



CARTOGRAMS

# NUCLEAR POWER

BY BENJAMIN HENNIG

Nuclear power contributes only a small share to global energy production. According to *World Energy Statistics 2015* published by the International Energy Agency, nuclear power accounts for 4.8 per cent of the total primary energy supply worldwide, far behind oil (31.1 per cent), coal (28.9 per cent), natural gas (21.4 per cent) and even behind biofuels and waste (10.2 per cent). Of the producers of nuclear power, the United States is by far the largest with 33.2 per cent of the world's total, followed by France (17.1 per cent) and Russia

(seven per cent). The UK's production accounts for just 2.9 per cent. In contrast, France generates the largest share of its domestic electricity generation from nuclear power (74.4 per cent). It is followed by Sweden (43.4 per cent), Ukraine (43.0 per cent) and South Korea (25.8 per cent), while the UK comes fifth with 19.2 per cent.

Nuclear power is not a renewable source of energy. It relies on uranium which is a relatively common resource. According to a 2014 OECD study, the largest currently known recoverable resources exist in Australia (approximately 29 per cent of the world), Kazakhstan (12 per cent) and Russia (nine per cent). When looking at the actual production, more than half the world's extraction takes place in Canada (28 per cent) and Australia (23 per cent).

Criticism of the civil use of nuclear technology mostly focuses on the technology's safety. The search for storage solutions for radioactive waste has made limited progress. Waste management and disposal options remain problematic and controversial. Furthermore, there is the risk of a nuclear accident, described by the International Atomic Energy Agency (IAEA) as 'an event that has led to significant consequences to people, the environment or the facility'. In 1990 the IAEA introduced the International Nuclear and

Radiological Event Scale (INES) to describe the severity of such an event. The logarithmic scale reaches from 0 to 7 and each level indicates a tenfold more severe incident than at the previous level. Everything up to level 3 falls into the category of 'incidents', while those classified level 4 and above are considered to be 'accidents'.

A 2010 study concluded that there have been at least 99 recorded nuclear power plant accidents between 1952 and 2009. Chernobyl (1986) and Fukushima (2011) have been the most severe and were classified as level 7 ('major accidents'). The worst event in the UK was the 1957 Windscale fire at the Sellafield site which was classified as a level 5 'accident with wider consequences'.

It is not the number of immediate fatalities that make nuclear accidents problematic, but the exposure of people to radiation and the contamination that has long-term consequences. A look at the proximity of populations near nuclear power plants therefore helps to better understand the associated potential risks. The cartogram above displays locations of nuclear power plants from an IAEA database of nuclear reactors published by the Center for International Earth Science Information Network (CIESIN) at Columbia University. This includes facilities which are at

varying stages of decommissioning - a time-intensive and expensive process due to its continuing hazards.

In addition to the locations of the nuclear plants, circles of 20, 30 and 80km distances are drawn as the immediate risk zones. The underlying basemap uses a gridded cartogram based on equal population projection to put the differing exposures of populations into perspective. Each circle of equal distance is resized relative to the number of people living in the vicinity of each nuclear power plant. The locations of the most severe incidents above INES level 5 are highlighted. The inset map shows the distribution of nuclear sites in the UK on both a conventional map and gridded population cartogram for more detail.

As nuclear remains a technology that contains hazards from the production to waste storage and decommissioning of plants, strategies for managing possible accidents especially in some of the most densely populated locations are a key priority in handling the underlying risks.

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