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Renewable power sources could meet all global energy needs by 2050

There are no technical or economic barriers to providing all of the world's energy from renewable sources, according to a recent study. With a concerted effort, including reduced demand and international cooperation, the researchers suggest that the world could be entirely reliant on renewable energy for electric power, transportation and heating/cooling by 2050.

The study calculates that onshore wind, hydroelectric and geothermal power already typically cost less than fossil fuel and nuclear power (US$0.04-0.07 [€0.03-0.05] per kWh for the renewable technologies, compared with US$0.07kWh for conventional generation), and by 2020, offshore wind, wave, tidal, hydroelectric and concentrated solar sources of renewable energy could cost less than conventional power generation. All renewable technologies would also have a lower social cost (e.g. costs to manage air pollution and remediate climate change damage) than fossil fuel generation.

However, relying solely on renewable energy from wind, water or the sun (WWS) presents a challenge: dealing with the variability of energy generation from some renewable energy sources in order to ensure that energy demand, which always varies throughout the day, can be met reliably.

To counter this, the researchers identify seven technical solutions to ensure that energy demand can be met reliably from renewable energy sources. They include: connecting different, geographically dispersed sources; using an additional predictable power source, such as hydroelectricity to meet demand; "smart" demand-response management systems; storing power at the site of generation; over-sizing peak generation capacity and producing hydrogen with the excess; storing power in electric vehicles; and improving weather forecasting to better predict renewable energy supply.

Three of these, better weather forecasting, demand management and back-up hydroelectricity, would be inexpensive to implement. Incorporating long-distance transmission and using electric vehicles to store power when supply exceeds demand would increase the cost of electricity from renewable sources by US$0.02/kWh (€0.01), but such a system should reliably supply electricity to meet demand.

The study also considered whether WWS could be used to power vehicles. While several previous studies have predicted that by 2030 electric cars will have a lower lifecycle cost than petrol-driven vehicles, fewer have looked at battery or fuel-cell powered trucks, buses, ships or trains.. The analysis suggests that hydrogen-powered buses are likely to have a similar or lower lifecycle cost than diesel-powered buses by 2020. Similarly, hydrogen locomotives will have a lower lifetime cost once diesel fuel costs around US$2 (€1.4) per gallon (3.785 litres) and, for ships, a photovoltaic-powered hydrogen system would pay for itself in 10-20 years if the price of fuel oil rose by 15 per cent.

Finally, the researchers suggest that feed-in tariffs for renewable energy are the most suitable way to encourage renewable energy generation, as long as tariffs are gradually reduced over time to encourage innovation and lower renewable energy costs. Other policies, such as taxing fossil fuel use or eliminating subsidies for fossil fuels in recognition of the environmental damage they cause, are most effective if higher current estimates of the cost of climate change are assumed.

The key conclusions of this analysis are that the cost of energy in a 100 per cent WWS scenario are similar to the cost today, and barriers to a 100 per cent conversion to WWS power worldwide are primarily social and political, and not technological or even economic.

Source: Delucchi, M. A., & Jacobson, M. Z. (2011) Providing all global energy with wind, water and solar power, Part II: Reliability, system and transmission costs, and policies. *Energy Policy*. Doi:10.1016/j.enpol.2010.11.045.

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