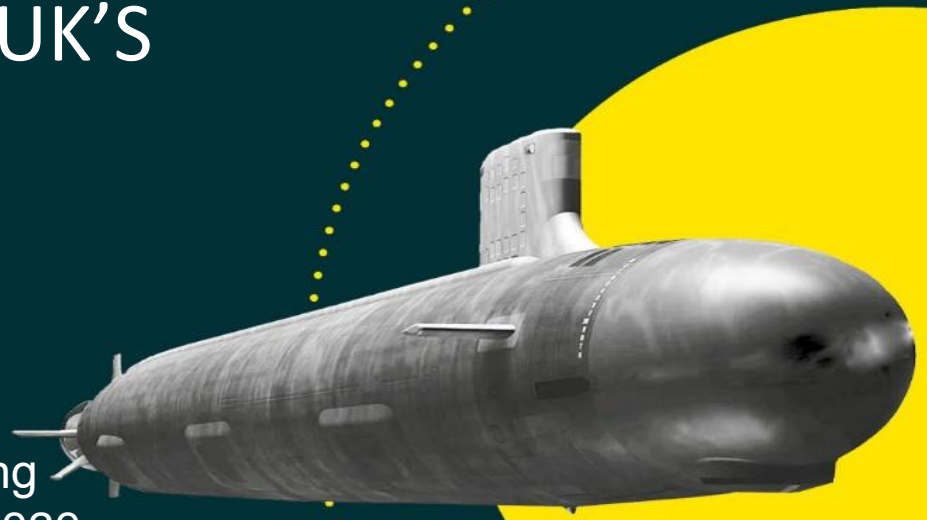
SCIENCE POLICY RESEARCH UNIT

QUALITIES OF DEMOCRACY AND CIVIL-MILITARY NUCLEAR INTERDEPENDENCIES: EXPLORING INTERNATIONAL PATTERNS AND THE UK'S NUCLEAR AMBITIONS



Phil Johnstone

Presentation for Greenpeace Conference, 'Critically examining Nuclear as a (false) climate solution, October 13th and 14th, 2020

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Introduction

background and motivations for our research

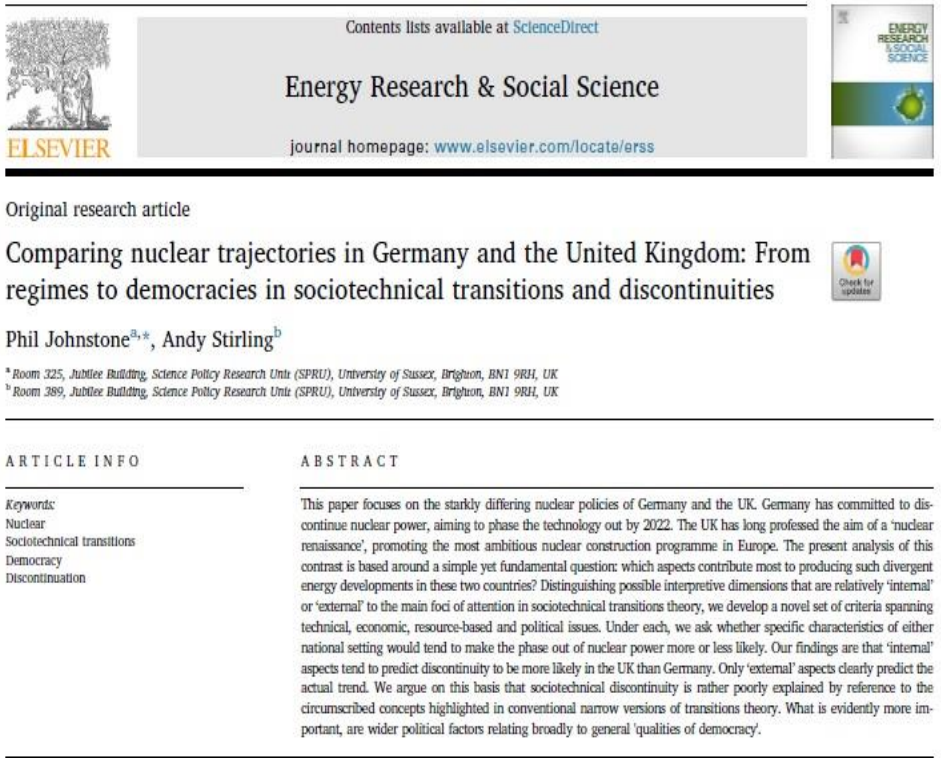
- Why is nuclear power is proving so surprisingly resistant in particular places around the world, to dramatically changing global energy market conditions and structures for electricity supply? In other words, why is it so challenging to discontinue nuclear power in certain contexts?
- Against backdrop of stark decline in the worldwide nuclear industry, nuclear new-build remains a major area of investment in a few specific countries. Intense attachments persist despite nuclear clearly becoming much less attractive, when compared with competing low-carbon options.
- This question clearly presents a classic focus for social science research. Unavoidable complexities, ambiguities, time-dynamics and associated 'mess' underscore need to triangulate multiple methods.
- Systematic criteria-based analyses; Pattern testing; UK/Germany comparison; international patterns; UK case study.
- *In contexts of persistent commitment to nuclear power, what are most important drivers?*

  What possible role might be played in specific settings & perspectives, by military nuclear pressures?

Comparing nuclear trajectories in Germany and the UK

factors under direct focus in mainstream ‘regime theory’

1) General market conditions
2) Penetration of nuclear in the generation mix
3) Strength of nuclear industry
4) Renewables resource potential
5) Strength of renewables industry
6) Public attitudes and social movement activity
7) General national political institutions and cultures
8) Qualities of democracy
9) Scales of military-related nuclear interests



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Original research article

Comparing nuclear trajectories in Germany and the United Kingdom: From regimes to democracies in sociotechnical transitions and discontinuities

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ABSTRACT

This paper focuses on the starkly differing nuclear policies of Germany and the UK. Germany has committed to discontinue nuclear power, aiming to phase the technology out by 2022. The UK has long professed the aim of a ‘nuclear renaissance’, promoting the most ambitious nuclear construction programme in Europe. The present analysis of this contrast is based around a simple yet fundamental question: which aspects contribute most to producing such divergent energy developments in these two countries? Distinguishing possible interpretive dimensions that are relatively ‘internal’ or ‘external’ to the main foci of attention in sociotechnical transitions theory, we develop a novel set of criteria spanning technical, economic, resource-based and political issues. Under each, we ask whether specific characteristics of either national setting would tend to make the phase out of nuclear power more or less likely. Our findings are that ‘internal’ aspects tend to predict discontinuity to be more likely in the UK than Germany. Only ‘external’ aspects clearly predict the actual trend. We argue on this basis that sociotechnical discontinuity is rather poorly explained by reference to the circumscribed concepts highlighted in conventional narrow versions of transitions theory. What is evidently more important, are wider political factors relating broadly to general ‘qualities of democracy’.

Johnstone, P. Stirling, A. (2020) “Comparing nuclear trajectories in Germany and the UK” *Energy Research & Social Science*.

criterion case	**GENERAL MARKET CONDITIONS** (GMC)
- Germany	- ‘coordinated economy’ - more state intervention - higher public spending
- UK	- ‘market economy’ neoliberalism - less public spending

criterion	DEPENDENCY ON NUCLEAR ELECTRICITY (DNE)

Figure 2: German and UK Production of nuclear power (GWh) 1990-2016

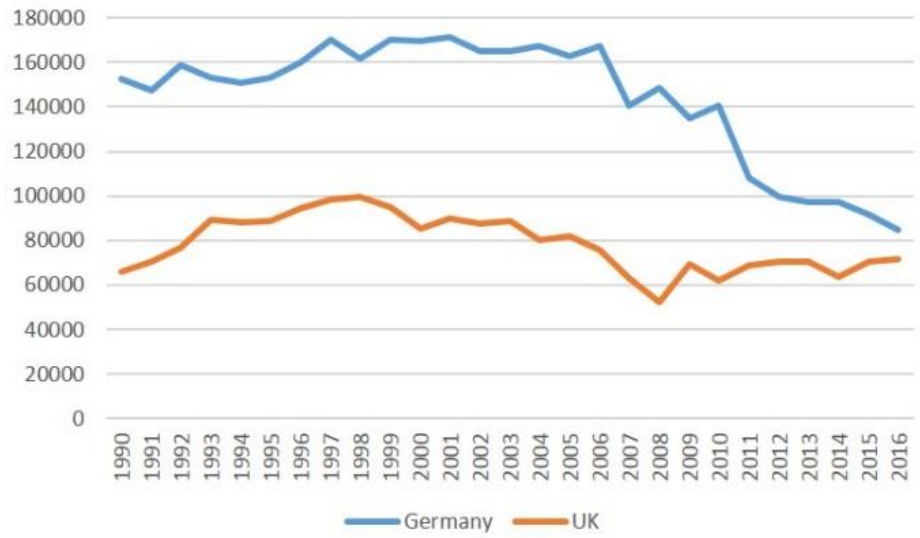
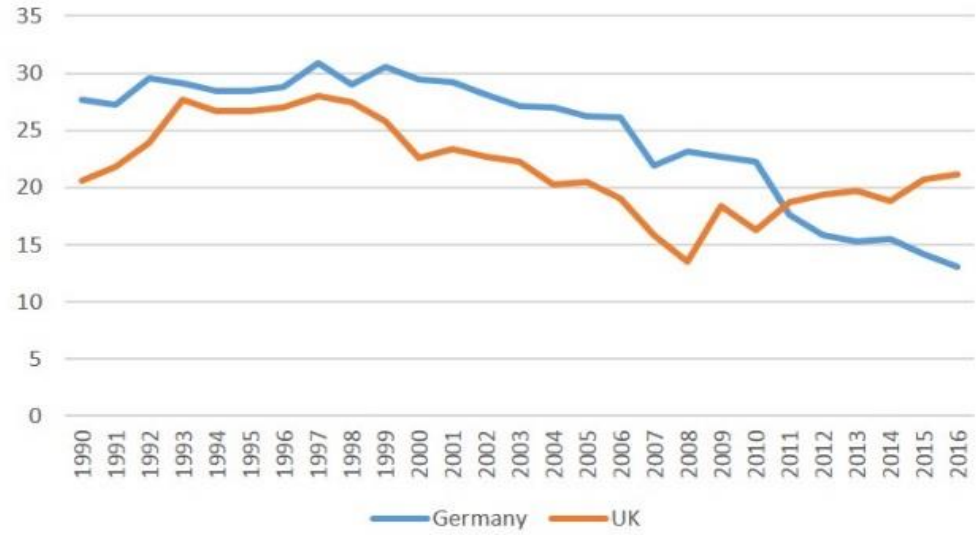


Figure 3: Percentage share of nuclear power in generation mix



Source: IEA (2018) International Energy Agency. International Energy Agency Country profile statistics

	Germany	UK
Production of nuclear energy in 2010 (GWh)	140556	62120
Average reactor size in 2010 (Mwe)	1196	548
Average annual production 1990-2016 (GWh)	144,020	78,461
Historic maximum nuclear production in one year (Gwh)	171,305 (in 2001)	99,486 (in 1998)

criterion case	**STATUS: NUCLEAR ENGINEERING INDUSTRY (SNI)**

Figure 5a: German and French nuclear innovation index

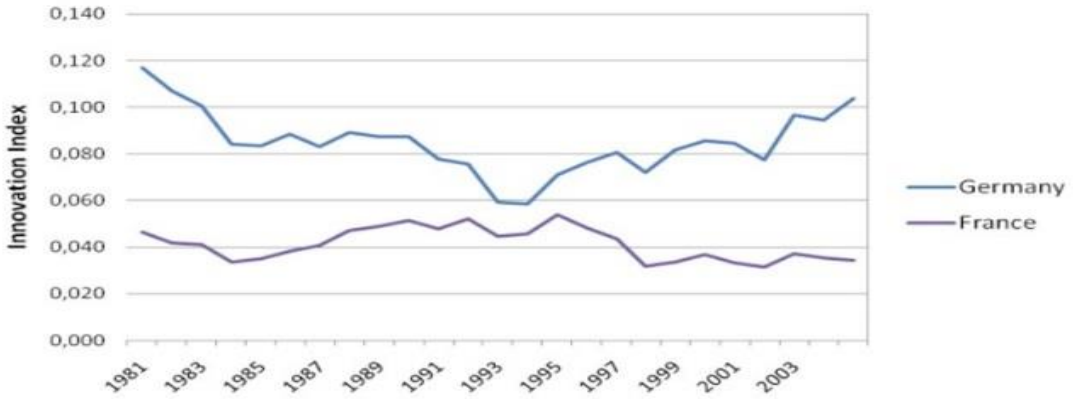


Figure 5b: Share of worldwide nuclear patents by country

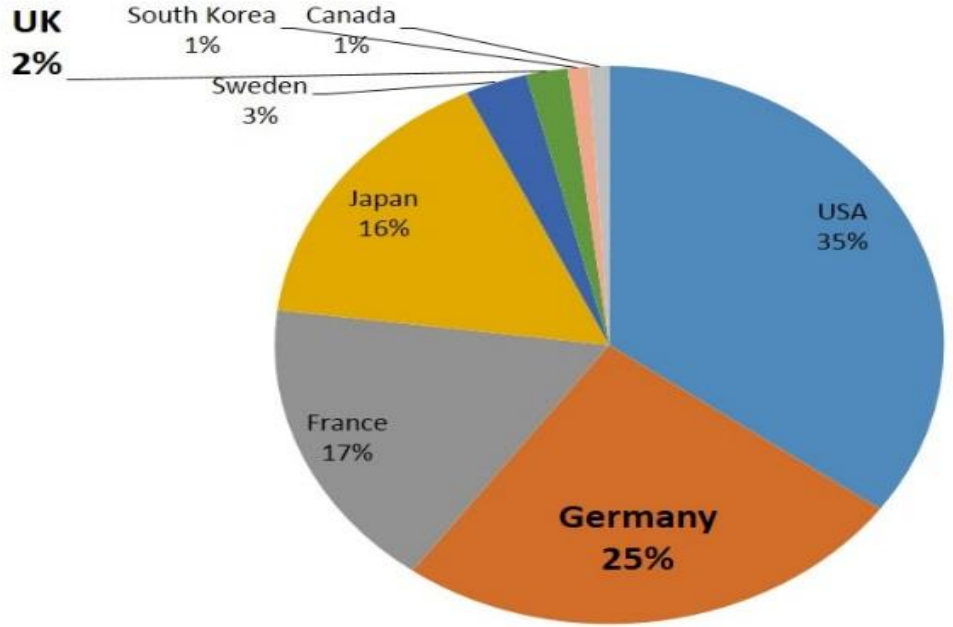
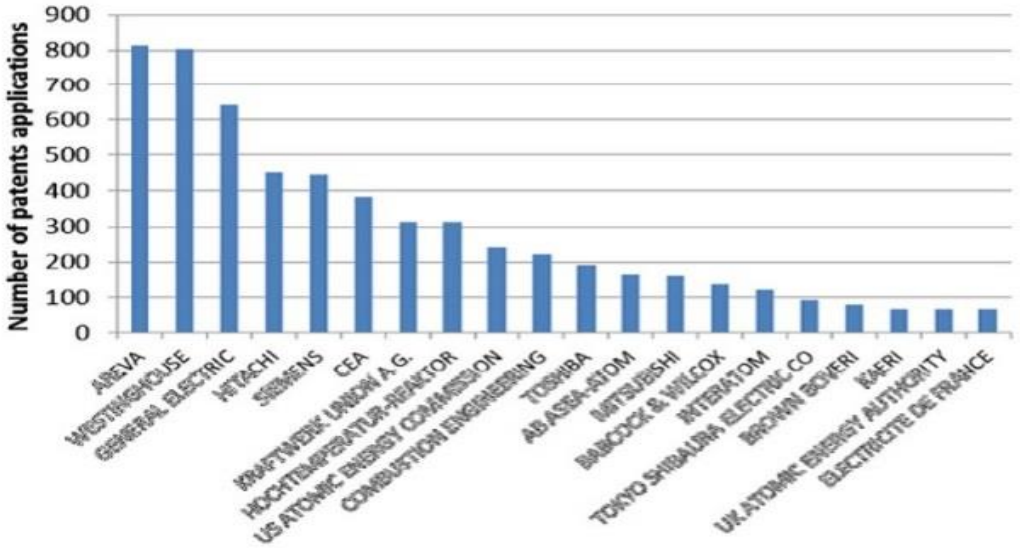


Figure 5c: patent applications for civilian nuclear power by country

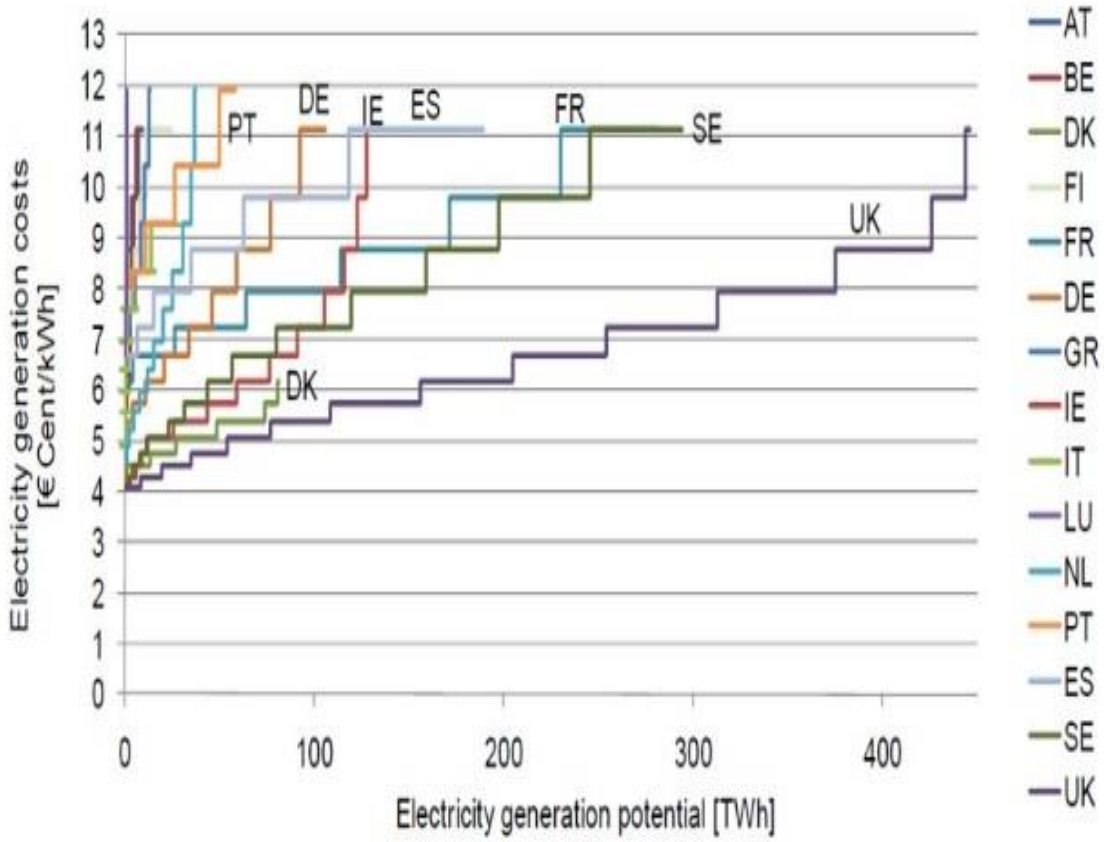


Sources: Lévêque (2010)
http://www.energypolicyblog.com/2010/05/09/innovation-trends-in-nuclear-power-generation/

Berthélemy (2012) What drives innovation in nuclear reactors technologies ? An empirical study based on patent counts

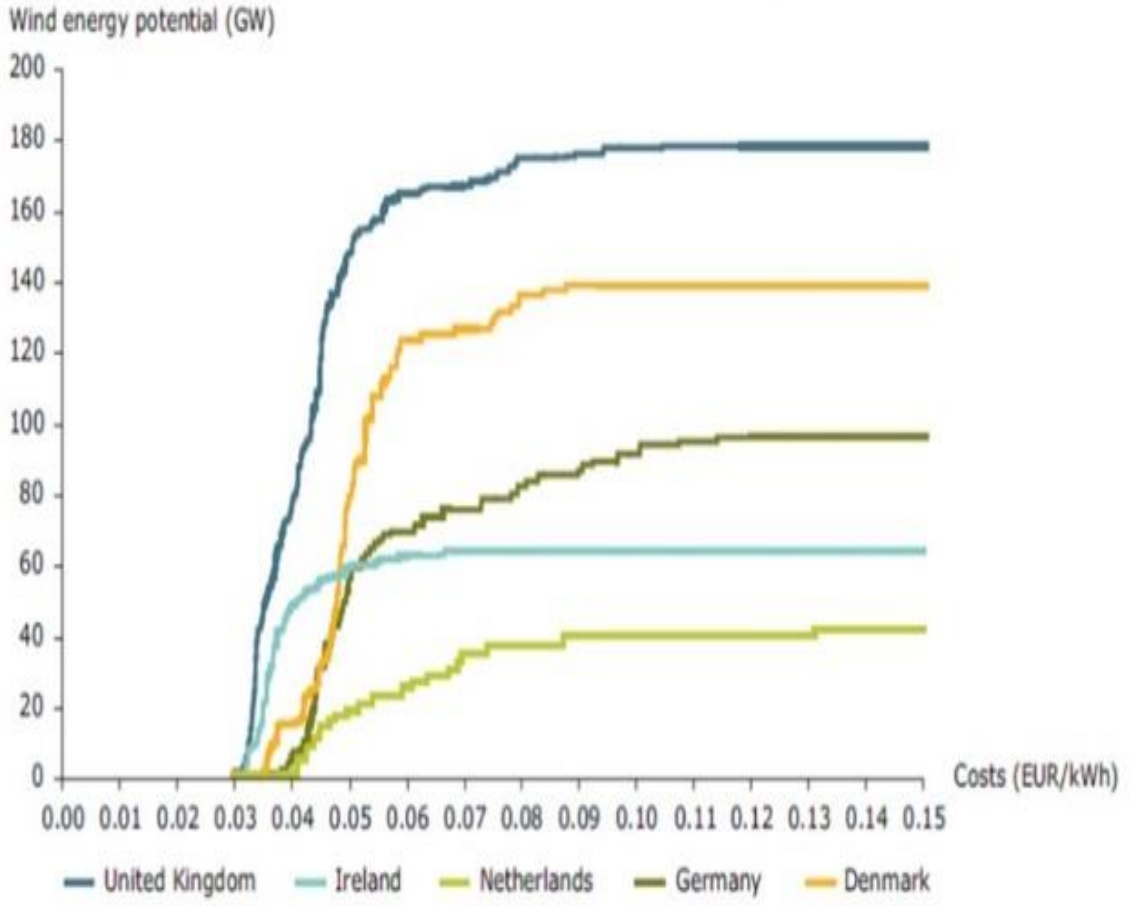
criterion case	**RENEWABLE RESOURCE ENDOWMENTS (RRE)**

Figure 6a: Cost resource curve for onshore wind in European countries



Source: Held (2010) *Modelling the future development of renewable energy technologies in the European electricity sector using agent-based simulation*

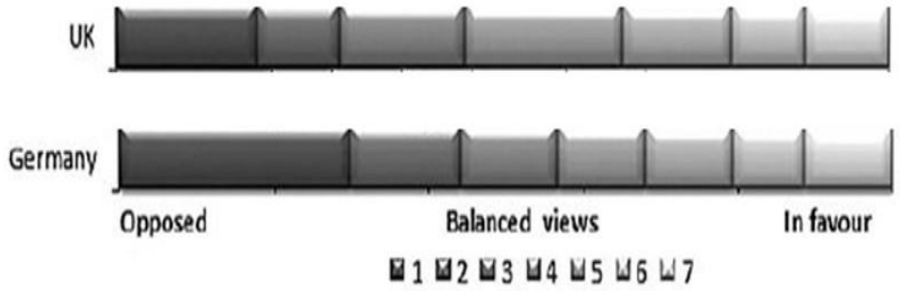
Figure 6b: Cost resource curve for offshore wind in European countries



Source: European Environment Agency (2009). *Europe's onshore and offshore wind energy potential.*

criterion	PUBLIC ATTITUDES AND SOCIAL MOVEMENT ACTIVITY

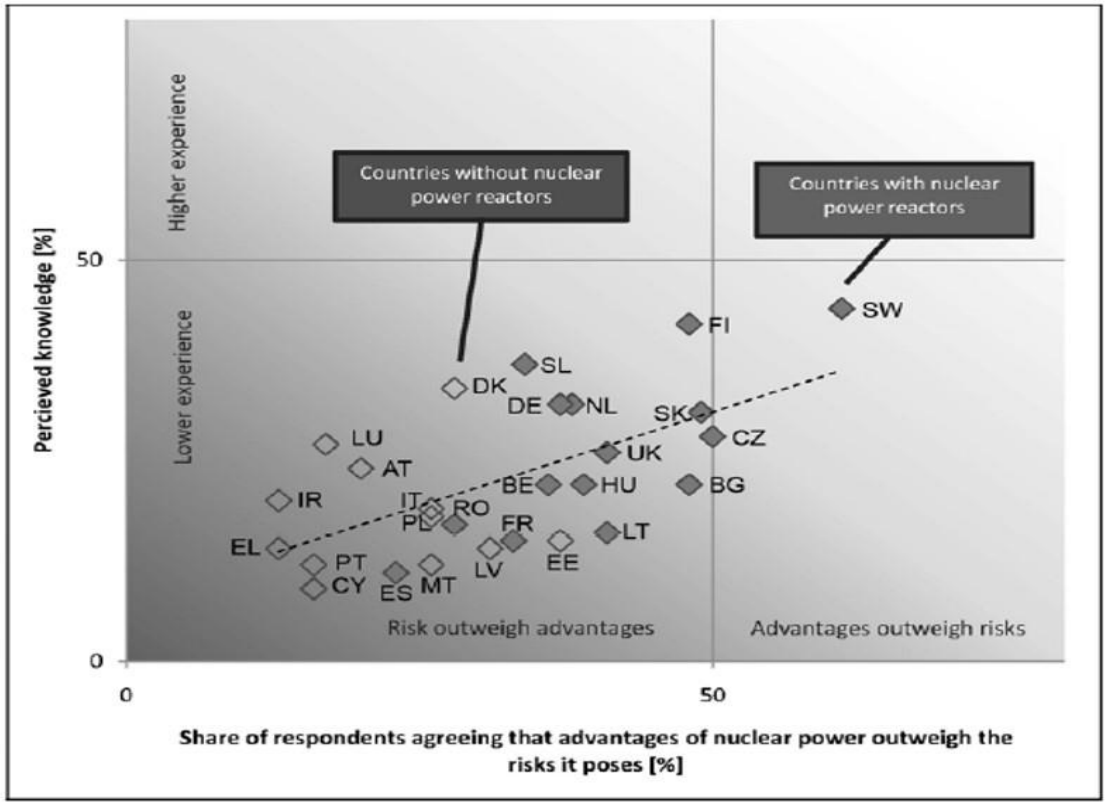
Figure 16: Public strongly opposed to nuclear power ranked 1-7



Source: NEA (2010) *Public Attitudes to Nuclear Power*

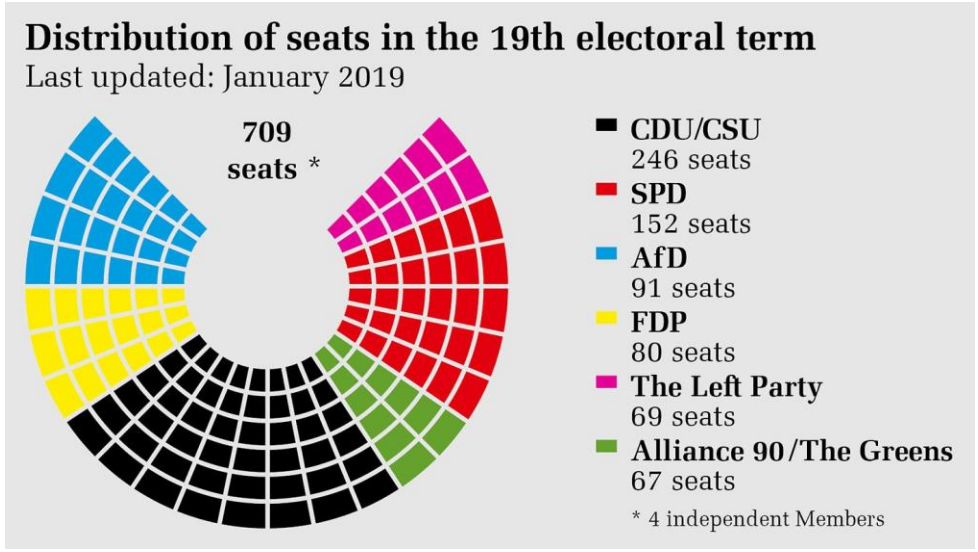
Source: Financial times (2020)

Figure 18: Perceived knowledge and perception of risks of nuclear power



Source: NEA (2010) *Public Attitudes to Nuclear Power*

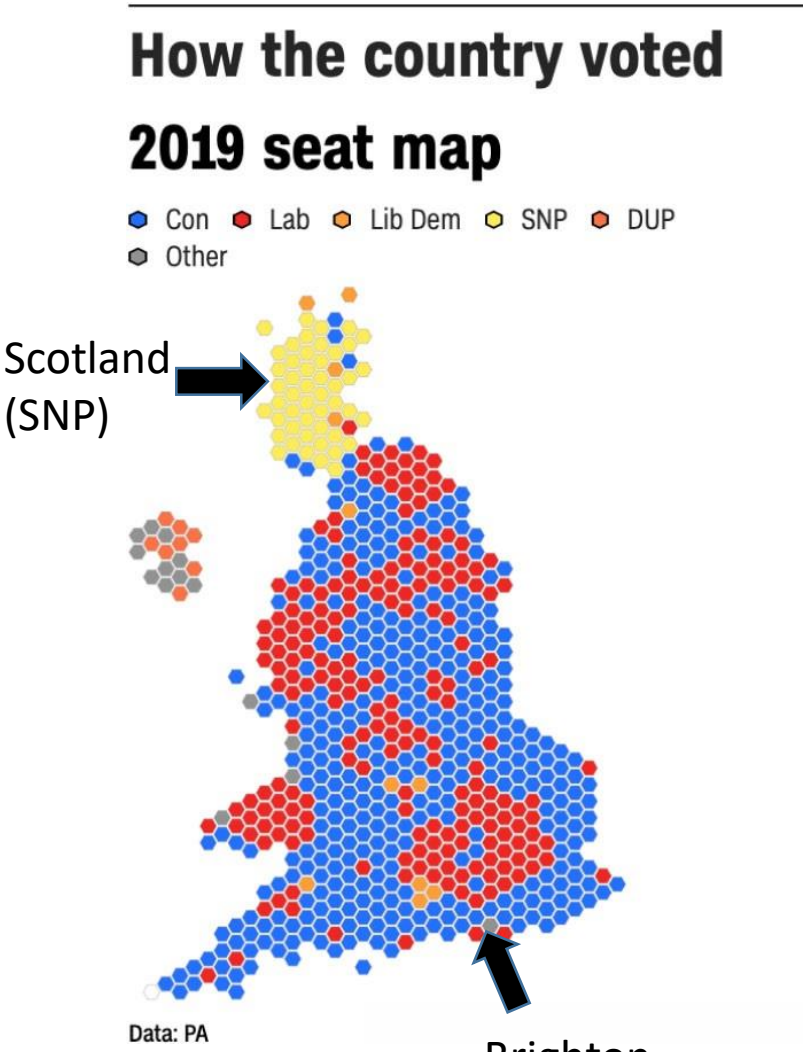
criterion	GENERAL NATIONAL POLITICAL INSTITUTIONS AND ELITE CULTURES



Source: Budenstag.de (2020)

	Majoritarian	Consensual
Executive power	Concentration of executive power in single party	Power-sharing in coalitions
Executive-Legislative relationships	Executive is dominant	Executive-legislative balance
Party system	Two party system	Multi-party system
Voting system	Disproportionate representation	Proportional representation
Interest group systems	Pluralist interest groupings with 'free-for-all' competition	Coordinated and corporatist interest group systems aimed at compromise and concentration

Source: Lijphart (2002) *Negotiation democracy versus consensus democracy*



criterion	NATIONAL DEMOCRACY RANKINGS

	Majoritarian	Consensual
Executive power	Concentration of executive power in single party	Power-sharing in coalitions
Executive-Legislative relationships	Executive is dominant	Executive-legislative balance
Party system	Two party system	Multi-party system
Voting system	Disproportionate representation	Proportional representation
Interest group systems	Pluralist interest groupings with 'free-for-all' competition	Coordinated and corporatist interest group systems aimed at compromise and concentration

Source: Lijphart (2002) *Negotiation democracy versus consensus democracy*

Rating system	German ranking	UK ranking
Democracy Barometer	11th	26th
Economist Intelligence Unit 2010	14th	19th
Global Democracy ranking	8th	13th

Sources: *Economist Intelligence Unit analysis, Global Democracy Ranking, Democracy Barometer.*

criterion	RELATIVE SCALES OF MILITARY-RELATED NUCLEAR ACTIVITIES

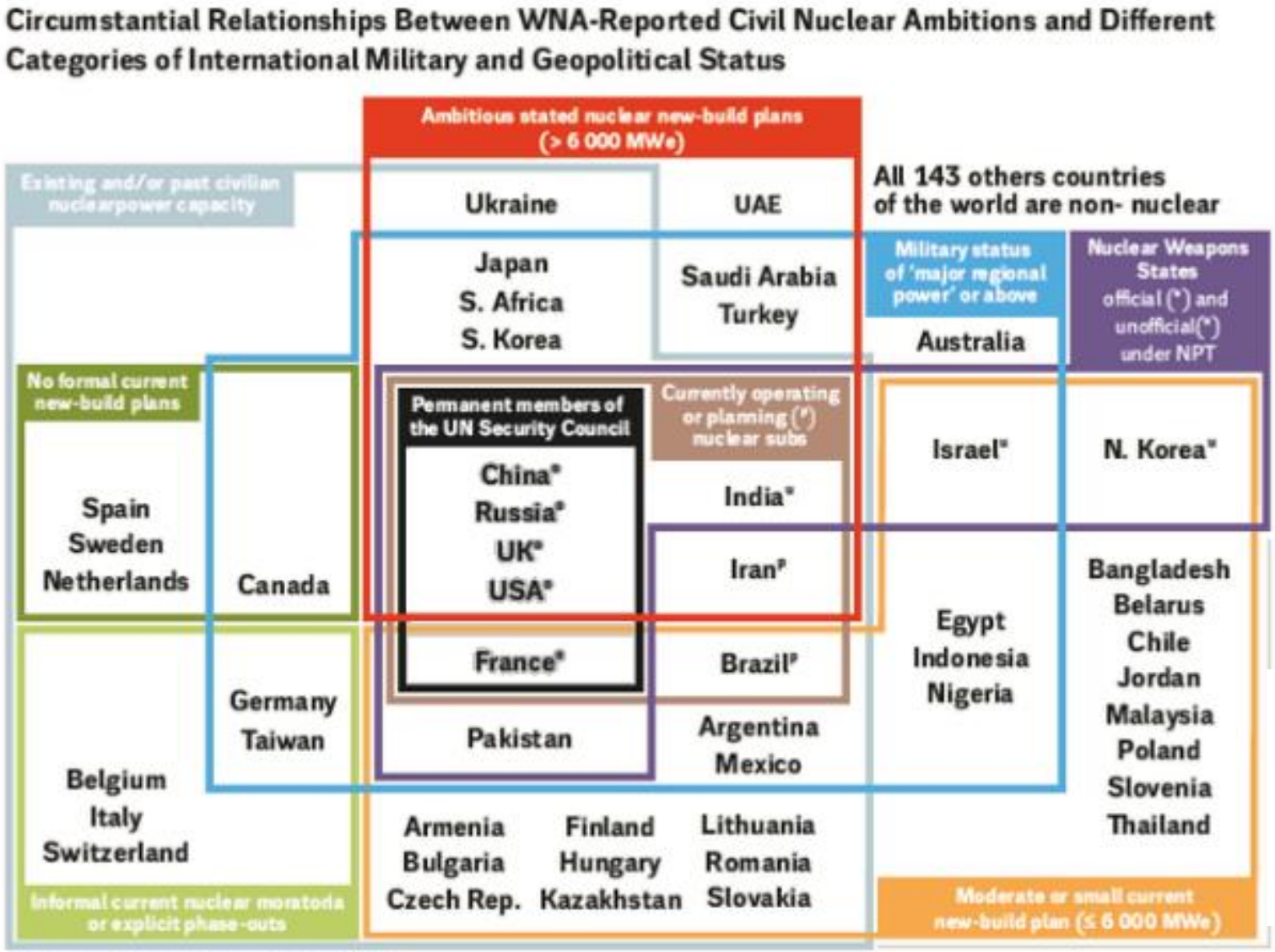
- The difference between the UK and Germany regarding nuclear weaponry is stark. Put briefly: the UK is one of only five official nuclear weapons states recognised under the global Non Proliferation Treaty and Germany is not.

- The UK has a large industrial base employing over 30,000 people committed to the production of nuclear weapons and submarines. Germany does not.

Source: UK Defence Journal (2017) *Who controls Trident?* https://ukdefencejournal.org.uk/controls-trident-brief-look-operation-britains-nuclear-weapons/

Broad global patterns

are consistent with civil-military nuclear links



- The leading global **military** powers are the **most committed** to large scale new nuclear build
- There is no global or regional **military power** that does not hold an active history of very **strong pressures** for civil nuclear power
- No country either with or planning nuclear weapons or submarines is currently pursuing either a nuclear moratorium or a phase-out

Military rationales
are openly declared in many countries

In the few countries where nuclear support persists most strongly, key reason is military

- **Russian military priorities for civil nuclear industry**: *"…*[r]*eliable provision of Russia's defense capability is the main priority of the nuclear industry"* [Rosatom 2017]
- Many **US** reports **highlight military priorities for civil nuclear industry,** especially by former Energy Secretary Ernest Moniz emphasising ***"need to provide for nuclear Navy requirements***"
- **Leaked US** Government Memorandum (2018): *"Our national security also relies … on a robust civilian nuclear power industry to support the entire US nuclear enterprise and US* ***nuclear leadership*** *abroad"*
- **France**: Media debate risks to 'Force de Frappe' of civil nuclear decline. Environment Minister Hulot resigns; attributed in press to secret report emphasising civil-military nuclear interdependence
- **Military drivers of civil nuclear programmes** are also clear in frequent high-level statements in **Japan, Brazil, Saudi Arabia, Iran, Egypt, Turkey, UAE** and elsewhere

UK case study:
clarity in military policy / silence in energy policy

- Military debates show UK **nuclear submarine capabilities** heavily depend on civil nuclear programme
- Industry says UK without "***financial or personnel resources to develop both programmes in isolation***"
- Redacted MoD report: capabilities "*are at the* ***bare minimum necessary to deliver the programme"***
- UK submarine industry openly states aims to ***"mask"*** **military costs** behind civil nuclear programme
- But UK energy policy documents (and wider debates) leave these pressures **almost entirely hidden**
- NAO audits: civil non-energy ***"strategic factors"***; assume **non-defence support** for *"submarine base"*
- NAO in 2016 shows nuclear *"top-up payments"* amount at least to **many tens of billions of pounds**
- Defence chief (lead in EDF talks) tells PAC **civil-military links need** ***"concerted Government action"***
- Energy Minister: need to involve MoD in energy policy - **time** ***"artificial distinction … came to an end"***

Rare surfacings of the submarine issue in UK debates

A UK SMR programme would increase the security, size and scope of opportunities for the UK supply chain significantly, enabling long-term sustainable investment in people, technology and capability

Advantages to the UK's nuclear deterrent programme

One particular application for deployment of the talent developed through the UK SMR programme would be in the ongoing maintenance of the UK's independent nuclear deterrent. Currently, the UK Government is required to invest funding to sustain the skills and capability necessary for the maintenance of the Royal Navy's nuclear submarine programme. Recent decisions in Parliament have committed the UK to continue with independent deterrence for another generation, and therefore the need to maintain the relevant skills and capability remains paramount.

The indigenous UK supply chain that supports defence nuclear programmes requires significant ongoing support to retain talent and develop and maintain capability between major programmes. Opportunities for the supply chain to invest in new capability are restricted by the limited size and scope of the defence nuclear programme. A UK SMR programme would increase the security, size and scope of opportunities for the UK supply chain significantly, enabling long-term sustainable investment in people, technology and capability.

Expanding the talent pool from which defence nuclear programmes can draw from would bring a double benefit. First, additional talent means more competition for senior technical and managerial positions, driving excellence and performance. Second, the expansion of a nuclear-capable skilled workforce through a civil nuclear UK SMR programme would relieve the Ministry of Defence of the burden of developing and retaining skills and capability. This would free up valuable resources for other investments.

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Science & Environment

Nuclear: Energy bills 'used to subsidise submarines'

By Roger Harrabin
BBC environment analyst

5 June 2019 | Share

Motion S5M-17597: Bill Kidd, Glasgow Anniesland, Scottish National Party, Date Lodged: 06/06/2019
Link Between Civil and Military Nuclear Use
That the Parliament notes analysis by the University of Sussex, which suggests that energy bills are inflated to partly subside the UK's nuclear weapons arsenal; highlights that the university's Science Policy Research Unit has published evidence brought to light by Professor Andy Stirling and Dr Phil Johnstone identifying "that the need to maintain submarine nuclear capabilities in the military sector has played an influential role in the UK's decisions to champion nuclear power" and the finding that suggests that this provides "a compelling explanation for the UK's resolute commitment to nuclear energy projects... despite the widespread criticism of its economic and technical feasibility"; believes that the UK Government spends £2.2 billion per year on nuclear weapons and that a single nuclear weapons system could cost from £74 billion to £140.5 billion over its lifetime; recognises calls on the UK to adopt the 2017 UN Treaty on the Prohibition of Nuclear Weapons, and encourages investment into green energy to facilitate the transition towards a sustainable future.

Supported by: John Finnie, John Mason, Alison Johnstone, Fulton MacGregor, Richard Lyle, Kenneth Gibson, Gillian Martin, Mark McDonald, Stuart McMillan, Sandra White, Colin Beattie, David Torrance, Jenny Gilruth

Meanwhile in the USA…

Atlantic Council
GLOBAL ENERGY CENTER

ISSUE BRIEF

The Value of the US Nuclear Power Complex to US National Security

OCTOBER 2019

DR. ROBERT F. ICHORD, JR.
BART OOSTERVELD

V. CONCLUSIONS AND RECOMMENDATIONS

The United States has a large educational, R&D, and industrial-support system that underpins its civilian nuclear power sector, as well as its military nuclear enterprise. Closure of nuclear reactors erodes this system and impacts both current and future military operations, technologies, and the national security innovation base.

This report concludes that—based on conservative estimates of the value it provides due to human capital, dependability of the energy supply, vibrancy of the supply chain, and contributions to green power—the civilian nuclear energy industry contributes at least $42.4 billion annually to the pursuit of US national security priorities. In other words, an economic shock of at least that size, as well as almost-immediate federal budget implications, would result immediately in the case of a more rapid erosion of civilian nuclear capacity than the one currently underway. Therefore, this report recommends that the federal policy and budget

This analysis defines this complex as also including universities, national and independent research-and-development laboratories, fuel providers, and suppliers of equipment and technical services. These companies and institutions are active internationally. Nuclear fuel, technology, and services exports are also included in this national security equation. The role of these institutions in innovation and the R&D of new technologies is also of growing importance. The Trump Administration's National Security Strategy and National Defense Strategy both highlight the need to maintain and enhance what is being called the "National Security Innovation Base" and the increasing interaction between civilian and military technologies.

A major component of the US nuclear power complex is the development, operation, and maintenance of nuclear reactors in the US Navy's fleet. The nuclear fleet includes sixty-eight submarines; eleven aircraft carriers; and four research, development, and training platforms, and constitutes 45 percent of the navy's major

The UK discussion: democratic challenges

~~OFFICIAL SENSITIVE NNPP~~

Royal Navy Nuclear Reactor Test Facility Review

2.1.13 [redacted]

2.1.14 We were grateful to the captain and crew of [redacted] for hosting us on-board and providing us with an opportunity to observe nuclear plant operation and maintenance. [redacted]

2.1.15 [redacted]

Source: Grimes et al (2014) *Royal Navy Nuclear Reactor Test Review*

THE TIMES | Today's sections | Past six days | Times Radio

Mini-nuclear reactors to power the north

David Collins, Northern Correspondent

Sunday August 11 2019, 12.01am, The Sunday Times

The Never-ending cycle of UK nuclear enthusiasm

- *The AGR programme*
- *The legacy of UK fast breeder reactors*
- *The legacy of UK nuclear waste and the Sellafield Facility*
- *THORP and MAGNOX reprocessing plants and MOX fuel production*
- *The Thatcher Government's nuclear new build agenda.*
- *The very recent economic history of nuclear in the UK: e.g the 'other' Hinkley C, the Bail-out of British Energy.*
- *Now SMR euphoria.*

- ***Incredible lack of discussion on the question of 'why' in academia, media, and politics.***

Conclusions on military drivers of civil nuclear commitments: evidence is sufficiently strong, to put onus of persuasion on denial

- As is routine in long-run technical change, innovation is driving growing obsolescence of nuclear power
  - but nuclear infrastructures remain globally unique in the intensity of their institutional commitments

- Pattern-testing shows social theory fails to explain major divergence in UK / Germany energy policy
  - factors emphasised in regime theory predict opposite pattern. Democracy and military come to fore.

- Strong circumstantial links are also evident in intensities of global civil & military nuclear commitments
  - increasing acknowledgement in many nations: US, Russia, France, Japan, Brazil, Turkey, Saudi Arabia

- In-depth case study of UK confirms this picture; highlights unequivocal confirmation on military side
  - but almost complete silence on energy side and in wider policy and media debates

- In cases where intensity of civil nuclear commitments are even only partly driven by military pressure
  - significant queries arise on rigour, robustness & cost-effectiveness of energy policy in its own terms

- In cases (like UK) where such a interdependency is not justified (even acknowledged) in energy policy
  - wider grave implications arise for policy accountability and the quality of democracy more widely.

The nuclear debate: Give peace (and democracy) a chance…

- There is a danger of becoming stuck in the narrow frames of policed nuclear ‘debate’.
- Discussions of *demilitarising* energy systems and *democratising* energy systems were key to early green movements however arguably the discussion has become more technocratic.
- On a technical level we can see that renewables and energy efficiency clearly offer more cost effective and rapid means of decarbonising energy systems.
- Questioning the persistence of nuclear incumbency, and the military, geopolitical, and political reasons behind this persistence is necessary and useful to work towards more democratic and peaceful energy futures.