Does nuclear power effectively reduce carbon emissions?

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If countries want to lower emissions as substantially, rapidly and cost-effectively as possible, they should prioritize support for renewables rather than nuclear power

Renewables are more effective in climate mitigation. Nuclear power is less.

- Diverse renewables are generally proving, in the real world, to be crucially more effective than nuclear power at reducing climate disruption.
- Countries with larger-scale national nuclear power attachments do not tend to associate with significantly lower levels of national carbon emissions. However, lower levels of carbon emissions do associate more strongly with the relative scales of national attachments to renewable energy.
- If nuclear power is to play a role in global reductions of CO_2 emissions, it would have to expand at an unprecedented scale. For the world to drop 50% in energy-related CO_2 emissions, the International Energy Agency says nuclear energy must reach 1,200 gigawatt electrical of installed capacity by 2050. This would require about $4 trillion in additional funding, raising key queries over cost-effectiveness.
- Renewable energy growth associates more strongly than nuclear with lower CO_2 emissions, and, unlike for nuclear, this applies regardless of whether a country has a high or low GDP per capita.
- With the current unprecedented pace of renewable energy development and cost reduction, a 100% global renewable electricity system by 2050 appears an achievable goal with countries able to meet all of their energy needs with wind-, water-, and solar-based energy systems.
- Wind and solar energy have a 40-month average lead-time compared to 90 months for nuclear power. Therefore, per dollar invested, the modularity of renewables projects also offers quicker emissions reductions than do large-scale, delay-prone nuclear projects.

Nuclear and renewables tend to crowd each other out

- The relative scale of nuclear attachments associates negatively with renewables attachments, and vice versa. The two options show tendencies to mutual impedence – creating lock-ins or path dependencies that crowd out the other. So, countries planning large-scale new nuclear investments are risking suppression of greater climate benefits from alternative renewable energy investments – a bit like investing in caviar to fight world hunger.
- A grid structure optimized for larger-scale centralized power production (like conventional nuclear) will tend to make it more difficult, time-consuming and costly to introduce small-scale distributed power (like many renewables).

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A "do everything" strategy may impede renewables

- Simply to "do everything" begs key queries over what counts as 'everything'. Scare resources allocated to slower or less cost effective options – like nuclear power – detract from greater progress with more effective options like renewables. No single option is essential in a diverse mix.
- Inclusion of nuclear power on "do everything" grounds would therefore be irrational – and add significant further burdens associated with safety, security, waste management and proliferation protection.

The military connection

- Why do nuclear strategies remain so prominent? Here, it can be seen that prioritizations between nuclear and renewables vary across national political circumstances and perspectives. Existing nuclear weapons countries – and those with quiet aspirations to nuclear weapons – tend to favor use of nuclear power more than non-nuclear weapons countries. Expensive and relatively ineffective nuclear attachments are increasingly obviously driven by military agendas.

Costs and performance

- Renewables display higher rates of 'positive learning'. In other words, increased deployment results in lower costs and improved performance. Nuclear power has been prone to 'negative learning' with rising costs and reduced performance in the "next generation" reactor projects.

Safety

- Present day renewables are not subject to catastrophic accident risks or consequent regulatory ratcheting. At the same time, there is no reason not to expect intermittent regulatory shocks to continue with nuclear power well into the future.

The above are drawn from Differences in carbon emissions reduction between countries pursuing renewable electricity versus nuclear power, *by* ***Benjamin K. Sovacool, Patrick Schmid, Andy Stirling, Goetz Walter*** *and* ***Gordon MacKerron****, which analyses data from 123 countries over 25 years. The full article was originally published by Nature Energy and may be requested from the authors, here: https://www.researchgate.net/publication/344482658_Differences_in_carbon_emissions_reduction_between_countries_pursuing_renewable_electricity_versus_nuclear_power*

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