Value(s) of fusion

and Public Policy:

what can we learn from nuclear fission

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The Yes/No nuclear debate

- The debate about the future of nuclear energy is often reduced to a dichotomy
- Proponents often emphasize
  - Energy resource benefits
  - No emission of greenhouse gases
  - Large electricity production capacity, etc.
- Opponents refer to
  - Risks of accidents
  - Longevity of nuclear waste
  - Problematic history of nuclear technology

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The ethics of nuclear energy
Its past, present and future

- *Old* challenges
  - Safety (radiation) risks, nuclear melt-downs
  - New (reactor) technology can address these

- Present and future challenges
  - It is not only about the safety, but also security, sustainability (resources & environment), economics and justice
  - Multinational disposal for waste & justice
  - The need for (global) governance of safety
  - Nuclear risks, values & emotions

Source: Taebi, B, and S Roeser. 2019. “The Ethics of Nuclear Energy: Its Past, Present and Future.” In *In Search of Good Energy Policy*, edited by M Ozawa, J Chaplin, M Pollitt, D Reiner, and P Warde, 101–16. Cambridge: Cambridge University Press.

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Technologically informed ethics

- In the Yes/No question, there are many (hidden) ethical dilemma's involved

- Before getting to Yes/No question, many other important questions must be answered
  - What is the technology capable of now?
  - What can it possibly and reasonably do in the future?
  - What production (& waste management) methods are available?

- These questions have important ethical implications for present and future generations.

The role of new technology

- New reactors, but also new types of fuel cycles could change the considerations regarding:
  - Safety (no, less likely melt-down)
  - Security (& safeguard)
  - Waste management (and disposal)
  - Resource durability (e.g. using thorium)

- But we cannot *optimize* all these criteria
  - Choice need to be made regarding what we deem to be more important

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The public values approach

- Understanding what is ethically at stake in terms of public values

- Values are things worth striving for for societal reasons
  - They are different from the preferences of individuals

- This approach helps to map out what is ethically relevant in a broader societal context
  - And helps to relate to state-of-the-art of technology

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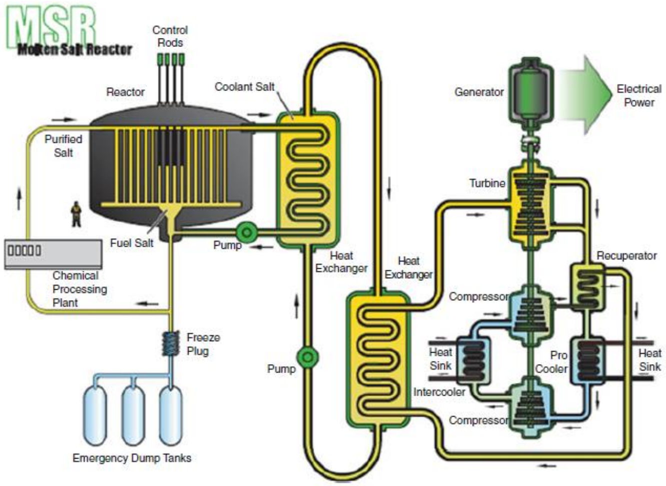
Design for values in nuclear technology

	HTR-PM	GFR	MSR
Safety	++	–	+
Security	+	– –	–
Sustainability (durability)	–	+	+ +
Economic viability	+	0	–



Taebi, Behnam, and Jan Leen Kloosterman. 2015. "Design for Values in Nuclear Technology." In Handbook of Ethics, Values, and Technological Design: Sources, Theory, Values and Application Domains, edited by Jeroen van den Hoven, Pieter Vermaas, and Ibo Van de Poel, 805–29. Dordrecht: Springer.

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Values Sensitive Design

Delta Journalistic platform TU Delft

Education Science Campus Opinion

Professor Batya Friedman is the founder of the Value Sensitive Design Lab at the University of Washington in Seattle. Her roots lie in computer sciences and in the early 1990s she studied the interaction between people and computers. This is also where her original awareness of value sensitive design grew, explains TPM Professor Ibo van de Poel. In the meantime, the design method is also being applied to hydraulic engineering, self-driving vehicles and artificial intelligence.

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Methodology of VSD
The tripartite methodology

- Conceptual investigations aim at *conceptually* (not yet empirically) identifying stakeholders, values at stake, potential conflicts and trade-offs.
- Empirical investigations aim at answering conceptual questions by investigating them among stakeholders, focusing on how values have been perceived and choices made.
- The technical investigations focus on the suitability of a certain technology for accommodating certain vales

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Rli Council for the Environment and Infrastructure

- Five key values
  1) Supply Certainty
  2) Affordability
  3) Safety (& Security)
  4) Sustainability
  5) Distributive Justice

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SPLITTING THE ATOM, SPLITTING OPINION?

DECISION-MAKING ON NUCLEAR ENERGY BASED ON VALUES

SEPTEMBER 2022

Council
for the Environment
and Infrastructure

Five values for ethical reflection on nuclear energy
Source: Rli report

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Ethical (normative) uncertainties

- Better appreciating ethical subtleties
  - We will inevitably run into normative uncertainties

- Normative uncertainties are situations where there are different partially morally defensible -- but incompatible -- options or courses of action, or ones in which there is no fully morally defensible option.

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A taxonomy of normative uncertainties

BOX 1 We distinguish between four categories of normative uncertainties

1.Evolutionary normative uncertainty related to situations in which it is unclear which moral norm would apply in the future to a certain situation creating technological risk. That is because both the technology and moral views could *evolve* in the future.

2.Theoretical normative uncertainty related to when different ethical theories offer different answers to an ethical question in risk governance.

3.Conceptual normative uncertainty occurs when different ethically relevant concepts (e.g., values) could be *prioritized* or *interpreted* differently.

4.Epistemic normative uncertainty is a situation in which there is incomplete knowledge about fundamental phenomena, or different interpretations are possible about the same body of knowledge.

Taebi, Behnam, Jan H. Kwakkel, and Céline Kermisch. 2020. "Governing Climate Risks in the Face of Normative Uncertainties." *WIREs Climate Change* 11 (5): e666.

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Evolutionary normative uncertainties

- Relate to situations in which it is unclear which moral norm will apply in the future to a certain situation creating risk, because
  - Both technology and morality could evolve
- Technology could evolve
  - And present to us unprecedented moral challenges
  - Or enable possibilities previously assumes impossible
- Morality could evolve
  - Or how we consider *good* in the society

Dodewaard and evolutionary normative uncertainties

- Since opening (1969), technology (for disposal) and our understating of radiation risks have evolved
- Also morality has evolved: intergenerational justice integral part of public policy
- Waste disposal by 2120

Changing ethical relevance of independent access to energy

- The invasion of Ukraine has influenced (and continues to influence) how we think about independent (access to) energy
- The *double effect* on the nuclear energy debate

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Zaporizhzhia & Chernobyl plants

A Russian serviceman stands guard at the Zaporizhzhia nuclear plant | CREDIT: AP

Credit: [VOA, 3 AUG 2022]

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Germany to Keep Last Three Nuclear-Power Plants Running in Policy U-Turn

Move prompted by the mounting economic war with Russia marks the first departure from a two-decade policy to abandon nuclear energy

The Isar nuclear-power plant in Essenbach, Germany, is one of the last nuclear plants still operating in the country.

PHOTO: ALEXANDRA BEIER/GETTY IMAGES

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Credit WSJ, 16 AUG 2022

Nuclear fusion & public values

1) Helps to appreciate the social complexity
   – of the problem at hand (the energy mix of the future)

2) Enables a technologically informed ethical analysis
   – that goes beyond the dichotomy

3) Paves the way for public participation
   – In terms of these values and their potential conflicts

4) Appreciates normative plurality of the society
   – e.g., morality changes (and has changed) between the envisioning and realization of these technologies

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It’s complicated!

- Indeed, appreciating the ethical subtleties and normative uncertainties is a rather complex matter
- But to be fair, that complexity has not been created by normative uncertainties
  - This notion only helps to make them tangible
- The alternative is accepting stalemates
  - Or failures of newly proposed technologies

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