

APPENDIX C

Recommended Steps toward a Renewable Future

Research Areas

1. Large- and small-scale energy storage research
2. Studies on optimizing overall wind harvesting over areas more than 100 square kilometers, including effects on weather
3. High-temperature superconductivity
4. Solar PV cell efficiency
5. Better biomass yields
6. Better systems of converting biomass to usable biofuels
7. Studies of whether combinations of geographically distributed renewable energy sources could meet actual rather than average U.S. energy needs without improved storage

Technological and/or Social Changes Not Requiring New Science

1. Convert to electrical cars, preferably powered by renewable energy.
Consequences: Lower energy use for any electricity source. Emissions depend on electricity source, where renewables are best and coal-burning plants are worst.
2. Use hybrid cars in urban situations where braking and idling are frequent.
Consequences: Lower energy use and emissions by recycling energy and avoiding use of the internal combustion energy in regimes far from peak efficiency.

3. Exploit computing power to reduce energy use that does not benefit consumers, including training consumers (e.g., driving around looking for parking spaces, sitting still in traffic jams, heating and lighting empty rooms).

Consequences: Lower energy consumption overall, reducing all negative energy use consequences and making an all-renewable energy economy more feasible.

4. Use computing power to even out electric power consumption, so that producing plants operate continuously near maximum efficiency, including smart meters that allow consumers to reduce their use during periods of peak demand.

Consequences: Lower energy consumption and reduce cost by allowing plants to operate near peak efficiency.

5. Put solar panels on as many roofs as possible and create PV solar farms in deserts.

Consequences: Lower commercial electricity generation by around 30 percent, which would reduce emissions. Lower peak commercial demand on hot sunny days.

6. Install large rotor wind turbines on high towers in windy places.

Consequences: Provides the most cost-effective wind power.

7. Develop long-distance transmission networks to deliver renewable energy from favorable sites and reduce fluctuations by pooling both supply and demand.

Consequences: If the network is spread wide enough, the network always includes places where the wind is blowing and/or the sun is shining, allowing continuous renewable energy delivery without storage.