

N-power without emissions a tall tale – Benjamin Sovacool

Indonesian policymakers should beware that nuclear power is not as clean as industry claims. These days, advocates of nuclear power frequently portray it as an important part of any solution aimed at fighting climate change and reducing greenhouse gas emissions. The Nuclear Energy Institute reports that nuclear power is a “Carbon-free electricity source”. The World Nuclear Association says “nuclear energy today represents nothing less than an indispensable asset” if our world is to fight climate change. Even Mr. Patrick Moore, co-founder of Greenpeace, has said that nuclear energy is the only non-greenhouse gas emitting energy source that can effectively replace fossil fuels and satisfy global demand”.

Opponents of nuclear power have responded in kind in their calculation. Australian researchers have estimated that wind turbines have one-third the carbon-equivalent emissions of nuclear power over their lifecycle and hydro-electric a fourth. The Oxford Research Group says if the percentage of world nuclear capacity remains what it is today, by 2050 nuclear power will generate as much carbon dioxide per kilo-watts-hour (kWh) as comparable gas-fired power stations. Which side is right?

A new study in the August 2008 issue of the peer-reviewed journal Energy Policy attempts to answer this question by screening 103 lifecycle studies of greenhouse gas-equivalent emissions for nuclear power plants. The study attempts to identify a subset of the most current, original, and methodologically rigorous studies. Researchers calculated that while the range of emissions for nuclear energy over a plant's lifetime reported from qualified studies examined is significant, the mean value is about 66 g of CO₂ equivalent per kWh (gCO₂/kWh).

The front-end component of the nuclear fuel cycle (uranium mining, milling, and enrichment) is responsible for 38 per cent of equivalent emissions. Decommissioning and plant operation, including the use of fossil-fuelled generators to backup nuclear plants when they offline for servicing, account for 35 per cent. The back-end of the fuel cycle, which includes storing spent fuel and fuel conditioning, account for 15 percent, and plant construction is responsible for 12 percent.

This average of 66 g of CO₂ for every KWh is staggeringly high compared to what the nuclear industry has reported. It also shows, conclusively, that nuclear energy is in no way “carbon-free” for “emissions free”, and that nuclear power is worse than the equivalent carbon emissions over the lifecycle of renewable and small-scale distributed generators.

To provide just a rough estimate of how much equivalent CO₂ nuclear plants emit over the course of their lifecycle, a 1,000 MW reactor operating at a 90 percent capacity factor will emit the equivalent of 1,427 tonnes of CO₂ a day, or 522,323 metric tones of CO₂ every year.

Nuclear facilities were responsible for emitting the equivalent of some 183 million metric tones of CO₂ in 2005. Assuming a carbon tax of \$24 per tonne – not too extreme when existing carbon taxes in the UK and Denmark are between \$16 and \$31 per tonne – a 1,000 MW nuclear plant would have to pay almost \$12.6 million per year for its carbon-equivalent emissions. For the global nuclear power industry, this equates to approximately \$4.4 billion in carbon taxes per year.

Additionally, researchers in the UK conducted lifecycle analyses for 15 separate distributed generation and renewable energy technologies found that all but one, solar photovoltaic (PV), emitted much less gCO₂kWh than the mean reported for nuclear plants. In an analysis using updated data on solar PV, researchers in the

US found that current estimates on the greenhouse gas emissions for typical solar PV systems range from 29 to 35 gCO₂/kWh.

This has two very important insights for the current debate about nuclear power and its impact on climate change in Indonesia.

First, due to the greenhouse-gas intensity of its lifecycle, nuclear power plants will not benefit directly from a global carbon tax or a carbon cap-and-trade system. While the nuclear industry would certainly be penalized less than fossil-fuelled generators, the carbon equivalent emissions from uranium, mining operations, enrichment facilities, plant construction, decommissioning, and spent fuel storage are significant. Any type of cost for carbon emissions would absolutely increase the price of these elements of the nuclear fuel cycle, and would thus make nuclear power more expensive.

Second, while it may be unfair to compare base load sources such as nuclear to intermittent or non-dispatchable sources such as wind and solar PV, if these numbers are correct, then offshore wind power has less than one-seventh the carbon equivalent emissions of nuclear plants; large-scale hydropower, offshore wind, and biogas, about one-sixth the emissions; small-scale hydro and solar internal one-fifth. This makes these renewable energy technologies seven, six, and five times more effective on a per kWh basis at fighting climate change.

Put simply, nuclear power is much worse at emitting greenhouse gases than pursuing wind, solar, and other small-scale power generators.

(The Writer is a Research Fellow at the Energy Governance Programme at the National University of Singapore)

The Jakarta Post/ANN