

**Spark! Contest 2016:
PRE-SELECTION ONE-PAGER**



‘THE NUCLEAR FUEL CYCLE IN 2040: THE CHALLENGES AND SOLUTIONS TO ACHIEVE SUSTAINABLE NUCLEAR GENERATION IN EUROPE’

GEORGE AUCKLAND AND MATTHEW LOCKWOOD, MANCHESTER UNIVERSITY/ATKINS GLOBAL, 2015

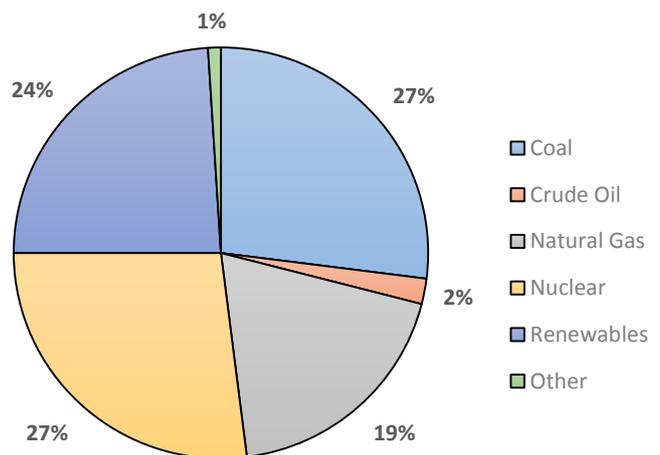
The ever changing landscape of the nuclear industry in Europe is entering a new Anthropocene. The energy industry has seen an increase in pressure to **provide sustainable, secure, affordable, low-carbon energy**.

The ‘2020 climate & energy package’ legislates for carbon emission targets, with **2020 set to a 20% reduction – rising to 40% by 2030**. The Energy Union and Climate group, part of the European Commission, has set out a plan for a fully integrated energy market to supply Europe with a sustainably sourced energy mix.^[1]

The European populous agrees that **nuclear will be the 3rd largest energy source over the next 30 years**, however, historical disasters, such as Fukushima, have the ability to threaten public and political opinion.^[2] For example, the liberal coalition of Germany, a spearhead member of the EU, ceased their nuclear program in 2011 with all reactors to be shut down by 2022.^[3] A **multi-billion euro investment in renewable energy is required** to fill their energy gap, consequently, coal-fired power stations alongside energy imports have been used to meet the ever growing demand. This grossly undermines Germany’s pledge to reduce carbon emissions proving that **nuclear generation is still an essential source of low-carbon energy** and fits within the wider EU policy.^[4]

Currently, 64% of uranium used is imported from outside Europe, questioning its security.^[5] However, uranium ore is abundant in geopolitically stable countries and is therefore **not under the same political-economic pressure as oil and gas supplies**.^[6] Advancing technology provides scope for the use of alternate fuels such as untapped thorium and plutonium stocks in a diverse fuel market.^[7] Continued development of generation IV, molten salt and fast reactors would see **efficient and safe** use of such fuels. The challenge here would be to develop the infrastructure for fuel production and supply whilst dispelling social negativity surrounding the use of unfamiliar nuclear technology, displayed by some member states.^[8]

EU Energy Mix in 2012.^[15]



Mining, decommissioning and storage have key environmental challenges associated with increasing nuclear generation. **Geological disposal facilities** are majorly delayed by a ‘not in my back yard’ culture, hindering the pragmatic management of nuclear waste.^{[9][10]} We argue these facilities **are required** in order to progress.

Ultimately, **nuclear energy generation benefits** when competitive on a free market. Subsidy for low-carbon energy generation is not sustainable and unfavourable. An economy where a nuclear grounded energy mix is traded in a centralised market is more favourable in the longer-term.^[11] However, the **European need for foreign investment** hinders nuclear fuel cycle development.^[12]

These **challenges give scope for innovation**. The underdeveloped, yet promising, proposal of highly mobile, factory built small modular reactors could ease investment and allow nuclear generation to be localised.^[13] Fusion technology has the potential to produce **near limitless energy** whilst replenishing our dwindling supplies of helium, but faces engineering challenges in practice.^[14]

Aiming to solve the challenges of nuclear industry alone is futile – a holistic approach to the entire energy market is required. Forward progress starts with wiping out the notion that renewable technologies are the complete solution with regards to meeting our energy demands – **they aren’t**. Over-emphasising their value is inhibiting progress within the energy industry. Nuclear generation is the only provider poised to create lasting change and meet carbon emission targets. **The greatest single challenge to nuclear generation is the threat of weak links, most notably the group of renewable technologies whose capabilities are too immature to take any meaningful load in the chain.**