Beyond Nuclear Fact Sheet

Renewable Energy and Energy Efficiency: The Solutions to Climate Change

INTRODUCTION

To curb the threat of climate change, humanity must change the way it produces and uses energy. Renewable energies including wind, solar, geothermal and certain forms of biomass can completely replace both fossil fuel and nuclear power. According to a 2007 study, "a reliable U.S. electricity sector with zero-CO2 emissions can be achieved without the use of nuclear power or fossil fuels."[1] Not only would this reduce or eliminate net production of certain greenhouse gases like carbon dioxide[2], it would ensure energy independence at the individual, national, international and corporate level by bringing more options to consumers and introducing a level of democracy into the energy industry not possible with the use of fossil and nuclear fuels and the energy structures these technologies require.

1. Wind power is inexhaustible, widely distributed, and the fuel is free. Generation from wind power does not release greenhouse gases. [3]

- As of September 2008, the United States has nearly 21,000 megawatts (MW) installed wind power capacity providing electricity to the equivalent of 5.3 million homes.[4]
- Worldwide, on- and offshore wind generates enough electric power to satisfy the residential needs of over 150 million people with an installed capacity of over 100,000 MW.[5]
- Prospects for continued expansion are good[6] with a projected total of 600 gigawatts (GW) global installed wind base by 2020.[7] By 2050, wind power could provide thirty percent of the world's energy needs.[8]
- Land-based wind energy could supply almost 30% of electricity in the United States –on par with the European Union's predictions for Europe--by 2030.[9]
- Onshore wind power costs are about 7 cents per kilowatt hour (kWh) currently making it competitive with conventional power sources like natural gas which still receive federal subsidies.[10]
- Offshore wind turbines have several appealing qualities including steadier and faster wind for fuel, closer proximity to heavier cost populations and a greatly lessened concern over "visual pollution".[11]
- The total offshore wind estimated potential capacity off the US coast is 908 GW. As a comparison, total U.S. electrical generation capacity for all fossil, nuclear and renewable generation is 914 GW.[12]
- Currently offshore wind capacity accounts for 1,170 MW worldwide [13] with another 11,455 MW planned by 2010.[14]
- Shallow offshore wind costs range from 8-15 cents per kWh, roughly twice the cost of onshore wind.[15] By 2014 offshore wind could decrease to 5 cents per kWh.[16]

2. Solar panels constructed on current rooftops *and* parking lots could provide most of the US electricity supply.[17]

- Grid connected solar photovoltaic (PV) has been one of the world's fastest growing technology since the early 2000s.[18]
- Worldwide, grid connected solar PV capacity was 5000 MW at the start of 2007.[19]

- By the end of 2007 some estimates say solar PV installed capacity reached 12,400 MW worldwide[20] with the greatest production in Germany and Japan.[21]
- If proper investment and construction measures are taken, solar technology could meet 86% of total US residential electricity need by 2025.[22]
- Currently, the average cost of solar electric is 20 cents per kWh [23]with high-yield areas like Arizona averaging 8-15 cents. [24] With technical improvements, 5-8 cents per kWh is not improbable within the next few years.[25]
- Solar thermal energy uses plates, mirrors or other heat collecting and reflecting surfaces to heat air, water or other liquids, and in some cases, food.[26]
- Installing a solar thermal water heater could reduce a single home's emission of greenhouse gases by one to two tons per year, recoup its cost in 7-10 years and require little maintenance. [27]
- Large-scale solar thermal costs between 15-17 cents per kWh for electricity generation,[28] and with further technical development electricity generation costs could be as low as 6 cents per kWh by 2020[29].
- In developing nations, using solar to cook, pasteurize and dry foods saves costs and health risks of other types of fuels such as fuel wood or coal. Disinfection and solar still desalination reduces health risks of water-borne illnesses and makes these technologies readily available at lower cost to the areas that need them.[30]

3. Non-food biofuels can create a carbon neutral or carbon negative system and can be used for vehicle fuel and electricity[31] without competing for plant food sources needed for a hungry world.

- Grasses may be one of the best biofuel sources, often yielding carbon negative energy. Experts estimate grasses could produce 19% of global energy needs while not adding greenhouse gases.[32]
- Based on small-scale algae production, algae-derived oil could replace all existing vehicle gasoline usage. [33] This could be accomplished in an algae-growing area about the size of Maryland and Delaware.[34]
- In addition to replacing auto fuel, algae can be harvested and burned in the same manner as other biofuel crops to produce heat and electricity.[35]
- Right now algae production is high-yield and high cost—making commercial production less attractive, but research could bring the cost down to commercial viability in just a few years.[36]
- Water hyacinth is another abundant biofuel source which is also considered an invasive pest in many countries causing severe environmental and socioeconomic destabilization. [37,38]
- Water hyacinth can be used to produce biogas production and is a viable energy source for tropical nations that produce sugar cane because acetic acid, which is a leftover from refining sugar cane facilitates this biogas production.[39]

4. Total hot dry rock geothermal (HDR/EGS) resources are 140,000 times the US annual primary energy use and the extractable energy is sufficient to provide all of the world's current energy needs for several millennia.[40]

- Hot dry rock/enhanced geothermal produces base load (steady and constant) power[41], making it specially suited to pairing with other renewable energy sources which can have intermittency issues. [42]
- Additionally, current HDR/EGS technology is able to be built to scale and modular, unlike former geothermal technology[43], making it a great candidate for a distributed grid.

- Commercial projects are in various phases in Japan, Europe,[44]Australia, Germany and the United States.
- HDR/EGS has markedly lower negative environmental impacts compared to fossil fuels or nuclear power.[45]
- As of August 2008, the on-line capacity of geothermal power in the United States was almost 3000 MW and new geothermal activity could result in installed capacity of nearly 4000 MW in the next few years.[46]
- With an investment of one billion dollars total over 15 years, (a fraction of the cost of one 1000 MW nuclear reactor) 100 GW (that equals 100,000 MW) of electricity or more could be installed by 2050 for as low as 3.9 cents per kWh depending on resource temperature and system efficiency.[47]

5. It is possible to cut climate emissions and reduce energy use in general in the United States by half almost immediately using existing technology while enabling a cost-effective switch to massive amounts of solar, wind and other renewables. [48]

- Simple energy saving steps, such as weatherizing, unplugging electronic devices, setting computers to "sleep" when not in use, using compact fluorescent bulbs, etc. can save the average home owner 30% on their electric bill. [49]
- Bigger efficiency steps like solar hot water heaters, and the savings reach 75%-all using techniques that cost less than production of the electricity.[50]
- More sophisticated technologies are on the horizon that would allow electronics and appliances which sense and adjust to grid conditions and commercial climate control systems that allow remote diagnosis and control.[51]
- According to the International Energy Agency, "one dollar spent on efficiency improvements avoids two dollars of investment in electricity supply." However, market incentives currently reward utilities for selling energy NOT saving it. This incentive structure has to change.[52]
- A model which accounts for energy saving, not just selling (a concept Amory Lovins calls Negawatts) advantages transition to renewable energy and a distributed grid and provides a model to the rest of the world for wise energy use.[53]

Endnotes

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