CLEAN ENERGY SOLUTIONS FOR AUSTRALIA

Anti-nuclear & Clean Energy (ACE) Campaign
Friends of the Earth, Australia
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Australia has one of the world's highest per capita levels of greenhouse gas emissions, in part because of our heavy reliance on coal for electricity generation. A strong body of evidence demonstrates that clean energy solutions will enable Australia to sharply reduce greenhouse emissions in the electricity sector without the need for nuclear power.

Energy efficiency – doing more with less

Energy efficiency and conservation offer many options to reduce greenhouse emissions that are low cost or even produce a financial gain. For consumers the economic savings from energy efficiency and conservation can pay for a major part of the additional costs of renewable energy. Numerous studies envisage energy efficiency and conservation doing much of the 'heavy lifting' to reduce greenhouse emissions. For example a 2007 Australian Bureau of Agricultural and Resource Economics study envisages that energy efficiency will account for 55% of Australia's emissions reductions, and 58% of global emissions reductions, by 2050.

Renewable energy technologies

- **Solar photovoltaics** (PV) convert solar radiation directly into electricity using semiconductors.
- **Solar thermal** with storage uses mirrors to focus the sun's rays onto a focal point, generating heat to produce steam which powers a turbine to generate electricity. At night, or if the sun is blocked by clouds, the prior storage of heat (e.g. in molten salts) allows the power plant to keep operating.
- **Wind power** uses the wind's kinetic energy to drive a turbine.
- **Geothermal energy** uses underground heat to make high-temperature steam which drives a turbine.
- **Bioenergy** comes from organic matter (derived from plants and animals). Bioenergy fuels include dedicated energy crops and many different types of waste, for example, sewage, food wastes and crop wastes.
- **Hydroelectricity** uses the kinetic energy of moving water to drive a turbine.
- **Ocean power** uses the movement of the ocean's tides, currents or waves to produce electricity.

Clean energy plans for Australia

Numerous studies have considered the mix of electricity sources that could be used to power Australia while sharply reducing reliance on coal. One of the most practical Australian studies was produced by a group of scientists for the Clean Energy Future Group (CEFG). It is practical in that it makes virtually no allowance for technical innovation, restricting itself to existing commercial technologies. The study is conservative in that it factors in official projections of economic growth and population growth.

The CEFG proposes an electricity supply plan that would reduce greenhouse emissions from the electricity sector by 78% by 2040 compared to 2001 levels. The clean energy plan comprises energy efficiency and conservation measures and electricity supply based on solar 5%; hydro 7%; coal and petroleum 10%; wind 20%; bioenergy 28% (largely from crop wastes so it is not competing with other land uses); and gas 30%

The CEFG study can be thought of as a baseline or a 'worst case' study, because it makes no allowance for developments in important areas like solar-with-storage or geothermal power. University of NSW academic Mark Diesendorf, who contributed to the CEFG study, has proposed a more ambitious scenario that replaces all coal and gas with renewables. Dr Diesendorf states: "By 2030 it will be technically possible to replace all conventional coal

power with the following mixes: wind, bioelectricity and solar thermal each 20 to 30%; solar photovoltaic 10-20%; geothermal 10-20%; and marine (wave, ocean current) 10% … There is an embarrassment of riches in the non-nuclear alternatives to coal."

CSIRO scientist Dr John Wright has proposed a scenario in which renewables generate over three-quarters of Australia's electricity by 2050: wind provides 19.4%; geothermal 19.0%; solar thermal 18.3%; solar PV 12.8%; bioenergy 5.1%; and ocean energy 0.7%. Dr Wright states: "Overall, increasing renewable energy technology will take out in the order of 200 million tons of CO2 by 2050 under this scenario. That is equal to about all of our major stationary energy CO2 emissions now. This is a major, major change."

Siemens Ltd., a company with extensive involvement in the energy sector, has mapped out an energy plan for Australia in which the contribution of fossil fuels to electricty generation falls from 93% to around 10%, with the remainder generated by a mix of renewable technologies consisting mainly of solar (35%), wind (18%), and geothermal (17%). Large-scale energy storage is provided by a mix of solar thermal and hydrogen. In the Siemens plan, most large-scale transmission interconnectors are High Voltage Direct Current (HVDC), providing significant reduction in losses and thus allowing for efficient, long-distance transmission of renewable energy-generated electricity around the country. Siemens also proposes the development of HVDC links to South East Asia to export renewable electricity.

Electricity supply reliability

How can the intermittency of some renewable energy sources (wind, solar) be reconciled with the need for reliable electricity supply? Options include limiting the contribution of intermittent energy sources to ensure overall reliability, and the use of energy storage systems. Some renewable energy sources − such as geothermal and bioenergy − are well suited to replace coal because they can provide reliable baseload power. In other cases, renewables with back-up (e.g. wind with gas or bioenergy back-up) or renewables with storage (e.g. solar thermal power with molten salt storage) can replace coal. (More information: Mark Diesendorf, 2010, 'The Base Load Fallacy', energyscience.org.au/factsheets.html)

More information:

- Australian Academy of Science - 2009 renewable energy lecture series: http://www.science.org.au/events/publiclectures/re/index.html
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- Clean Energy Council (Australia) http://www.cleanenergycouncil.org.au
- Beyond Zero Emissions www.beyondzeroemissions.org
- Yes2Renewables campaign: http://yes2renewables.org/
- ACF Clean Energy Solutions, acfonline.org.au/be-informed/climate-change/clean-energy-solutions
- WWF Clean and renewable energy, wwf.org.au/our_work/people_and_the_environment/global_warming_and_climate_change/solutions/clean_and_renewable_energy/