

Debate on the lessons of Fukushima and the costs of nuclear power

Wednesday 30 March 2011, by [BENNET Craig](#), [GREEN Jim](#), [MONBIOT George](#) (Date first published: 27 March 2011).

See also: Jeremy Legget, [Nuclear power is not the way to fight climate change](#) and Justin Podur [Fukushima and low-probability events](#)

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George Monbiot's nuclear mistakes

March 27, 2011 — *Green Left Weekly* — Prominent British columnist George Monbiot announced in the British *Guardian* on March 21, 2011, that he now supports nuclear power [see below]. That isn't a huge surprise — having previously opposed nuclear power, he announced himself “nuclear-neutral” in 2009. As recently as March 16, Monbiot declared himself neutral while saying that he would not oppose nuclear power if four conditions were met:

1. *Its total emissions — from mine to dump — are taken into account, and demonstrate that it is a genuinely low-carbon option.*
2. We know exactly how and where the waste is to be buried.
3. We know how much this will cost and who will pay.
4. There is a legal guarantee that no civil nuclear materials will be diverted for military purposes.

Along with renewables, nuclear meets the first condition — it is a low-carbon energy source. The other three conditions have not been met. No country has established a burial site for high-level nuclear waste and it is not clear how much waste disposal programs will cost nor who will pay.

And there is no meaningful legal guarantee against diversion of materials from peaceful nuclear programs to weapons programs.

So Monbiot's position hasn't changed as a result of his four conditions being met. Indeed there is no mention of them in his March 21 column. Instead, Monbiot has become a nuclear supporter as a

result of the Fukushima nuclear accidents.

He said on March 21:

"A crappy old plant with inadequate safety features was hit by a monster earthquake and a vast tsunami. The electricity supply failed, knocking out the cooling system. The reactors began to explode and melt down."

The disaster exposed a familiar legacy of poor design and corner-cutting. Yet, as far as we know, no one has yet received a lethal dose of radiation... Atomic energy has just been subjected to one of the harshest of possible tests, and the impact on people and the planet has been small."

The crisis at Fukushima has converted me to the cause of nuclear power.

Monbiot is understating the radiological impacts of Fukushima and ignoring the other impacts. So far, no one has received a radiation dose sufficient to cause the symptoms of acute radiation poisoning. But workers have received high doses and it's anyone's guess how many thousands (or millions) of people have received very small doses.

Monbiot seems not to understand that the weight of scientific opinion holds that there is no safe dose of radiation. For a tiny, unlucky percentage of the many people who have received small radiation doses as a result of Fukushima, that radiation exposure will prove to be fatal. Thus Monbiot's claim that "no one has yet received a lethal dose of radiation" does not stand up to scrutiny.

To estimate the death toll from Fukushima, it will be necessary to estimate the total human radiation exposure as a result of the accidents. We can be confident that the death toll from Fukushima will be far smaller than Chernobyl. Beyond that generalisation, it's best not to speculate until there is a credible estimate of total human exposure.

Monbiot ignores the impacts of Fukushima other than direct radiation exposure. These include restrictions on the consumption of food, water and milk; the expense and trauma of relocating 200,000 people; the very serious impacts of the nuclear crisis on the emergency response to the earthquake and tsunami; and big hits to the tourism industry and to agricultural industries.

He also trivialises the impacts of nuclear power more generally. In terms of radiation releases and exposures, long-term exposure from uranium tailings dumps is estimated to be a much more significant source of exposure than routine reactor operations or reactor accidents.

Nuclear fuel reprocessing plants have been another big source of radioactive pollution.

It's no small irony that nuclear power's worldwide reputation has taken a huge battering from one accident, while the vastly greater radiological impacts from routine operations receive virtually no public attention.

Monbiot notes that routine discharges of ionising radiation from coal-fired power plants are higher than those from nuclear reactors. But emissions of ionising radiation across the nuclear fuel cycle are — not surprisingly — greater than those from fossil fuels.

Monbiot takes offence at ill-informed, moralistic objections to nuclear power. Fair enough. Yet two of the greatest objections to nuclear power both have a moral dimension — one because of its particularity, the other because of its generality.

The particular moral problem concerns the disproportionate impacts the nuclear industry has on

Indigenous peoples. The industry's racism is grotesque.

In Australia, we can point to examples such as the (defeated) attempt to mine the Jabiluka uranium deposit in the Northern Territory, despite the unanimous opposition of traditional owners. Another example is the current push to establish a national nuclear waste dump at Muckaty in the Northern Territory.

Regardless of all the other debates about energy options, it's difficult to see how the industry's pervasive racism can be reduced to being just another input into a complex equation, and tolerated as a price that must be paid to keep the lights on.

The other big moral (and practical) concern with nuclear power is its connection to the proliferation of nuclear weapons.

There is a long history of peaceful nuclear programs providing political cover and technical support for nuclear weapons programs. Recent examples include North Korea's use of an "experimental power reactor" to produce plutonium for bombs, and the ongoing controversy over Iran's nuclear program.

The nuclear industry exacerbates the proliferation problem. Japan's plutonium program illustrates the point.

A 1993 US diplomatic cable posed these questions: "Can Japan expect that if it embarks on a massive plutonium recycling program that Korea and other nations would not press ahead with reprocessing programs? Would not the perception of Japan's being awash in plutonium and possessing leading edge rocket technology create anxiety in the region?"

Since 1993, Japan's plutonium stockpile has grown enormously and regional tensions are sharper than ever.

Yet Japan is still pushing ahead with the huge reprocessing plant at Rokkasho that will result in a rapid expansion of Japan's already obscenely large stockpile of separated, weapons-useable plutonium.

Another recent example of a grossly irresponsible policy fanning proliferation risks is the decision of a number of national governments, led by the US, to abandon the principle that civil nuclear trade should not be permitted with countries that refuse to sign the Nuclear Non-Proliferation Treaty. That is a recipe for weapons proliferation.

The nuclear industry is its own worst enemy. We can't reasonably be expected to support an industry that behaves so irresponsibly.

Nuclear weapons are the most destructive, indiscriminate and immoral of all weapons. They pose a real threat to humanity, all the more so because nuclear warfare has the capacity to directly cause catastrophic climate change.

Academics Alan Robock and Brian Toon summarise recent research on the climatic impacts of nuclear warfare:

"A nuclear war between any two countries, each using 50 Hiroshima-sized atom bombs, such as India and Pakistan, could produce climate change unprecedented in recorded human history. This is less than 0.05% of the explosive power of the current global arsenal."

Much of Monbiot's argument discussed the limitations of renewable energy. But instead of

addressing serious clean energy proposals, Monbiot simply demolishes one particular argument — that current electricity supply systems can be replaced with off-grid, small-scale distributed energy.

There is certainly a role for local energy production. But no serious analyst would argue that it can completely displace centralised production. Monbiot is demolishing a straw person argument.

In Australia, a growing body of literature shows how the systematic deployment of renewable energy sources and energy efficiency policies and technologies can generate big cuts in greenhouse emissions without recourse to nuclear power.

These include important contributions by the Australia Institute, engineer Peter Seligman, CSIRO scientist John Wright, Siemens Ltd., Greenpeace and Beyond Zero Emissions, among others. (See *Clean and green ... or nuclear?*)

The Fukushima disaster will put a significant dent in nuclear power expansion plans around the world. Fukushima will prove to be an even greater disaster if that energy gap is filled with fossil fuels.

It is more important than ever to fight for the systematic, rapid deployment of existing, affordable clean energy solutions.

It is also vital to insist on major research and development programs to expand the capabilities of renewables and to reduce the costs and to aggressively pursue the energy efficiency and conservation measures that can deliver the largest, cheapest, quickest cuts to greenhouse emissions.

By Jim Green

* From *Green Left Weekly*.

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Why Fukushima made me stop worrying and love nuclear power

Japan's disaster would weigh more heavily if there were less harmful alternatives. Atomic power is part of the mix.

George Monbiot

You will not be surprised to hear that the events in Japan have changed my view of nuclear power. You will be surprised to hear how they have changed it. As a result of the disaster at Fukushima, I am no longer nuclear-neutral. I now support the technology.

A crappy old plant with inadequate safety features was hit by a monster earthquake and a vast tsunami. The electricity supply failed, knocking out the cooling system. The reactors began to explode and melt down. The disaster exposed a familiar legacy of poor design and corner-cutting. Yet, as far as we know, no one has yet received a lethal dose of radiation.

Some greens have wildly exaggerated the dangers of radioactive pollution. For a clearer view, look at the graphic published by xkcd.com. It shows that the average total dose from the Three Mile Island disaster for someone living within 10 miles of the plant was one 625th of the maximum yearly amount permitted for US radiation workers. This, in turn, is half of the lowest one-year dose clearly linked to an increased cancer risk, which, in its turn, is one 80th of an invariably fatal exposure. I'm not proposing complacency here. I am proposing perspective.

If other forms of energy production caused no damage, these impacts would weigh more heavily. But energy is like medicine: if there are no side-effects, the chances are that it doesn't work.

Like most greens, I favour a major expansion of renewables. I can also sympathise with the complaints of their opponents. It's not just the onshore windfarms that bother people, but also the new grid connections (pylons and power lines). As the proportion of renewable electricity on the grid rises, more pumped storage will be needed to keep the lights on. That means reservoirs on mountains: they aren't popular, either.

The impacts and costs of renewables rise with the proportion of power they supply, as the need for storage and redundancy increases. It may well be the case (I have yet to see a comparative study) that up to a certain grid penetration – 50% or 70%, perhaps? – renewables have smaller carbon impacts than nuclear, while beyond that point, nuclear has smaller impacts than renewables.

Like others, I have called for renewable power to be used both to replace the electricity produced by fossil fuel and to expand the total supply, displacing the oil used for transport and the gas used for heating fuel. Are we also to demand that it replaces current nuclear capacity? The more work we expect renewables to do, the greater the impact on the landscape will be, and the tougher the task of public persuasion.

But expanding the grid to connect people and industry to rich, distant sources of ambient energy is also rejected by most of the greens who complained about the blog post I wrote last week in which I argued that nuclear remains safer than coal. What they want, they tell me, is something quite different: we should power down and produce our energy locally. Some have even called for the abandonment of the grid. Their bucolic vision sounds lovely, until you read the small print.

At high latitudes like ours, most small-scale ambient power production is a dead loss. Generating solar power in the UK involves a spectacular waste of scarce resources. It's hopelessly inefficient and poorly matched to the pattern of demand. Wind power in populated areas is largely worthless. This is partly because we have built our settlements in sheltered places; partly because turbulence caused by the buildings interferes with the airflow and chews up the mechanism. Micro-hydropower might work for a farmhouse in Wales, but it's not much use in Birmingham.

And how do we drive our textile mills, brick kilns, blast furnaces and electric railways – not to mention advanced industrial processes? Rooftop solar panels? The moment you consider the demands of the whole economy is the moment at which you fall out of love with local energy production. A national (or, better still, international) grid is the essential prerequisite for a largely renewable energy supply.

Some greens go even further: why waste renewable resources by turning them into electricity? Why not use them to provide energy directly? To answer this question, look at what happened in Britain before the industrial revolution.

The damming and weiring of British rivers for watermills was small-scale, renewable, picturesque and devastating. By blocking the rivers and silting up the spawning beds, they helped bring to an

end the gigantic runs of migratory fish that were once among our great natural spectacles and which fed much of Britain – wiping out sturgeon, lampreys and shad, as well as most sea trout and salmon.

Traction was intimately linked with starvation. The more land that was set aside for feeding draft animals for industry and transport, the less was available for feeding humans. It was the 17th-century equivalent of today's biofuels crisis. The same applied to heating fuel. As EA Wrigley points out in his book *Energy and the English Industrial Revolution*, the 11m tonnes of coal mined in England in 1800 produced as much energy as 11m acres of woodland (one third of the land surface) would have generated.

Before coal became widely available, wood was used not just for heating homes but also for industrial processes: if half the land surface of Britain had been covered with woodland, Wrigley shows, we could have made 1.25m tonnes of bar iron a year (a fraction of current consumption) and nothing else. Even with a much lower population than today's, manufactured goods in the land-based economy were the preserve of the elite. Deep green energy production – decentralised, based on the products of the land – is far more damaging to humanity than nuclear meltdown.

But the energy source to which most economies will revert if they shut down their nuclear plants is not wood, water, wind or sun, but fossil fuel. On every measure (climate change, mining impact, local pollution, industrial injury and death, even radioactive discharges) coal is 100 times worse than nuclear power. Thanks to the expansion of shale gas production, the impacts of natural gas are catching up fast.

Yes, I still loathe the liars who run the nuclear industry. Yes, I would prefer to see the entire sector shut down, if there were harmless alternatives. But there are no ideal solutions. Every energy technology carries a cost; so does the absence of energy technologies. Atomic energy has just been subjected to one of the harshest of possible tests, and the impact on people and the planet has been small. The crisis at Fukushima has converted me to the cause of nuclear power.

* From *The Guardian*, guardian.co.uk, Monday 21 March 2011 19.43 GMT:
<http://www.guardian.co.uk/commentisfree/2011/mar/23/fukushima-nuclear-power-renewable-energy>

Fukushima shows us the real cost of nuclear power

The economics of nuclear power don't add up - which is even more reason to invest in renewable energy.

Craig Bennett

The full fallout of Fukushima is still unknown. There has been a great deal of focus on the potential health dangers – understandable given the fears of local people, but easy to downplay in the wake of a wave that killed more than 10,000 people.

However, the effect on the nuclear industry will go much further than headline-grabbing concerns around the health impacts. Following the incredibly expensive evacuation, there has been a suspension of sales of food from the area, and now even fears about drinking water in Tokyo. These measures will hopefully ensure the health impact remains minimal.

As well as being incredibly distressing for the people living nearby, this is all costing a fortune. Add to it the clean-up costs, more stringent safety regulations and an inevitable increase in insurance arrangements, and the economics of nuclear will be forever changed. And they weren't particularly healthy to start with.

Our energy secretary, Chris Huhne, has said all such costs would be borne by the industry in the event of anything similar happening in the UK. (While we're not at risk of major earthquakes and tsunamis, our nuclear stations are vulnerable to sea surges, rising sea levels and terrorist attacks.) This would make for an eye-watering insurance quote, especially now the industry has lost its no-claims bonus.

No nuclear power station has been built without state cash – as our government recognises. No subsidies means no nuclear. Supporting nuclear means getting behind taxpayer-funded subsidies for, in George Monbiot's words, the "liars" who run the industry.

In contrast to the billions spent on nuclear, there remains real reluctance to invest in renewable energy. Only last week ministers cut support for small-scale renewable power. Their plans for electricity market reform will not support the development of offshore wind and other marine renewables.

For decades governments have fawned over fossil fuels and nuclear power at the expense of renewable power and energy saving. Nuclear has had billions of pounds of taxpayers' money – and still cannot produce electricity at a competitive price. By contrast, after just a few years' support in Germany, solar panels are expected to be producing power without the need for public subsidies.

Energy saving is much the same – our dilapidated buildings leak much of the energy we spend billions producing. A nationwide refit of homes – kickstarted by the government via its current energy bill – would create jobs as well as saving energy, but progress remains slow and halting.

Fears that the public won't accept large-scale renewable power because of the impact on our landscapes are understandable. But there is currently more public support for investment in renewable energy than in nuclear. Friends of the Earth has launched a new petition for those who want an energy future based on saving energy and renewable power.

The tide is turning. It's time to highlight the growing body of evidence showing we can keep the lights on with renewable power if we cut the amount of energy we waste. Experts from the Department of Energy and Climate Change's chief scientific adviser, David MacKay, to the respected European consultancy Ecofys, agree that it is possible to provide the energy we need and reduce carbon emissions without nuclear.

Nuclear power offers no safe solution for waste, economics that don't add up, and dangers of nuclear proliferation. An energy future is possible without these negatives.

* From *The Guardian*, guardian.co.uk, Wednesday 23 March 2011 17.35 GMT:

<http://www.guardian.co.uk/commentisfree/2011/mar/23/fukushima-nuclear-power-renewable-energy>

Clean and green ... or nuclear?

By Jim Green

What's the best mix of electricity supply sources for Australia in the context of growing scientific and public concern about climate change?

Energy efficiency and conservation provide the first part of the answer — they can provide large, quick, cheap greenhouse emissions reductions. Many 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 estimated energy efficiency would account for 55% of Australia's greenhouse emissions cuts, and 58% of global emissions cuts, by 2050.

We can curb the growth in electricity demand through energy efficiency and conservation, but we also need a major restructure of the electricity sector. One relevant study was written by Hugh Saddler, Richard Denniss and Mark Diesendorf in 2004. Their “Clean Energy Future Group” (CEFG) study maps out a restructure of the Australian electricity sector to the year 2040.

It makes virtually no allowance for technical innovation and it makes no allowance for cost reductions for renewable energy sources, either through innovation or mass production. One practical consequence is that the role of solar electricity is limited in the CEFG plan because of its cost.

Even with those constraints, the CEFG maps out a credible plan that would cut greenhouse emissions from the electricity sector by 78% by 2040 compared to 2001. The electricity supply plan comprises solar 5%, hydro 7%, coal and petroleum 10%, wind 20%, bioenergy 28%, and natural gas 30%.

What's not to like about the CEFG plan? The main concerns are bioenergy and gas. In the CEFG plan, a large majority of the bioenergy comes from crop wastes. This addresses one of the major global problems with bioenergy – competition for productive land, and flow-on effects such as increased food prices.

There are other concerns with bioenergy that would need to be carefully considered, not least whether it delivers the claimed reductions in greenhouse emissions.

Gas, a finite resource, could replace coal-fired plants for no more than a period of several decades. Emissions from gas-fired plants are about half those from coal fired plants, but about 10 times greater than emissions from nuclear power and most renewables.

If we were to accept the basic outline of the CEFG plan, we'd need to phase out the use of gas over a period of several decades. The most promising candidates are solar thermal power with storage (e.g. in molten salts) and geothermal “hot rocks”.

Solar with storage is about twice as expensive as other low carbon electricity sources (and four times as expensive as coal). It will certainly become cheaper, but we don't know how much cheaper.

For geothermal hot rocks, a great deal of exploration and development is underway in Australia, but we've yet to see large-scale geothermal electricity generation.

CSIRO scientist Dr John Wright has proposed a plan in which renewables generate over three-

quarters of Australia's electricity by 2050: wind and geothermal both produce 19% of electricity demand, solar thermal 18%, solar photovoltaics 13%, bioenergy 5%, and hydro continues to provide a small percentage.

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 electricity generation falls from 93% to around 10% by mid-century, with the remainder generated by a mix of renewables consisting mainly of solar (35%), wind (18%), and geothermal (17%).

Australian engineer Peter Seligman has proposed an energy supply system for Australia based largely on geothermal, wind and solar power. To ensure reliable electricity supply, Dr Seligman proposes the construction of a large 'pumped hydro' energy storage system. When electricity is in short supply (e.g. calm, cloudy days), water from a very large dam is run downhill through turbines to generate electricity. At other times, water is pumped up hill to replenish the dam.

In a 2010 paper, Diesendorf writes: "Some sustainable energy sources and measures are at least as reliable as coal power. These include demand reduction by means of energy efficiency, energy conservation and solar hot water, and renewable electricity supply by hydro with large dams, bioenergy, solar thermal power with thermal storage and geothermal power.

"They can all be used to reduce the demand for baseload coal without reducing the reliability of the generating system."

Some other clean energy plans for Australia are those by Greenpeace and Beyond Zero Emissions.

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