Technology Assessment and Nuclear Governance

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JRC Winterschool

30 JAHRE itas Institut für Technikfolgenabschätzung und Systemanalyse

Welcome – Living Statistics

Rules of the Game

- I will name categories or scenarios
- You position yourselves in the room
- There is no “right” or “wrong” – only personal perspectives
- Brief exchange about patterns, surprises, and perceptions

Welcome – Living Statistics

Academic Background

- Engineering
- Natural Sciences
- Social Sciences
- Humanities

How does the word “nuclear” feel to you?

- Positive
- Neutral
- Negative

Scenario: A country is searching for a site for a deep geological repository for high-level waste.

What first step would you take?

- Define scientific criteria
- Actively involve citizens
- Ensure political responsibility

Welcome – Technology Assessment and Nuclear Waste Governance

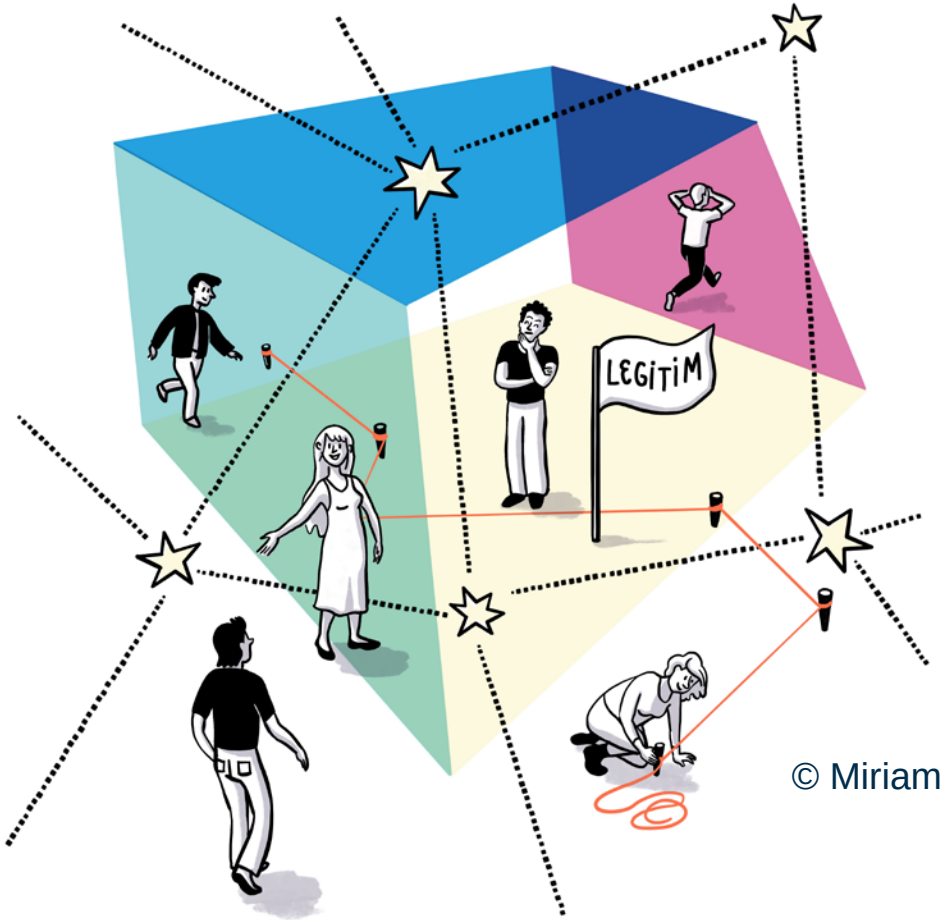
What shapes nuclear governance besides technical possibilities?

- Different values and priorities
- Different risk perceptions
- Different levels of trust in institutions and expertise

What role for Technology Assessment?

- Make uncertainties, perspectives, and value conflicts visible
- Structure complex decision landscapes
- Supports fairness, transparency, and traceability of decisions

→ helps shape long-term governance



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The Institute for Technology Assessment and Systems Analysis

Tasks and goals

Research into the consequences of new scientific and technological developments and their science-based evaluation

Analysis of complex interrelationships between technology, science, and society
➔ Provision of orientation knowledge for responsible design and societal embedding of new technologies

Policy advice and participation in public debate

Advancement of concepts and methods in technology assessment and systems analysis

Topics at ITAS

Data, information, knowledge

How can digital transformation be used for the benefit of all?

Focal points:

Digital work; artificial intelligence; (in)security, risk, and politics

Sustainability and transformation of the energy system

Which local and global strategies point the way to a resource-saving future?

Focal points:

Real-world lab research; society and energy transition; bioeconomy; sustainability assessment

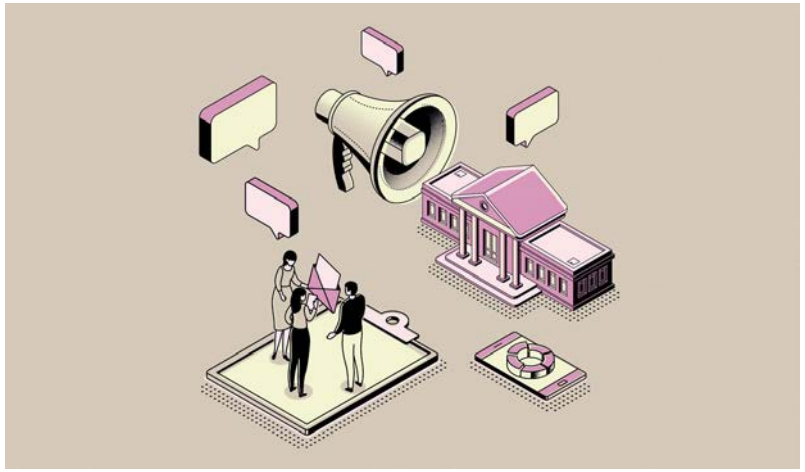
Mobility

How can modern societies satisfy growing mobility needs and make them more sustainable?

Focal points:

Sustainability of biofuels; socio-technical change; urban research

Topics at ITAS

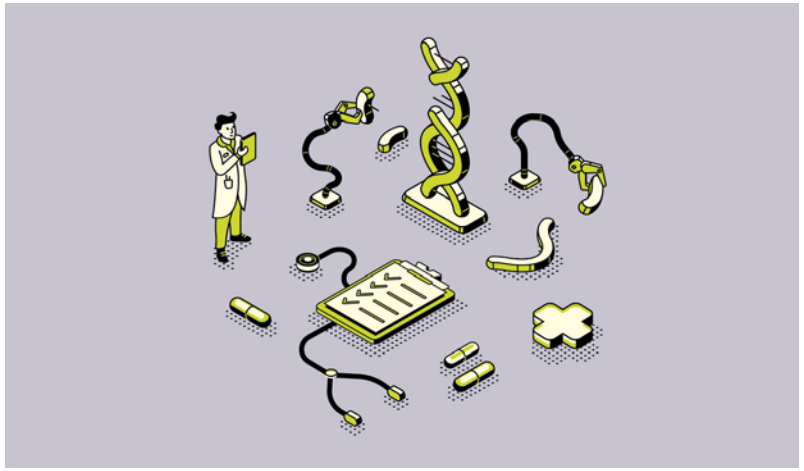


Participation and governance

How can conflicts over future issues in technology and science be resolved democratically?

Focal points:

Repository research; knowledge transfer; global TA; transformation of society



Life and technology

How are new technologies changing biology, medicine, and our human existence?

Focal points:

New biotechnologies; robotics and AI; mechanization of humans; responsible research and innovation

Visions and ethics

How do expectations of the future and ethical considerations shape science, technology, and politics?

Focal points:

Vision assessment; global ethics in science, technology, and innovation

ITAS-EndFo

The research group in numbers (03/2026)
5 Academic staff
1 PhD student
3 student helps

Topics
High-level radioactive waste
Uses of the deep subsurface
Large infrastructures

Inter- and intra-institutional learning

Policy advice

Long-term governance

Radioactive Waste Management as a Socio-Technial Project

Legal aspects in the German site selection process

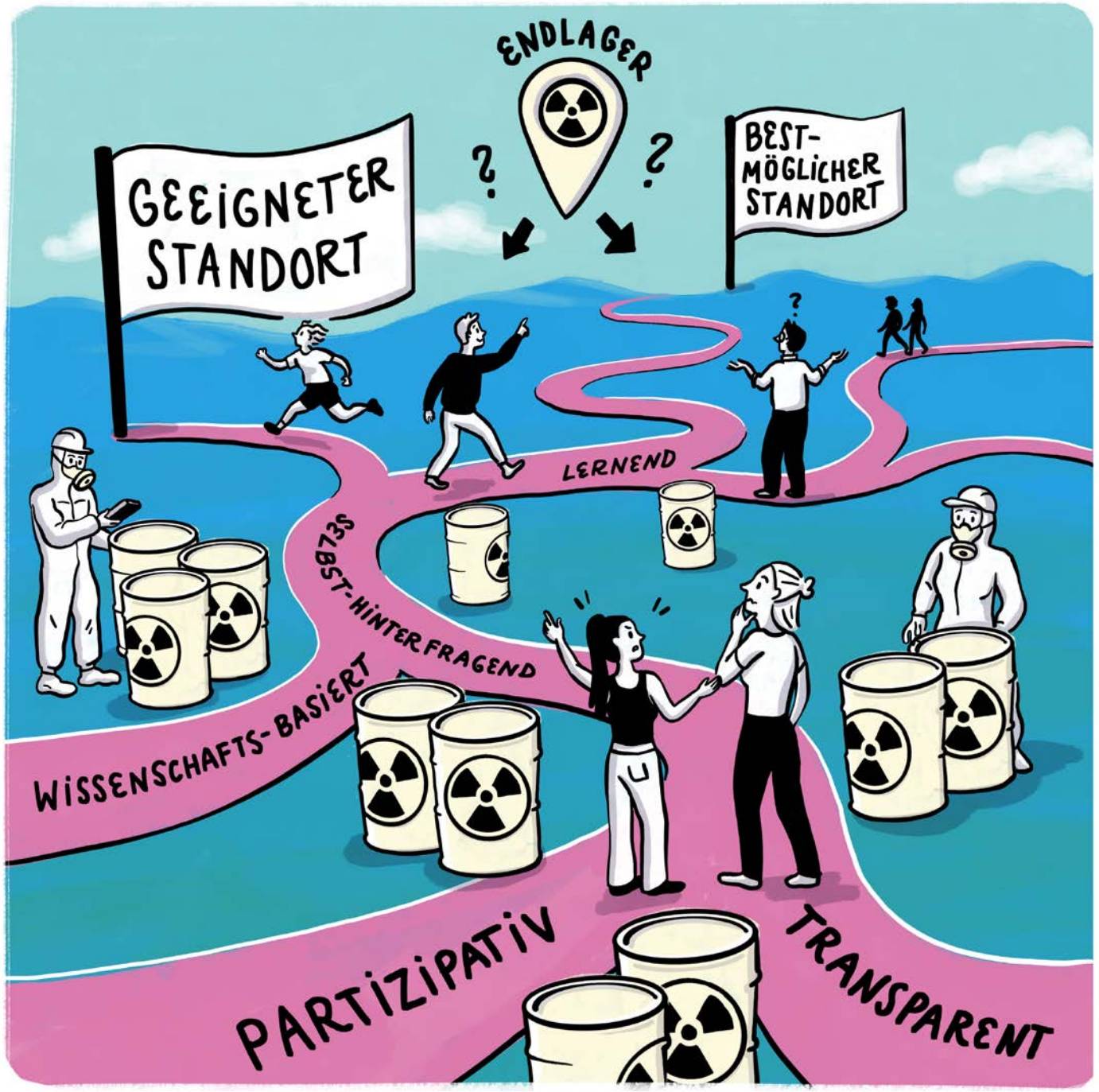
Inter- und trans-disziplinarity

Societal negotiation processes and conflicts

Governance of the deep subsurface

Administrative action

Case: The German Site Selection Procedure for a High-level Waste Repository



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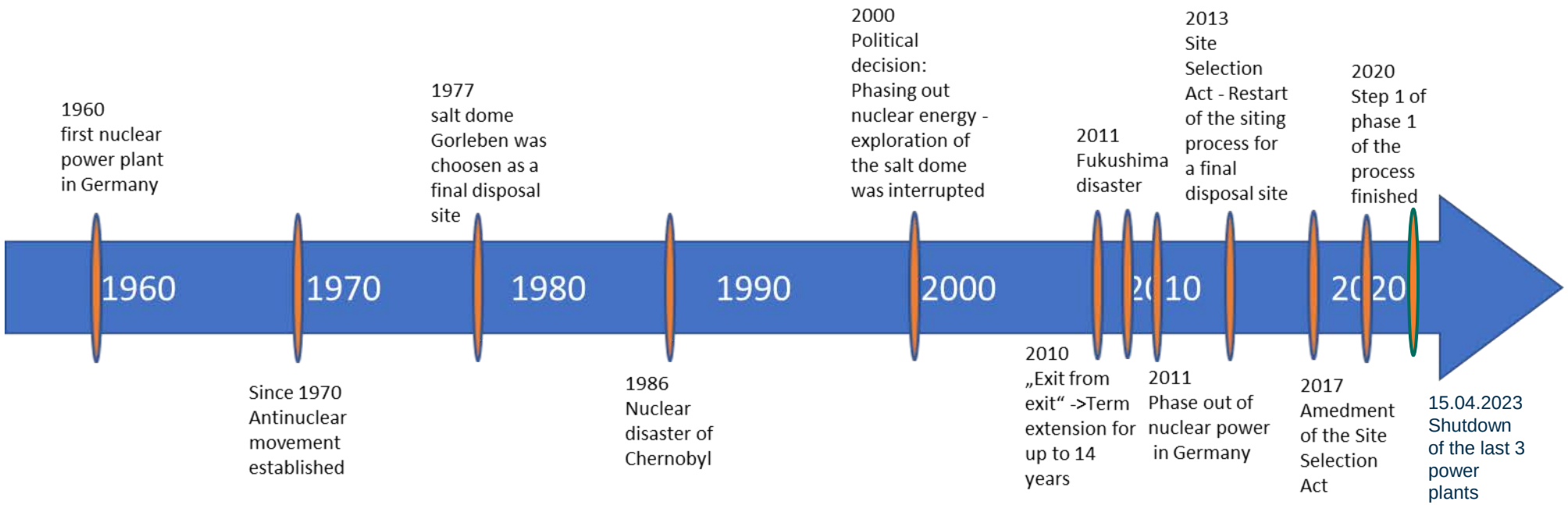
History of Nuclear Waste Governance in Germany



→ Protest against nuclear power, castor transports and the site selection Gorleben

The German Process of Repository Siting

phase 1

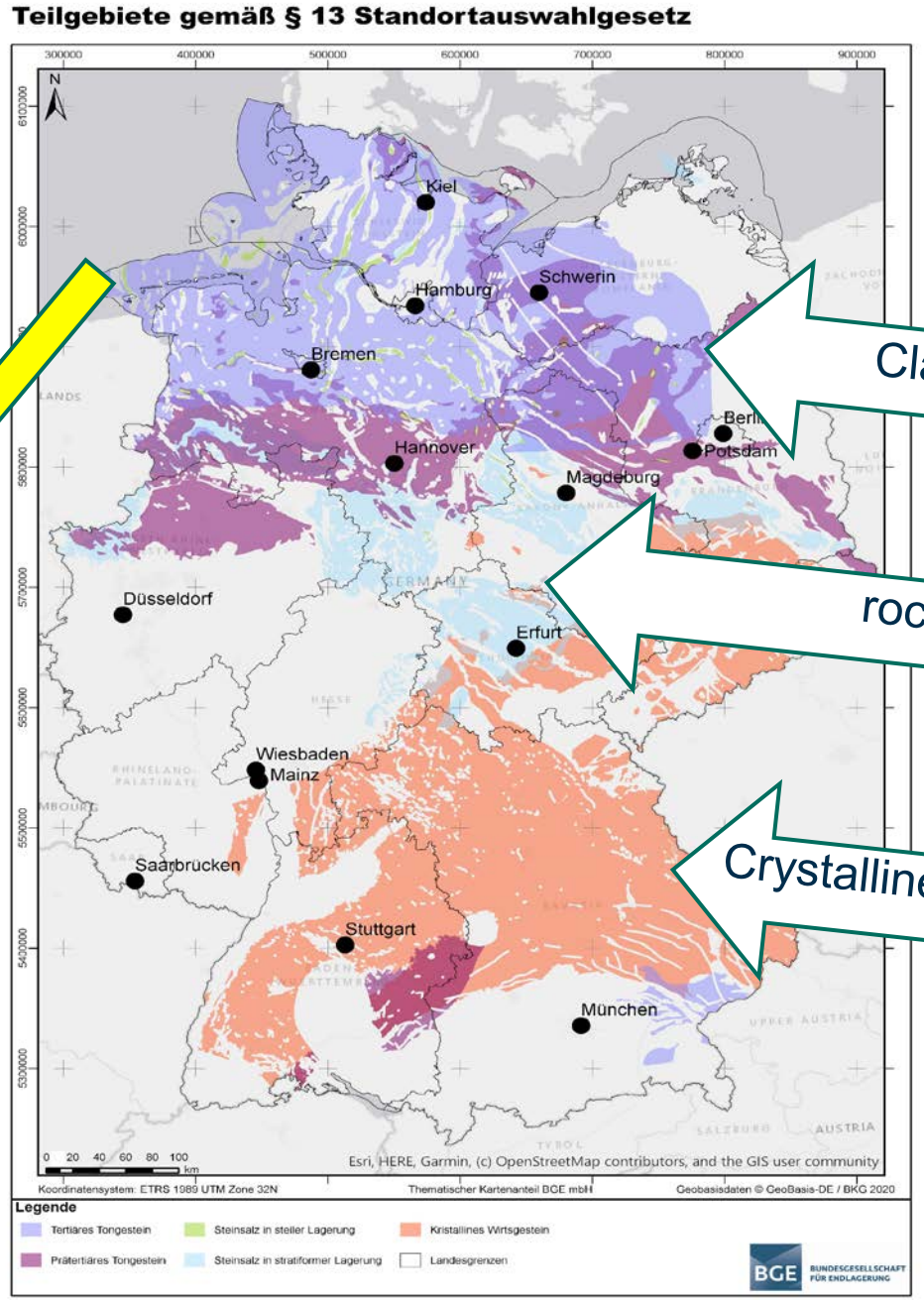
Step 1

Germany as a white landscape

Identification of sub-areas

-> Interim report 09/2020

Public participation (general public participation and s
Legal protection



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The German Process of Repository Siting

phase 1

Step 1

Germany as a white landscape

Identification of sub-areas

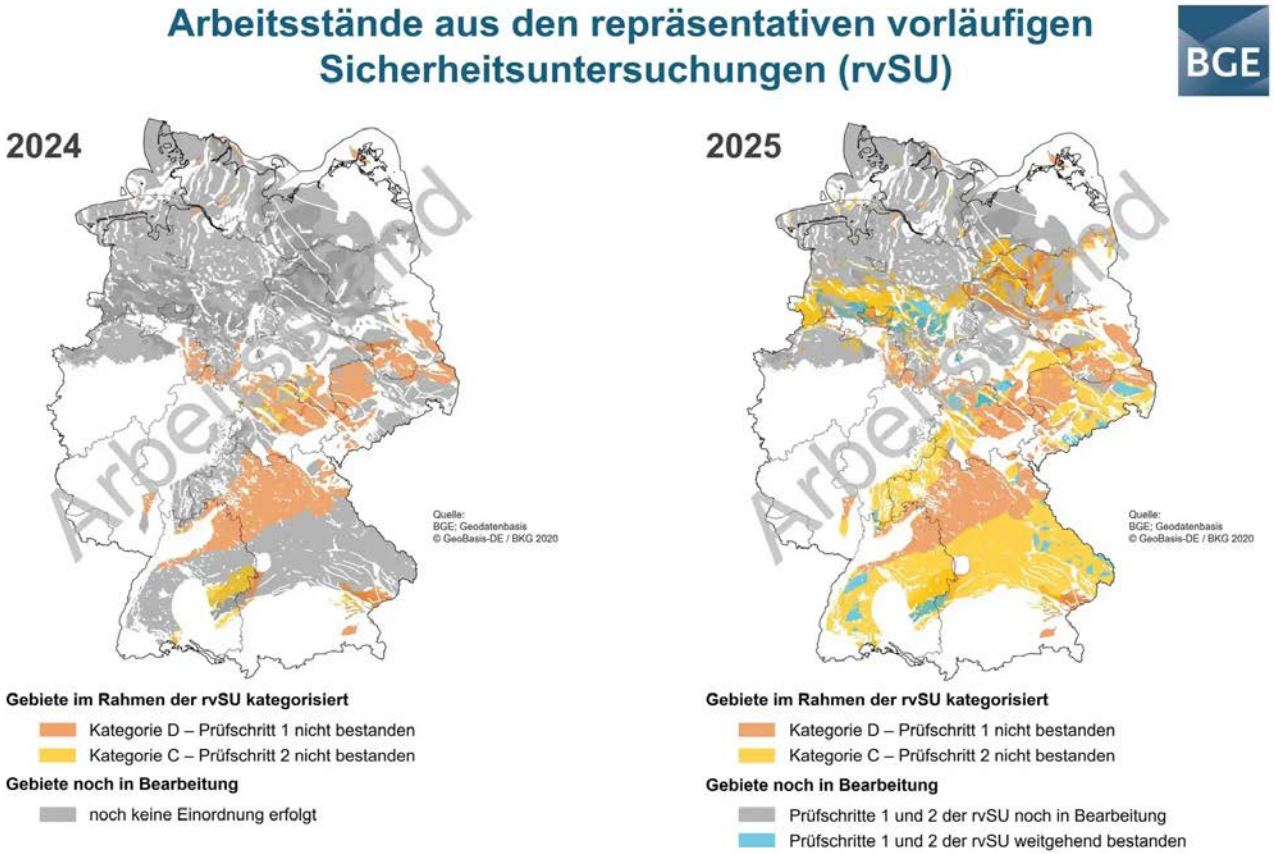
-> Interim report 09/2020

Step 2

Representative preliminary safety analyses

Proposal for regions for surface exploration to the Federal office for the safety of nuclear waste management and the german parliament

act



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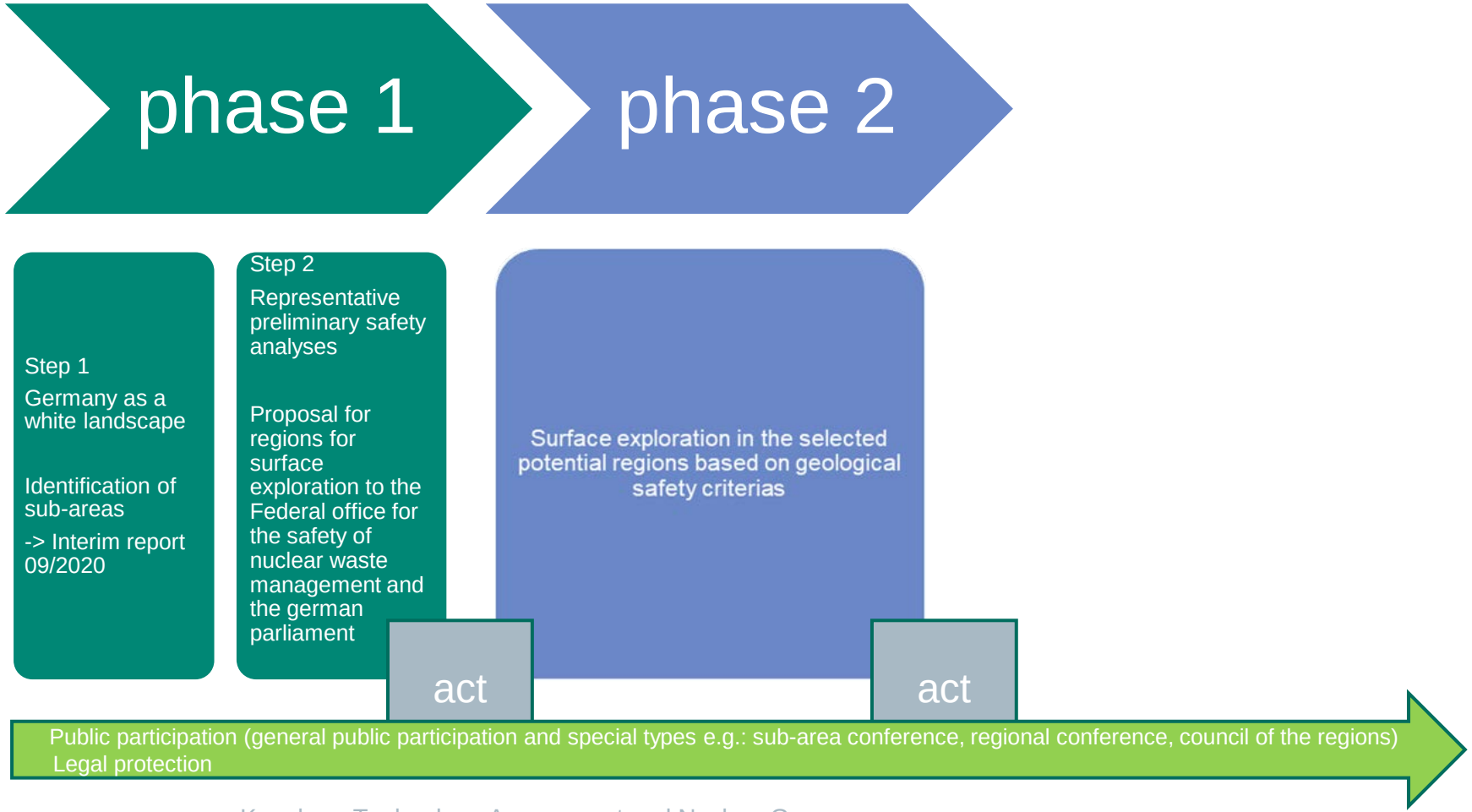
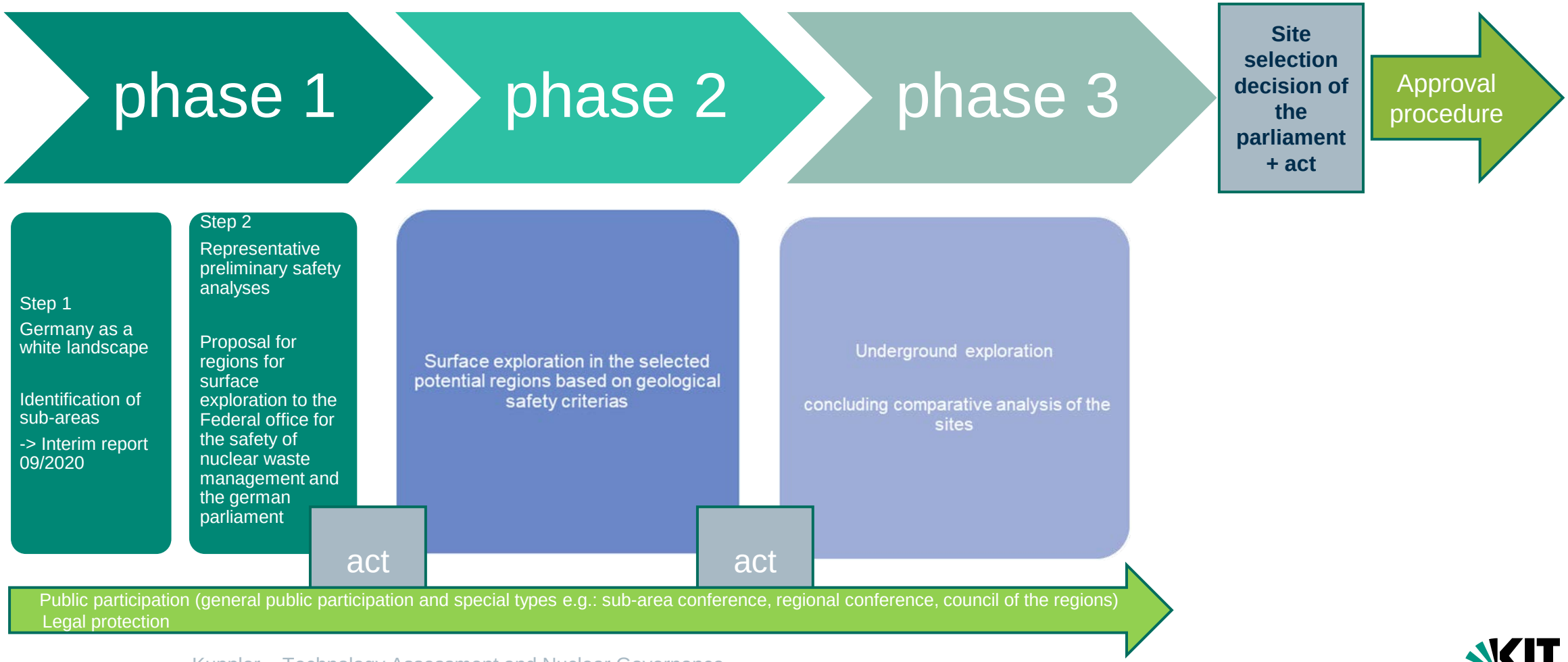
Public participation (general public participation and special types e.g.: sub-area conference, regional conference, council of the regions)
Legal protection

The German Process of Repository Siting



The German Process of Repository Siting



What are Sociotechnical Systems?

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Background

Why do we need to talk about technology in society?

„A divided society“: Dissent on e.g. key questions of the energy transition

- Conflicts due to different interpretations of contemporary problems
- Pressure to act in the face of clear policy challenges: How do we achieve the energy transition? How do we deal with the consequences of climate change?
- Reduction of complexity as necessity for decision-making and as challenge (e.g. Luhmann 2019)

Nuclear Technologies as Sociotechnical System

Definition Sociotechnical System

"[…] a collection of elements, such as technologies, science, regulations, user practices, markets, cultural significance, infrastructures, and production and supply networks (Geels & Kemp 2007: 442)

- Conflicts due to different interpretations of contemporary problems
- Stabilised by rules and practices
- No coordinated, planned processes

- The technical development of nuclear applications are influenced by the meaning attributed to them by relevant actors (cf. Bijker 1997)
  - Actors who attribute different meanings to those technologies may feel unrepresented

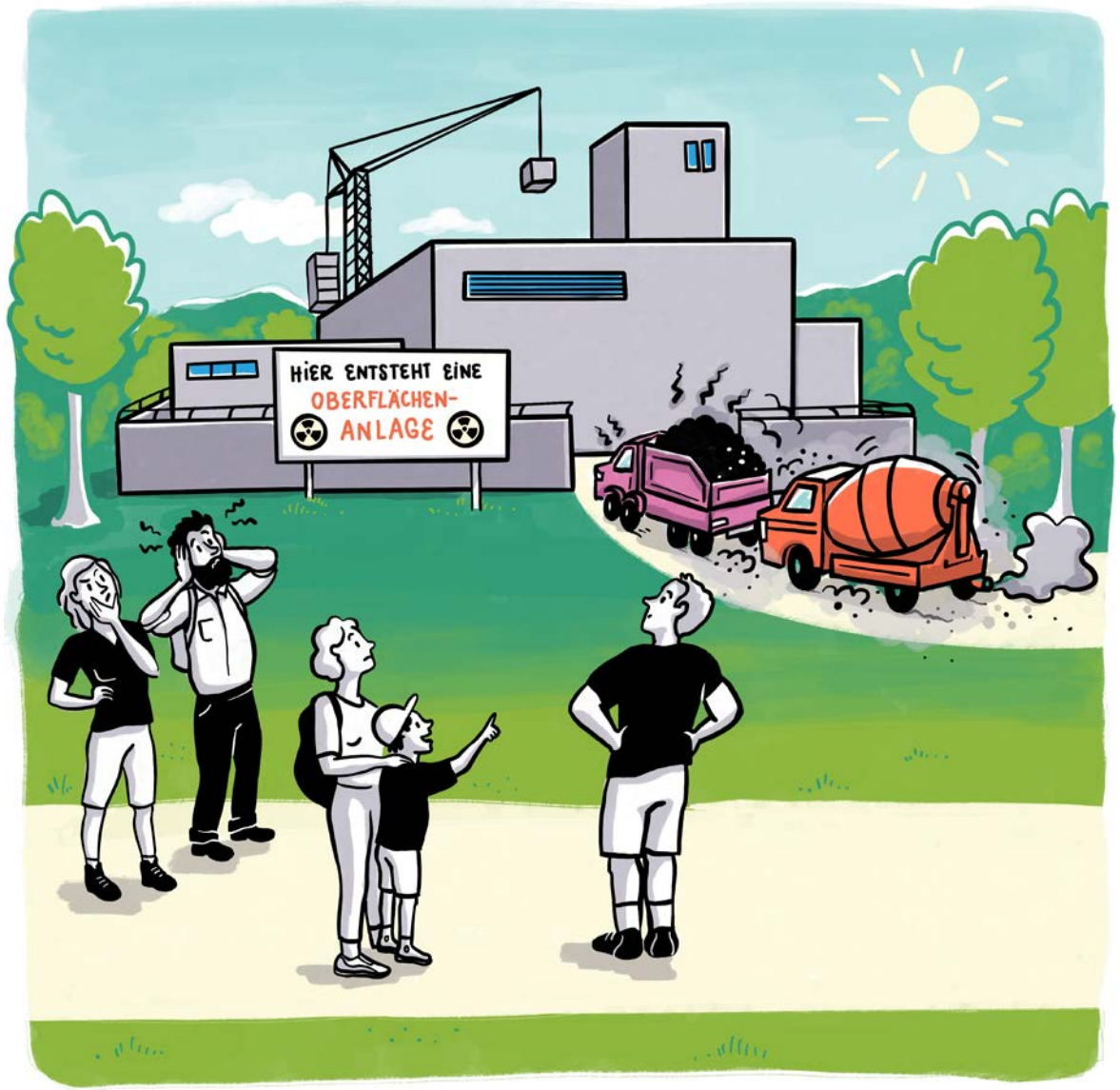
Nuclear Technologies as Sociotechnical System

NIMBY – Not in my backyard

- Traditional view: NIMBY as an ‘irrational’ protest stemming from public ignorance or driven by self-interest
- New approach: NIMBY is linked to social factors including various environmental policy discourses

Sociotechnical innovations as a consequence of climate change / the energy transition

- alter relationships between science, political decision-makers, stakeholders, etc.
- cause conflicts between “old” and “new” ways of thinking and patterns of behaviour (cf. Batel / Devine-Wright 2015).



Nuclear Technologies as Sociotechnical System

Environmental Policy Discourses

„Nine environmental discourses (1-4) (Dryzek 1996)

- „Survival“
  - Nuclear technologies are needed to counter climate change and have to be implemented authoritatively if needed
- „Promethean Answer“
  - Economic growth is always positive and there shouldn‘t be too many restrictions
- „Leave it to the experts: adminstrative rationalism“
  - Environmental problems can be solved through regulation
- Leave it to the people: Democratic Pragmatism“
  - Public participation is necessary to overcome the environmental problems related to nuclear technologies

Nuclear Technologies as Sociotechnical System

Environmental Policy Discourses

„Nine environmental discourses (5-9) (Dryzek 1996)

- „Leave it to the markets: Econonomic Rationalism“
  - Market-based incentives help to encourage compliance with environmental standards
- „Sustainable development“
  - Economic growth, social justice and environmental protection are not mutually exclusive. Nuclear technologies must be assessed in light of these criteria
- „Ecological modernization“
  - Economic growth through environmental protection. Nuclear technologies contribute to a healthy economy, even in the face of climate change
- “Saving the world through a new consciousness: Green Romanticism”
  - Nuclear technologies are an unacceptable intrusion into nature, which has a right to remain intact
- “Saving the world through new politics: Green Rationalism”
  - Environmental protection is a priority in political decision-making.

Risk Society

Socio-technical innovations as a consequence of reflexive modernisation (Beck 1996)

- A partial shift in the meaning of technologies from ‘panaceas’ to causes of undesirable side-effects

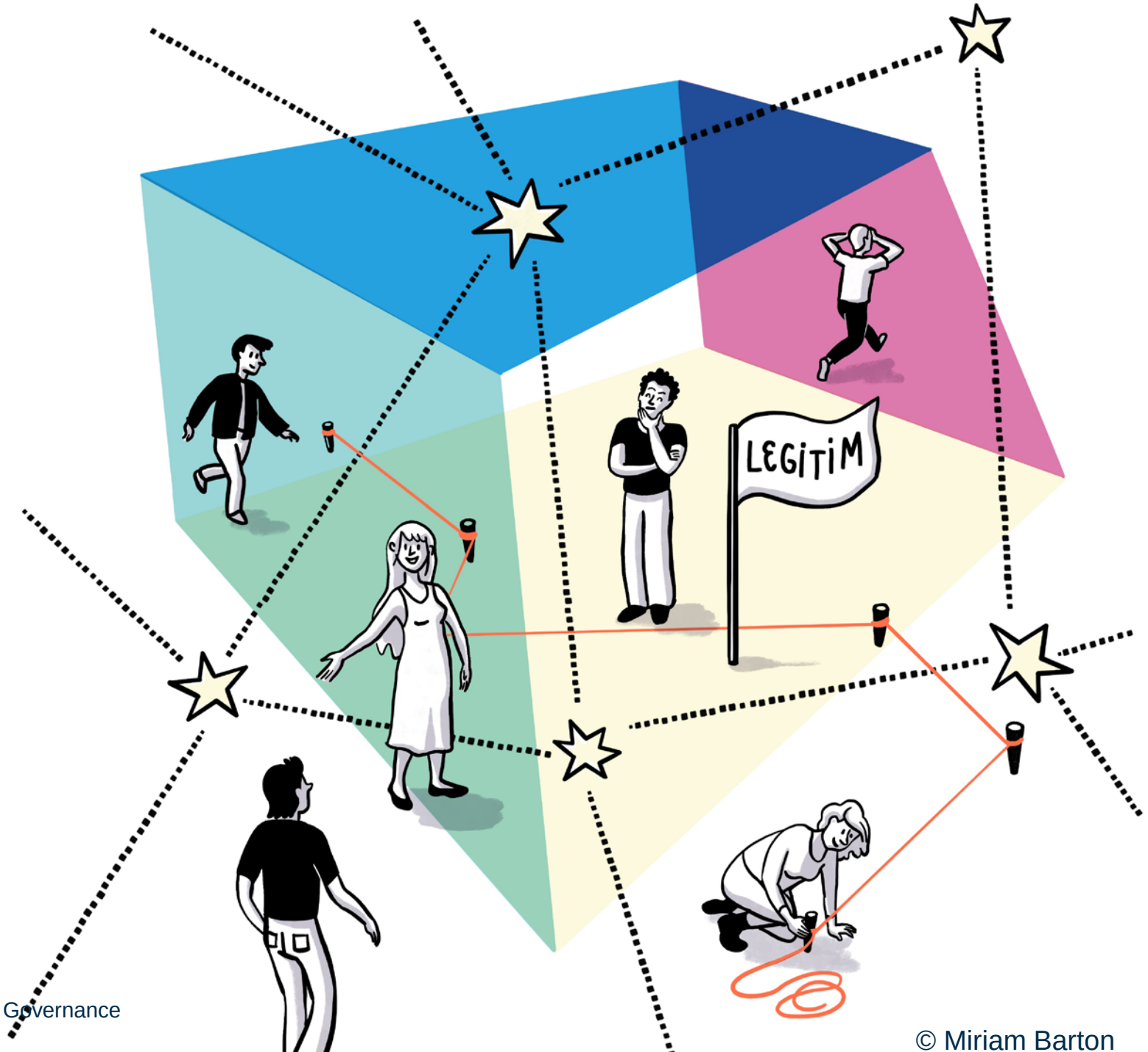
- This shift in meaning is also manifested in
  - institutional change
  - changes in the mode of political decision-making

Risk Society

Nuclear technologies are at the same time

- An investment opportunity for the energy sector
- An opportunity to address the consequences of climate change / a key component of the energy transition
- A source of environmental and health problems
- A tool of power in energy policy (cf. Abbink 2012)
- An intrusion into the lives of local residents (e.g. Habermas 1981)

Technology Assessment and Nuclear Governance



Technology Governance and TA

Participatory TA: involvment of stakeholders / citizens / public / practitioners in (debates on) technology development, regulation and use

Problems at the interface of technology, the natural and built environment and society are not only governed by political decision-makers and administrative staff

→ Governance as analytical concept

- (Governance as normative tool: WTO, etc)

Technology Governance research in TA: How do different actors contribute to decision-making on technologies? How can such processes take place more reflectively?

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Technology Governance

Governance: complex societal processes of cooperation and coordination that lead to decision-making or regulation of a certain problem

Here: used in the context of decision-making in democracies

→ in general, can include “institutional responses from states, markets and communities” (Chhotray&Stoker 2009, p. 192) that takes place in a certain regulatory context and in spaces created by governmental decision-making

Governance

Societal decision-making

- Takes place at many different levels
- Cannot be controlled
- Can be more or less open for different actors depending on the situation
- Is subject to change at different levels
- Highly complex interactions between and expectations of actors
- Multitude of actors with legitimate interests

Government or Governance?

„Government“: classical, formal governmental action

- Participation through elections
- Problems: plural, fragmented society; decisions by political representatives are sometimes not considered legitimate; high complexity of problems to be solved; "ungovernability” of some problems

- „Governance": non-classical actors are involved, mostly informally, at a very early stage in the decision-making process.
  - Participation, e.g through dialogue and deliberation preceding decision-making
  - Involvement in questions of how to shape participation
  - Promise of increased efficiency and legitimacy

Technology Governance

„[…] the process of exercising political, economic and administrative authority in the development, diffusion and operation of technology in societies.” (OECD)

- Particularly challenging in the case of „wicked problems“ (Rittel&Webber 1973)

1. Many stakeholders involved with different views on the problem and demands regarding possibilites for participation → more than one solution possible

Conflicts in Technology Governance

Knowledge Conflicts

- *Conflicts on relevant bodies of knowledge and their interpretation*

Conflicts of Interest

- *Conflicts on the distribution of good or bads*

Value conflicts

- *How to weigh different values in problem solving?*

Power conflicts

- *Who gets to take part in decision-making and in what role?*

Conflicts of recognition

- *Arise when individual rights and freedoms are disregarded, e.g. regarding democratic participation*

Government Approaches to Conflict Resolution

Established modes of conflict resolution, e.g. in form of laws, directives and administrative procedures

- Example: Planning approval procedure (land use)

1. In Germany: Takes place when operator applies for licence to build
2. Directly affected persons can assert conflicts of interest
3. Balancing of interests

Critique

- Late possibilites for public participation (when plans are already quite set)
- Only conflicts of interest are dealt with

Possibilites for cooperative decision-making

Conflict resolution through the identification of conflict levels

- Norms
- Interests
- Technology
- The sincerity of the actors involved
- The quest for recognition (political participation) (cf. Honneth 1992, Coser 1956)

Early detection of emerging problems by drawing on the knowledge of local actors

Ideally: establishing acceptability

Basic criteria for success

Cooperative decision-making needs to fulfil certain criteria to be able to succeed

- “Checks and Balances”

- Transparency

- Appropriate handling of scientific information

- Problem-oriented involvement of relevant actors/stakeholders in the policy cycle

- Fairness (minimal disparities in power and resources among actors)

- Interest in participatory processes among all actors (e.g. civil society, policymakers, businesses)

Public Participation as Panacea?

Early forms of public participation already in the planning stage are increasingly called for and implemented

- „participatory planning“, „deliberative turn“

Challenges: public participation

- can have many different objectives
- takes time and resources
- requires willingness to listen and adapt on operator‘s side
- needs clear communication on limits and objectives
- can lead to frustration among participants if not properly designed and communicated

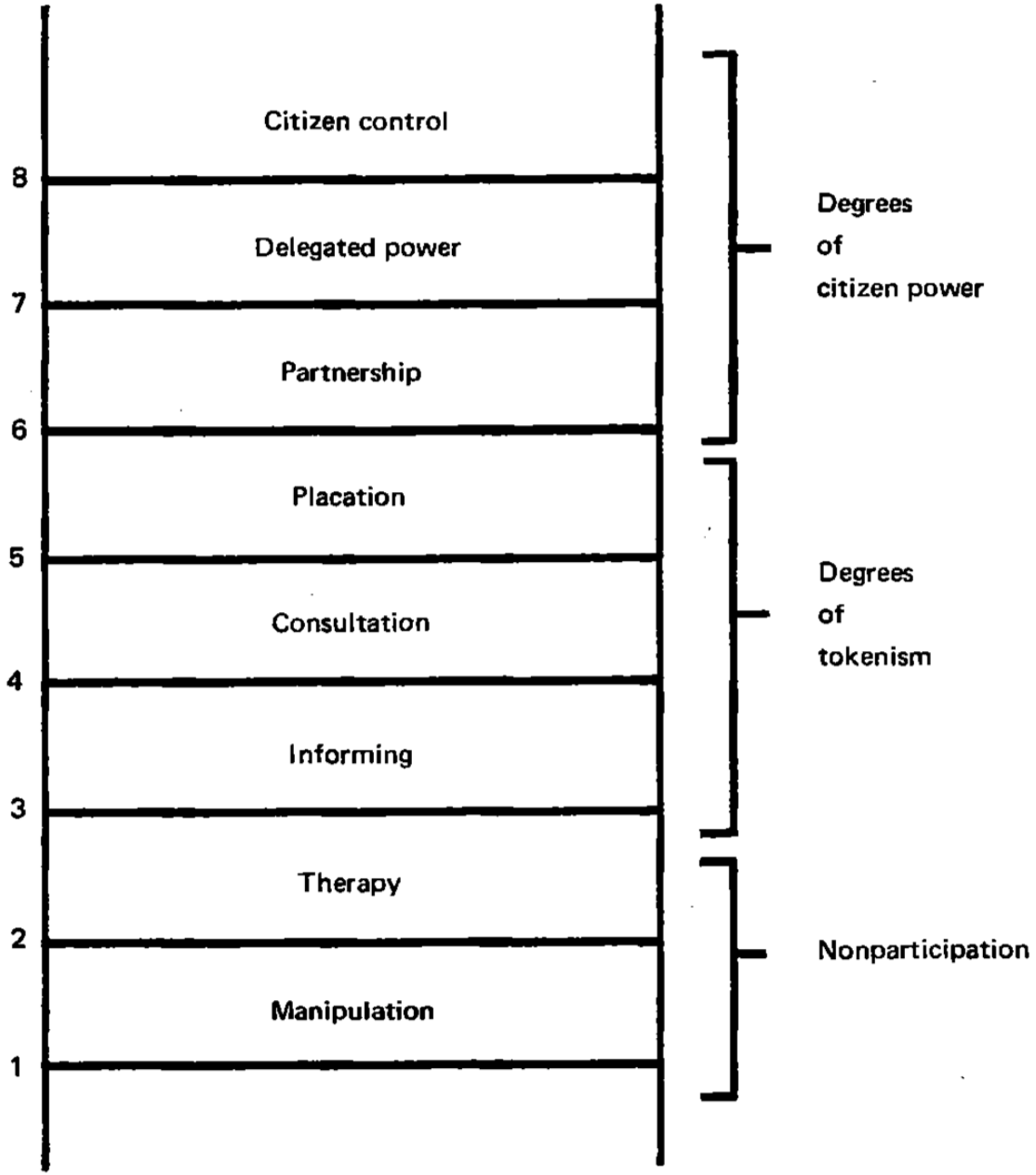
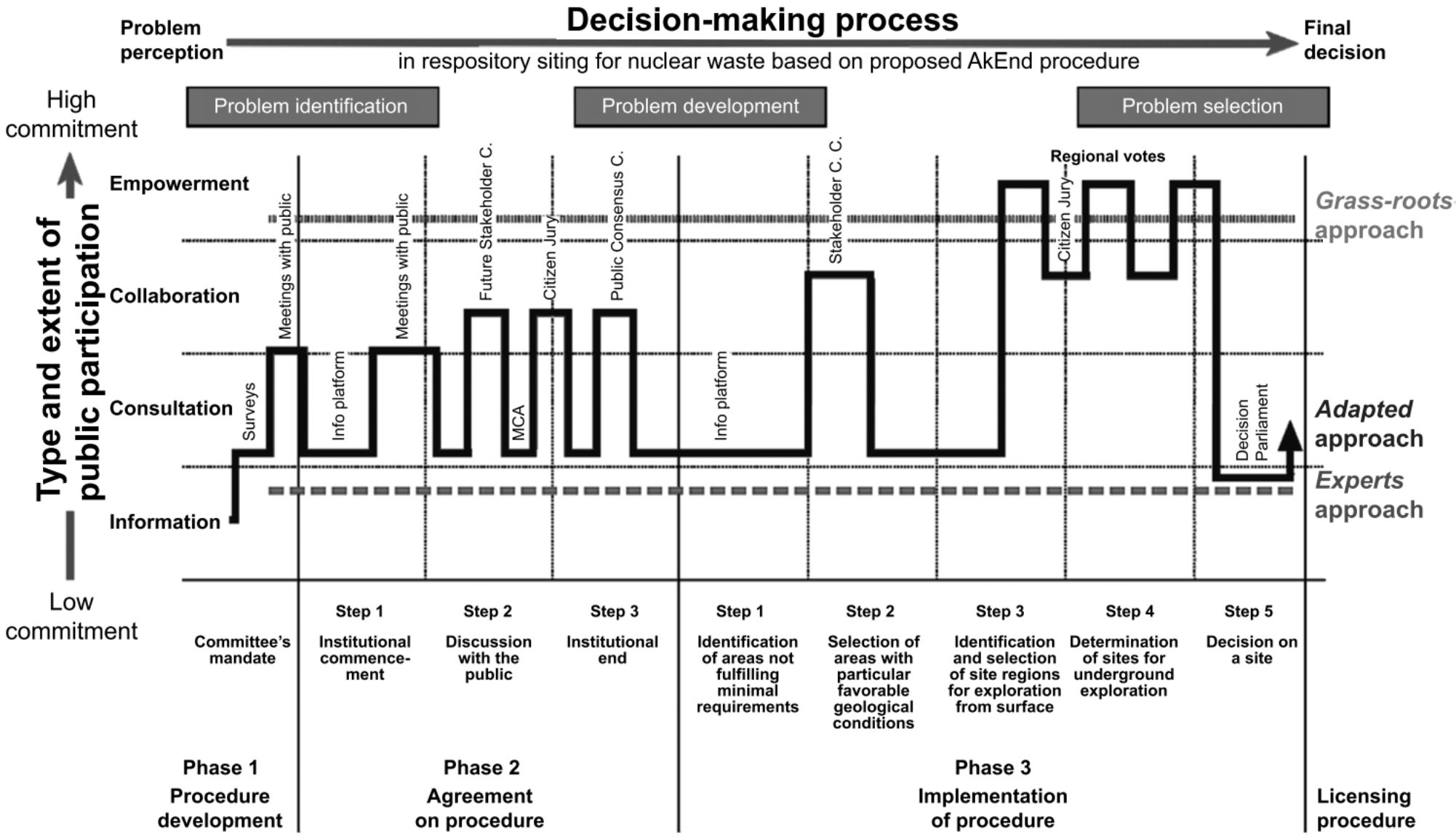


FIGURE 2 *Eight Rungs on a Ladder of Citizen Participation*

Public Participation as Panacea?

Arnstein 1969, p. 217



One idea: functional-dynamic public participation

Krütli et al. 2010, p. 7

What role for TA in Technology Governance?

TA has several relations to Technology Governance:

- As „honest broker“ (Pielke) offering alternative routes of action and their consequences
- Conducting research on public participation related to technological questions
- Offering reflection in early stages of technology development
- Uncovering hidden conflict lines, e.g. on ethical questions
- …

Roles of Technology Assessment

- Assessment (Grunwald 2014)
- Zeitdiagnose (diagnosis of the present) (Alpsancar 2018)
- Policy advisor (u.a. Normann und Paschen 2000)
- Visionary? (u.a. Hermeneutik Sand, Grunwald, Nordmann 2024)
- Bildungsangebot (educational programme) (Beecroft und Dusseldorp 2009)
- Facilitator of participatory processes (u.a. Grunwald 2000)

- In the project context: Consultant to other sciences on issues of social acceptance, ethics and the integration of technologies into everyday life
- Expert in complexity preservation and systems thinking
- Science communicator with scientific standards
- Activist with a commitment to transformation
- Researcher with interdisciplinary expertise

Slide by Gondolf / Dobroc 2026

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Thank you for your attention

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