
 - Renewable and nuclear technologies can be primary response portfolio elements
 - Time is wasting

STRATEGIES FOR GLOBAL SCALE FOSSIL FUEL REPLACEMENT

- Needed Future Context for New Energy Economy:
 - Social consensus demanding replacement of fossil fuels
 - Imposition of heavy carbon tax or equivalent
 - Serious effort to promote maximal use of portfolio of non-emitting technologies, both in US and globally*
 - ◆ Renewables
 - ◆ Hydro
 - ◆ Geothermal
 - ◆ Nuclear
 - ◆ Synfuels production
 - Constrained competition among non-emitting technologies in a global marketplace

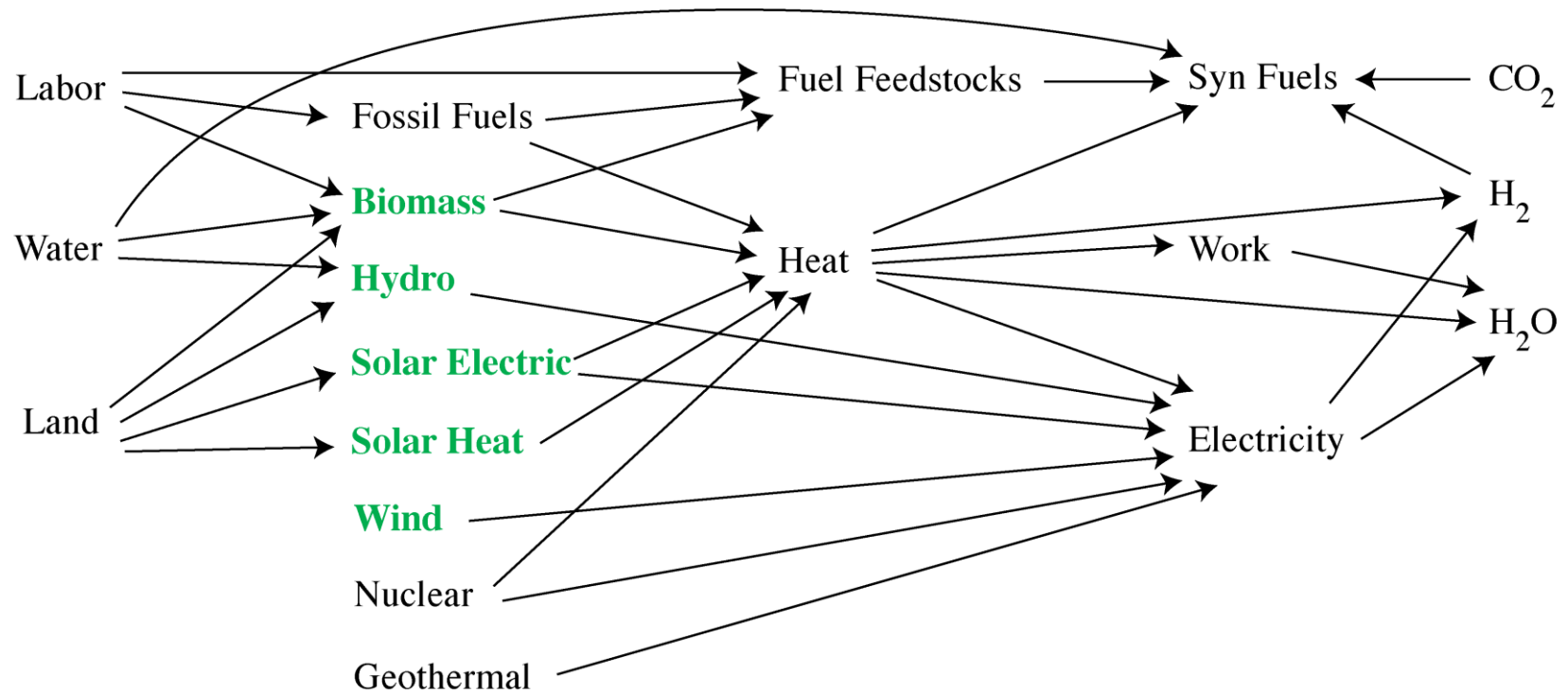
*Efficiency improvements and electrical grid renewal are also essential.



STRUCTURES FOR GLOBAL SCALE RENEWABLE AND NUCLEAR ENERGY-BASED FOSSIL FUEL DISPLACEMENT

- Required Scale? 5,000-10,000 GW
- Required Products? Electricity and Fossil Fuel Substitutes (Hydrogen-based)
- Required Deployments?
 - Renewables, globally
 - Nuclear
 - ◆ To industrialized world with fossil fuel replacements going to the rest of the world?
 - ◆ Or, Worldwide, with strict controls upon operations?

RENEWABLE AND NUCLEAR-BASED ENERGY ECONOMY STRUCTURE



Important implications of mission 2 versus mission 1

- Design of social and market incentives trump technological innovations – but all are important
- Very large scale energy technologies are needed for:
 - Renewables (ie, high temperature, dispatch-ability, biomass efficiency)
 - Nuclear, (i.e., high temperature and fuel efficiency, proliferation resistance)
 - Carbon capture and and recycle, and synfuels production (energy storage becomes less important)
- Integrated global nuclear fuel cycle control becomes essential (for control of all fissile material, nuclear fuel efficiency and waste disposal)

STRUCTURES FOR GLOBAL SCALE RENEWABLE AND NUCLEAR ENERGY-BASED FOSSIL FUEL DISPLACEMENT

- Seek Answers in Designing Mitigation Strategy*:
 - Focus upon identifying long lead-time development tasks and important uncertainties to guide use of resources (avoid near-term demonstration programs)
 - Identify global performance priorities
 - Identify attractive technological options and plan development strategies
 - Avoid premature technological down-selections, technology lock-in

* Seeking good engineering answers, before ideology, politics and self-interest affect the results.

