Ministerie van Klimaat en Groene Groei

The future perspective of salt mining in the Netherlands

Technical perspective in policy domain

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Future perspective of salt mining in the Netherlands

- Salt mining & hydrogen storage
- Dealing with risk in the energy transition
- Innovation and research
- Technical perspective on hydrogen storage risks
- Bridging the technical and social perspectives

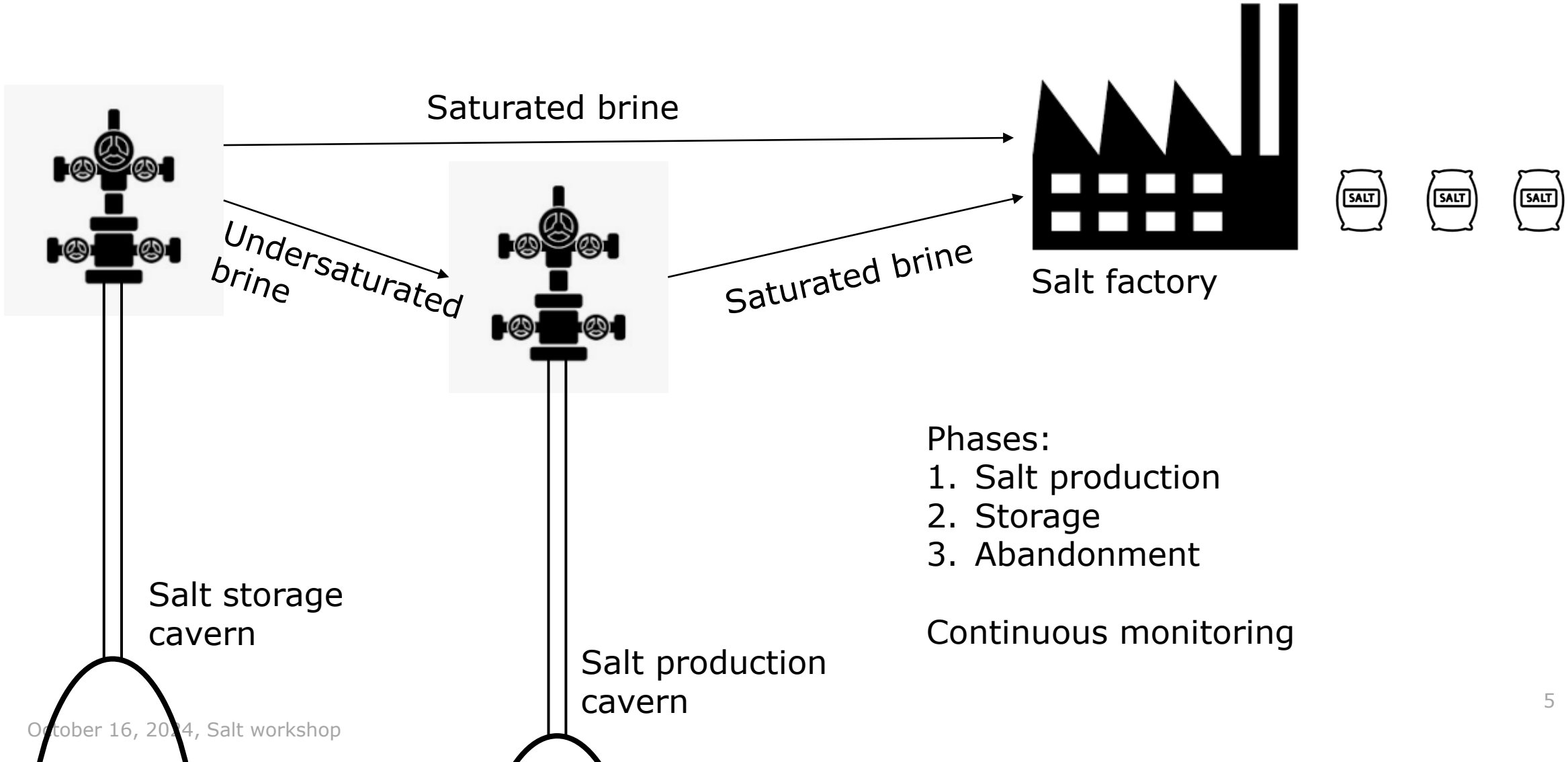
Future perspective of salt mining in the Netherlands

- Salt mining => hydrogen storage
  - No salt mining = no hydrogen storage = no energy transition
  - between 30 and 60 hydrogen caverns in 2050 are probably needed and will increase prosperity (MKBA TNO)
- Salt as a raw material
  - Strategic independence
  - Reliable availability of material for a.o. energy transition
- Political background
  - Groningen seismicity
  - Distrust of government, science, operators

Safe and responsible use of the subsurface

- Safe:
  - Risk analysis => mining law
    - Subsidence risk
    - Seismicity risk
    - Environmental risk
- Responsible:
  - Socially responsible
  - Avoid damages occurring
  - Importance of the energy transition
  - Strategic independence
  - Reliable availability

Salt production and storage are connected



Phases:
1. Salt production
2. Storage
3. Abandonment

Continuous monitoring

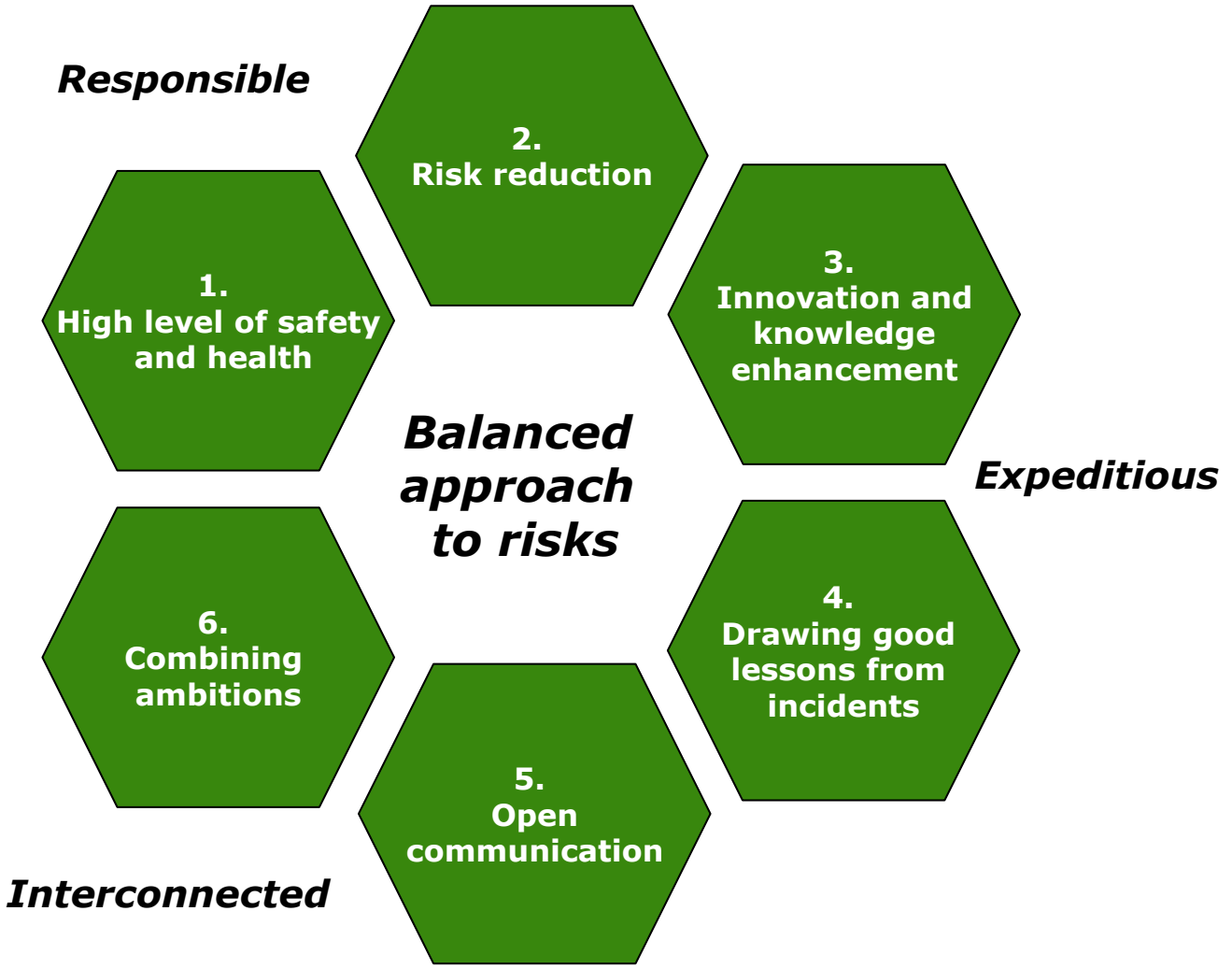
Risk in the energy transition

6 policy principles

- Risk=probability x effect
- Risk is never 'zero'
- Total risk after energy transition are lower than now*
  - Local/regional differences
  - Safe and responsible use of the subsurface

How to deal with uncertainty?

- Reduce uncertainty (data, research, (pilot) projects, monitoring)
- Mitigate uncertainty (monitoring, policy, supervision)



*source: Letter to Parliament, November 4th 2022 Dealing responsible with safety and health in the energy transition (Dutch: *verantwoord omgaan met veiligheid en gezondheid in de energietransitie)*

Balanced approach to risk
combining perspectives

Government sets stringent demands for activities with renewable energy…

… similar risks will not be judged more strictly than fossil energy activities

If an activity meets the government norm it is safe enough, residual risk is admissible …

… intention to further reduce risks, insofar as proportionately possible

Government exercises restraint prescribing technical or spatial requirements …

… although those may be the most suitable option in some cases

Risk analysis based on realistic assessments …

… reduce uncertainty by enhancing knowledge and applying new insights alertly

Room for innovation and experiment …

…with policy frameworks, knowledge sharing and drawing lessons from incidents

Communication takes account of perceptions and acceptance of risks …

… based on accurate and representative research

Government combines policy ambitions …

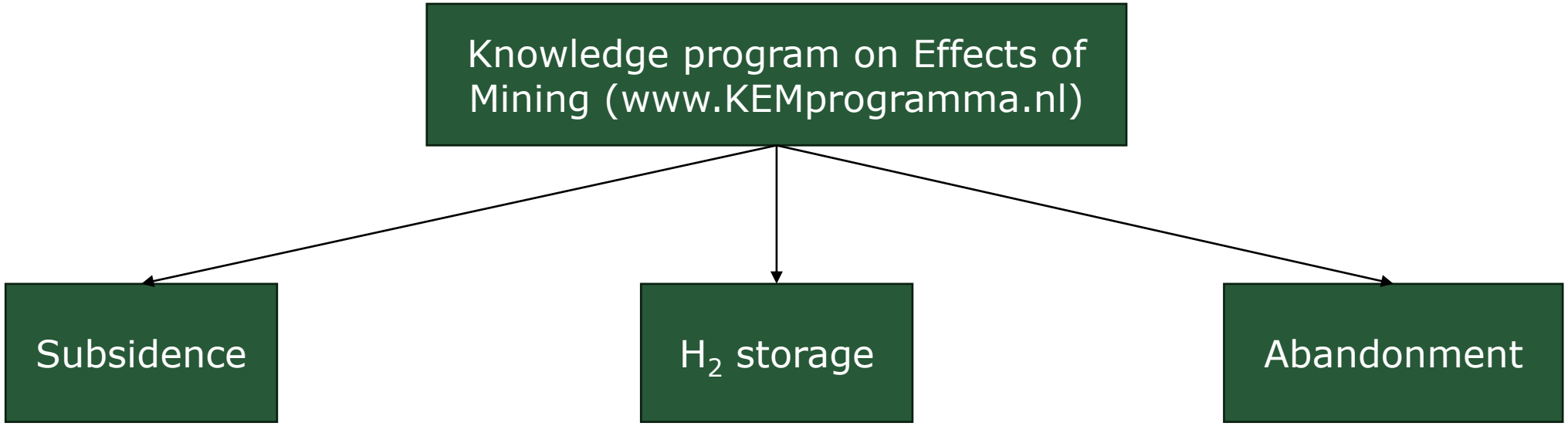
… making them mutually reinforcing and not get in each other's way

Activities related to renewable energy must comply with the rules and regulations …

… unintended bottlenecks will be resolved

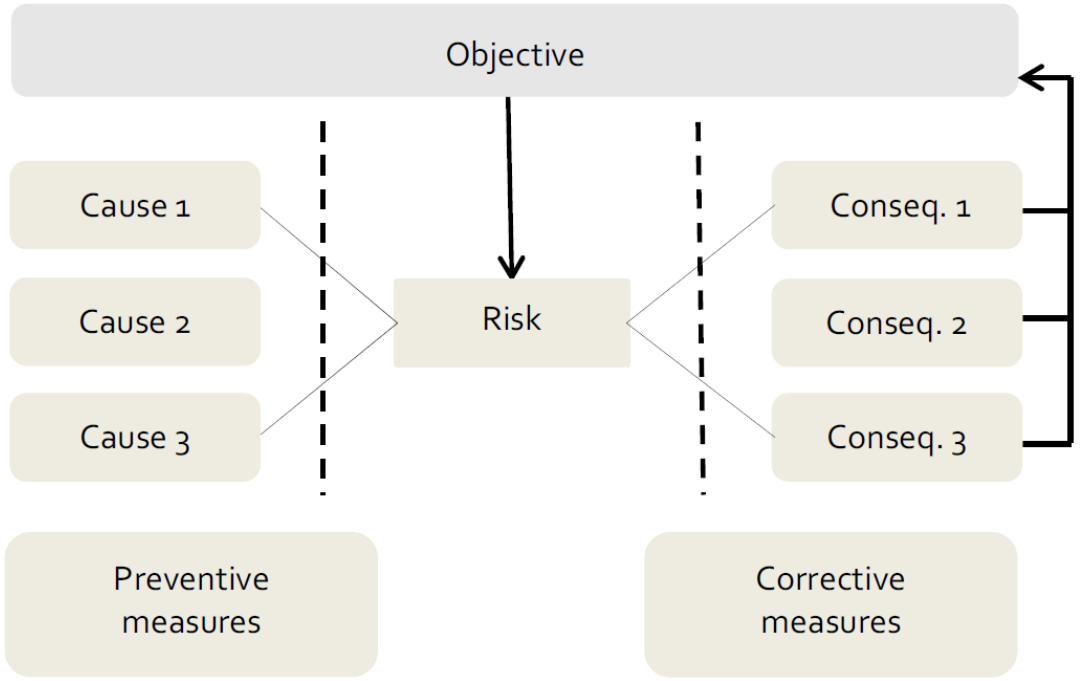
source: folder dealing with risks in the Dutch energy transition, conference june 27th

3. Innovation and knowledge enhancement - Ongoing research



	Subsidence	H_2 storage	Abandonment
KEM	- KEM-16 - KEM-47 - KEM-48	- KEM-28	- KEM-17
Other	GEMMA (CM/IMG) TNO/TU Delft research DEEP-NL	European research TCP task 42	CCC research Operators

KEM-28 Risk assessment for Underground Hydrogen Storage (UHS) in Salt Caverns and Interaction with other Underground Storage Locations



Few of the recommendations:

- Hydrogen storage in salt caverns is technically feasible
- Site-specific risk analysis is needed
- Preference for new caverns (H_2 en H_2S certified material)
- Start small, low frequency storage, do monitoring and research
- Share experiences and results

Source: KEM-28 report, published on KEMprogramma.nl

Technical perspective on hydrogen storage risk in salt caverns (risk policy principle 1, 2, 3 and 5)

- Experience with storage in salt caverns (natural gas, petroleum (strategic reserves), nitrogen)
- Learn from other countries:
  - Gas storage caverns
  - Hydrogen storage caverns
    - Pilots
    - Existing (UK 1 location, USA 2 locations)
- Share results from research (this workshop) and experiences
  - Tell the same technical story
- Site specific risk analysis is needed!
  - Scale (laboratory, cavern, dome scale) => safety, interactions
  - Risks => subsidence, seismicity, environmental
  - Transparant and understandable communication about risks

Policy perspective on hydrogen storage risk in salt caverns – mining law (risk policy principle 1, 2, 3 and 5)

- Risks:
  - Norms
  - Subsidence risks
    - Abandonment of caverns
    - Salt creep
    - Long term subsidence
    - Integrity
  - Seismicity risks
    - Microseismicity
    - Probability of felt events
  - Environmental risks
    - Leakage
    - H_2S formation
    - Blow-out
    - Integrity
- Reducing/mitigating risk :
  - Role of supervisor
  - Monitoring
    - Microseismics
    - Cavern shape
    - Subsidence
    - Pressure, temperature
  - Modelling (dome, cavern, lab scale)
    - Integrity
    - Subsidence
    - Seismicity
  - Experiments (lab)
  - (pilot) Projects

Bridging the technical and social perspectives

- How to bridge the gap?
  - Government needs to be clear about ambitions
    - **Risk policy**
    - Program sustainable use of the subsurface
    - Distribution of benefits and burden
    - **Transparant, clear, understandable communication**
  - **Knowledge development, knowledge sharing** and communication
    - Transparant
    - Accessible
    - Avoid unrealistic expectations
  - Involve stakeholders at an early stage
    - Development of policy
    - **Decision licensing**
    - Specific local projects (operator)

Questions?