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Research Platform

Disposal options for radioactive residues: Interdisciplinary analyses and development of evaluation bases ENTRIA

FFU-Project

Multi Level Governance-Perspectives on nuclear Waste Storage: A comparative Analysis

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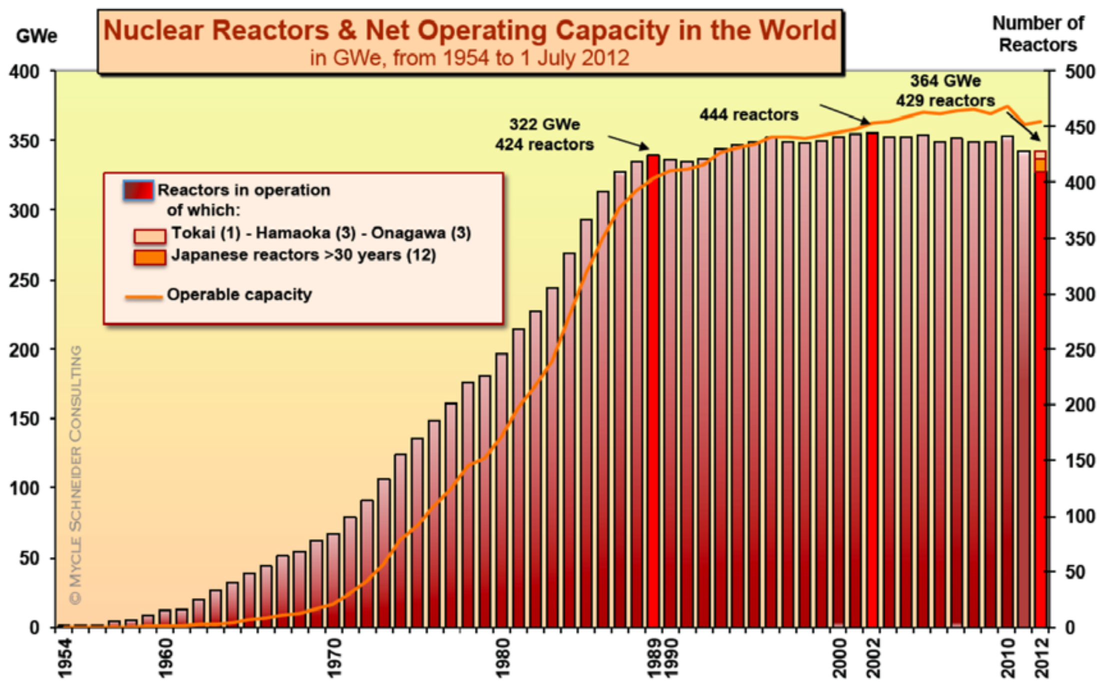
Nuclear Power Industry

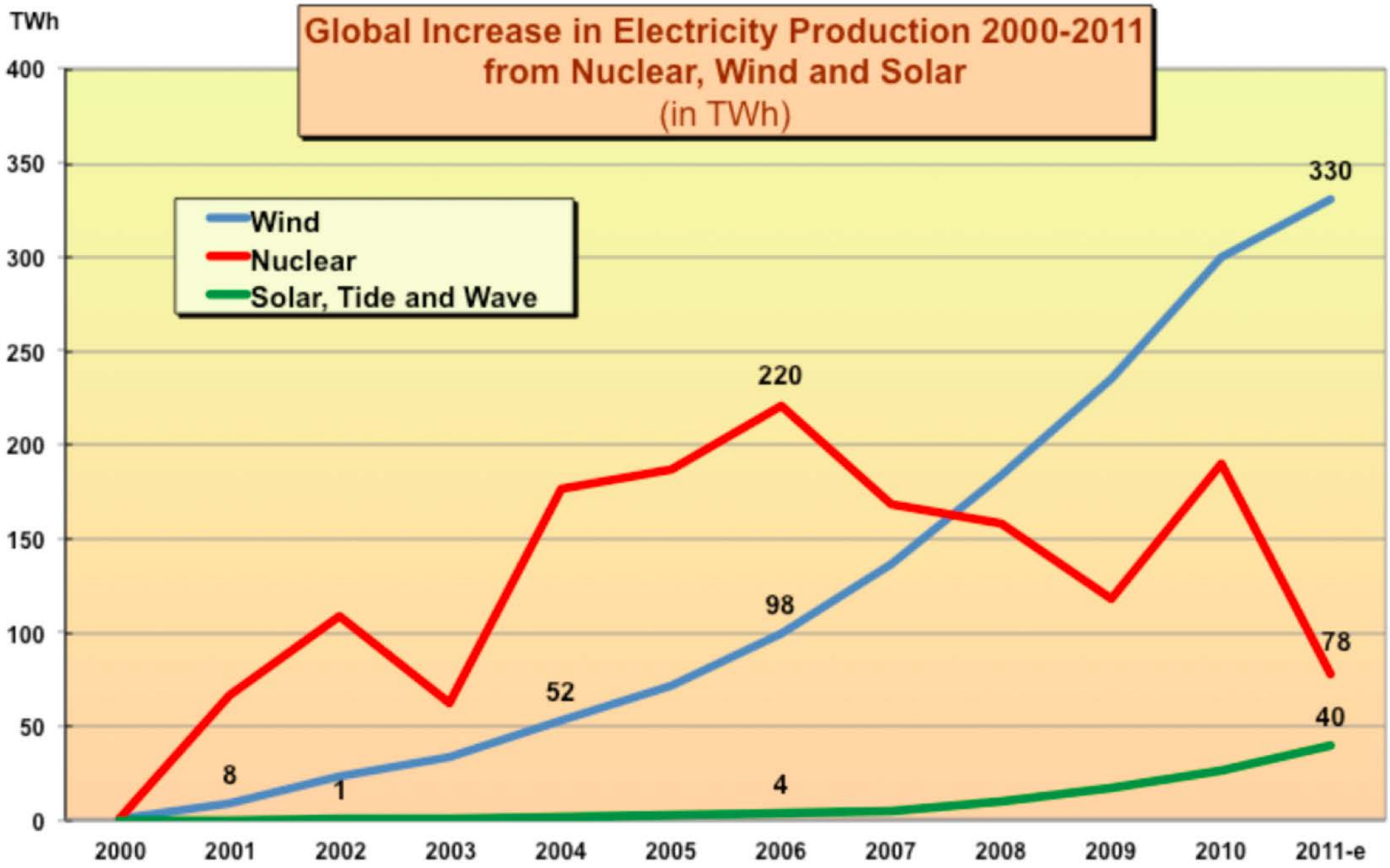
Peak number of operating nuclear power plants (444) was in 2002.

Peak capacity was in 2010 (375 GWe).



Multiple Challenges for Nuclear Industry

- *Nuclear accidents*: Three Mile Island, Chernobyl, Fukushima
- *Aging nuclear fleet*: (by 2014, average age of a NPP in Europe 30 years; US 34 years)
- *Changing energy structures*: e.g. US shale gas
- *Lack of movement globally on climate change*
- Growing success of *renewables*
- Growing number of states *abandoning nuclear energy* (e.g. Germany, Switzerland, Italy, Belgium...)
- *Difficulty finding investors*
- *Growing number of states abandoning nuclear energy*
- *Nuclear Waste Storage*


Global Increase in Electricity Production 2000-2011
from Nuclear, Wind and Solar
(in TWh)
TWh
400
350
300
250
200
150
100
50
0
Wind
Nuclear
Solar, Tide and Wave
330
220
98
78
52
40
8
1
4
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011-e

Nuclear Waste

270,000 tons of used fuel in temporary storage worldwide

Increase of 12,000 tons per year world wide

50 countries have spent fuel stored in pools at reactor sites or in central interim sites, awaiting reprocessing or disposal

Pressures to address nuclear waste are growing

- impacts of Fukushima
- safety concerns with interim storage
- judicial demands (US Court decision regarding NRC)
- regulatory requirements (Germany, European Union)
- Nuclear energy industry needs solution
- ethical concerns (leaving problem to future generations)

U.S. Court of Appeals

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"Due to the government's failure to establish a final place for spent fuel, SNF [spent nuclear fuel] is currently stored on site at nuclear plants. This type of storage, optimistically labeled 'temporary storage,' has been used for decades longer than originally anticipated. The delay has required plants to expand storage pools and to pack SNF more densely within them. The lack of progress on a permanent repository has caused considerable uncertainty regarding the environmental effects of temporary SNF storage and the reasonableness of continuing to license and relicense nuclear reactors."

New York v. Nuclear Regulatory Commission (2012)

EU Directive 2011/70/EURATOM

establishing a Community framework for the safe management of spent fuel and radioactive waste and requiring member states to agree to international peer reviews of their national frameworks and to issue implementation plans by August 23, 2015

Reprocessing

- About one-quarter of the spent nuclear fuel produced annually is reprocessed.
- Reprocessing: France, UK, Russia... Japan
- Nuclear proliferation concerns
- Does not do away with nuclear waste problem

Nuclear Waste

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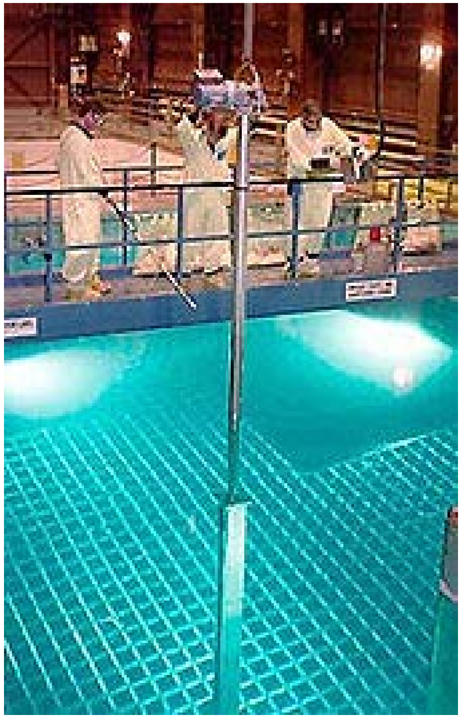
- Multiple dimensions of problem, socio-technical and political complexities and challenges
- socially strongly "politicized" problem associated with conflict
- Multi-level Governance Problem
- wicked problem



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Nuclear waste storage: a wicked problem

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- The issue of nuclear waste storage can be considered what in the literature is referred to as a “messy” or “wicked problem”

- Wicked problems are particularly difficult problems to solve as they are complex and characterized by many uncertainties

- They tend to generate conflict due to deep differences in the values and preferences of stakeholders who usually have different views on desirable outcomes

- They are problems that tend to lead to veto players that work to block policy change

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Wicked problems are complex, imperfectly understood and with no easy solution. Problem solving is exacerbated by the reality that those who are asked to bear the costs of nuclear waste management are often not the ones who have benefitted most from its use. In the case of nuclear waste, this is true both intra- and inter-generationally.

Changing Approaches to Site Selection

In the past, central governments tended to employ top-down approaches

nuclear energy policy making has been dominated by clientelism, patronage, and a *fait acompli politics*.

As demands for democracy and public participation.

Wicked Problem

- Few, if any good models
- Limitations of transferability of experiences internationally (Finland, Sweden)
- Uncertainties (e.g. regarding future, costs, safety, public response)
- Uncertainties regarding interactions among technical solutions and political/social responses
- There is no “right” answer
- Search for solution influenced by a country’s political, cultural, historical, geological factors

HLW Storage Sites

Protests:

Yucca Mountain

Gorleben

Acceptance:

Finland

Sweden

Emerging Approaches

Deep geological disposal (Finland, Sweden.... UK, US, Germany, Czech Republic...)

Retrievability??

Surface Repositories (Spain, Netherlands, Italy)

Waiting for technological and other improvements in conditions

How to?

- In order to deal with this kind of "wicked policy problem"

→ it is important to understand how different actors perceive and "frame" problems and solutions (Snow & Benford 1988)

→ their interests and core beliefs (Sabatier & Jenkins-Smith 1988), and how policies change (Baumgartner & Jones 1993)

- Solutions to wicked problems are not right or wrong. Every wicked problem is essentially novel and unique

- It is also necessary to consider what kinds of networks and learning processes can help to overcome these kinds of wicked problems (Balint, Stewart, Desai, Walters 2011)

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Thank you for your attention!

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