



JYVÄSKYLÄN YLIOPISTO  
UNIVERSITY OF JYVÄSKYLÄ

# **Envisioning CCS in the Nordic Context: Trends, Uncertainties and Scenarios**

BCF, 8-10 October 2025, Tallinn, Estonia

Ehsan Marzban, PhD

Postdoctoral Researcher

Department of Social Sciences and Philosophy, Finland

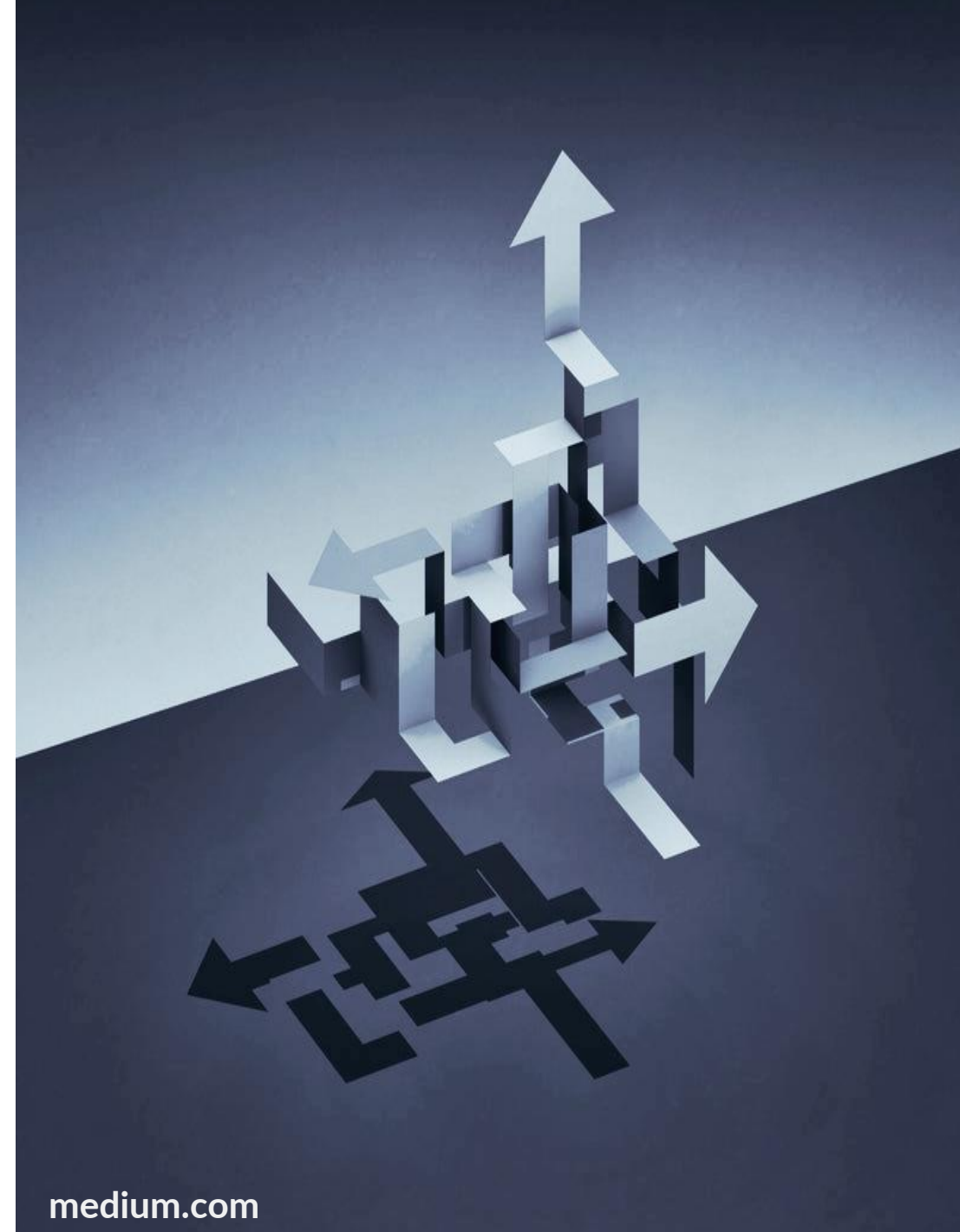
# Content



- ❑ **Background**
- ❑ **Objectives and Key Questions**
- ❑ **Methodology**
- ❑ **Results and Discussion**
- ❑ **Concluding Remarks**

# Conceptual background: a futures-oriented review

- **Non-technical dimensions influencing the deployment of CCS**
- **Exploring alternative futures through a futures studies approach**



# Objective

- Exploring the possible futures of CCS-related technologies in the Nordic region by 2050

# Questions

- What are the main drivers and uncertainties in the deployment of CCS?
- What scenarios can be imagined for CCS by 2050?



# Research Methodology

01

---

## Thematic Analysis

Extensive literature review examining CCS deployment factors in Europe

02

---

## Expert Survey

17 of 63 Nordic CCS experts responded, from Business, Academia, Policy and law

03

---

## Scenario Development

Scenario analysis through a focus group to explore alternative futures

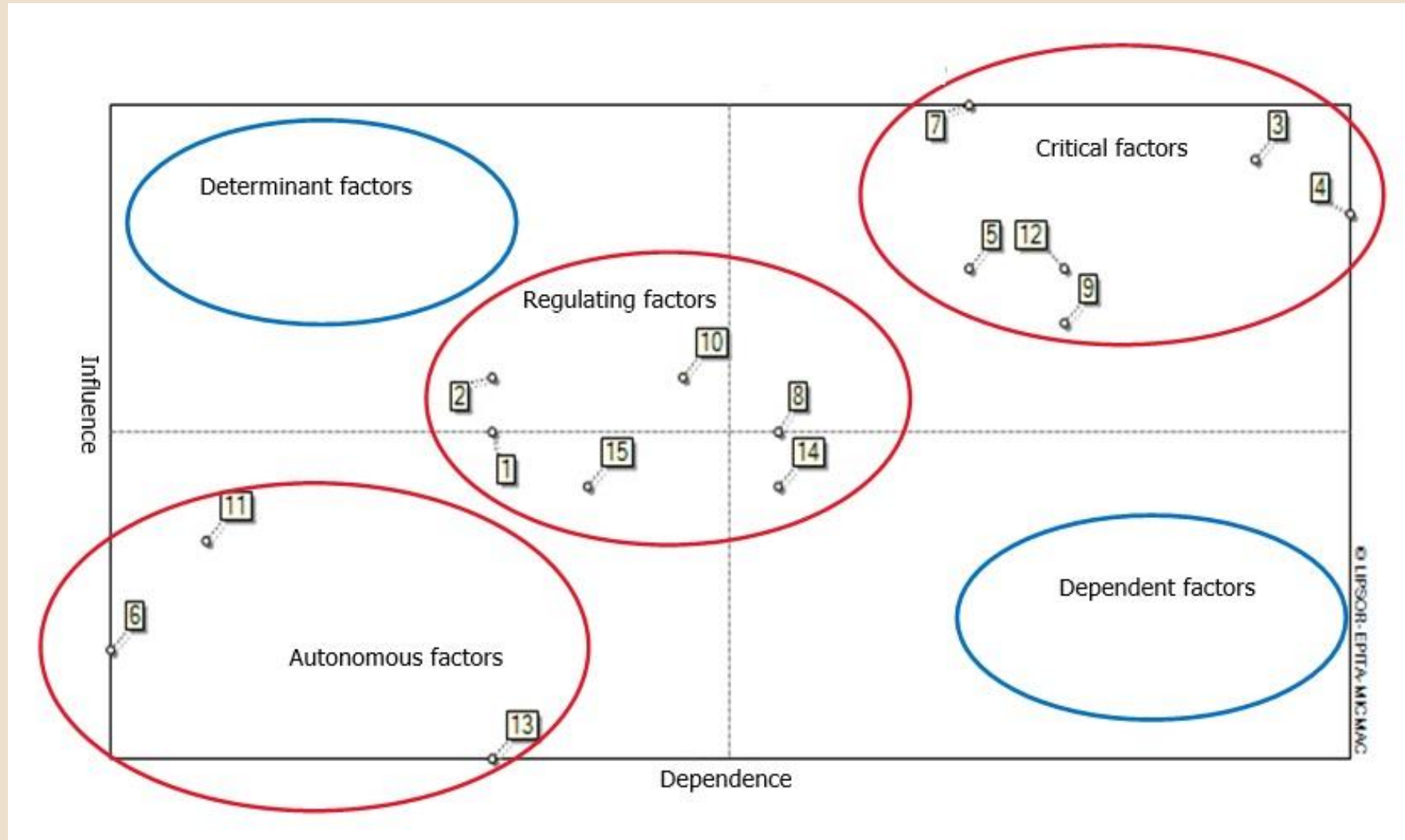


# The list of key factors



Raw	Category	Themes: Key factors
1	Social and cultural	Public knowledge of CCS
2		Communication and dissemination
3		Social acceptability
4		Risk/benefit perceptions
5		Trust in key actors
6		Cultural orientation
7	Political and legal	Political development
8		Regional and international commitments
9		Regulatory framework
10		Liability regime
11		Geopolitical circumstances
12	Economic	Funding and business models
13		Accounting issues
14		CCS market integration
15		MRV issues

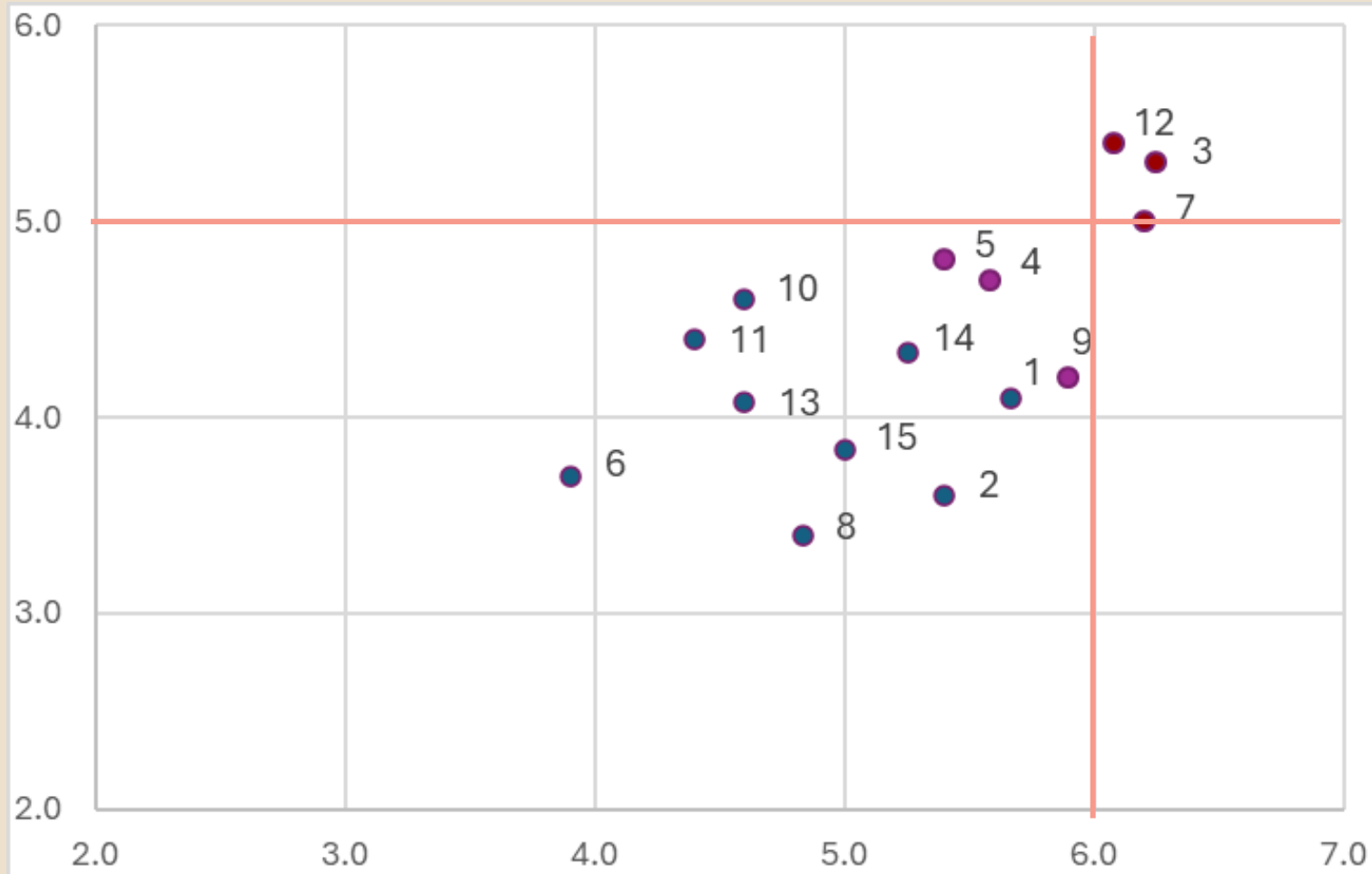
# Cross-impact analysis results



# Importance-uncertainty analysis results



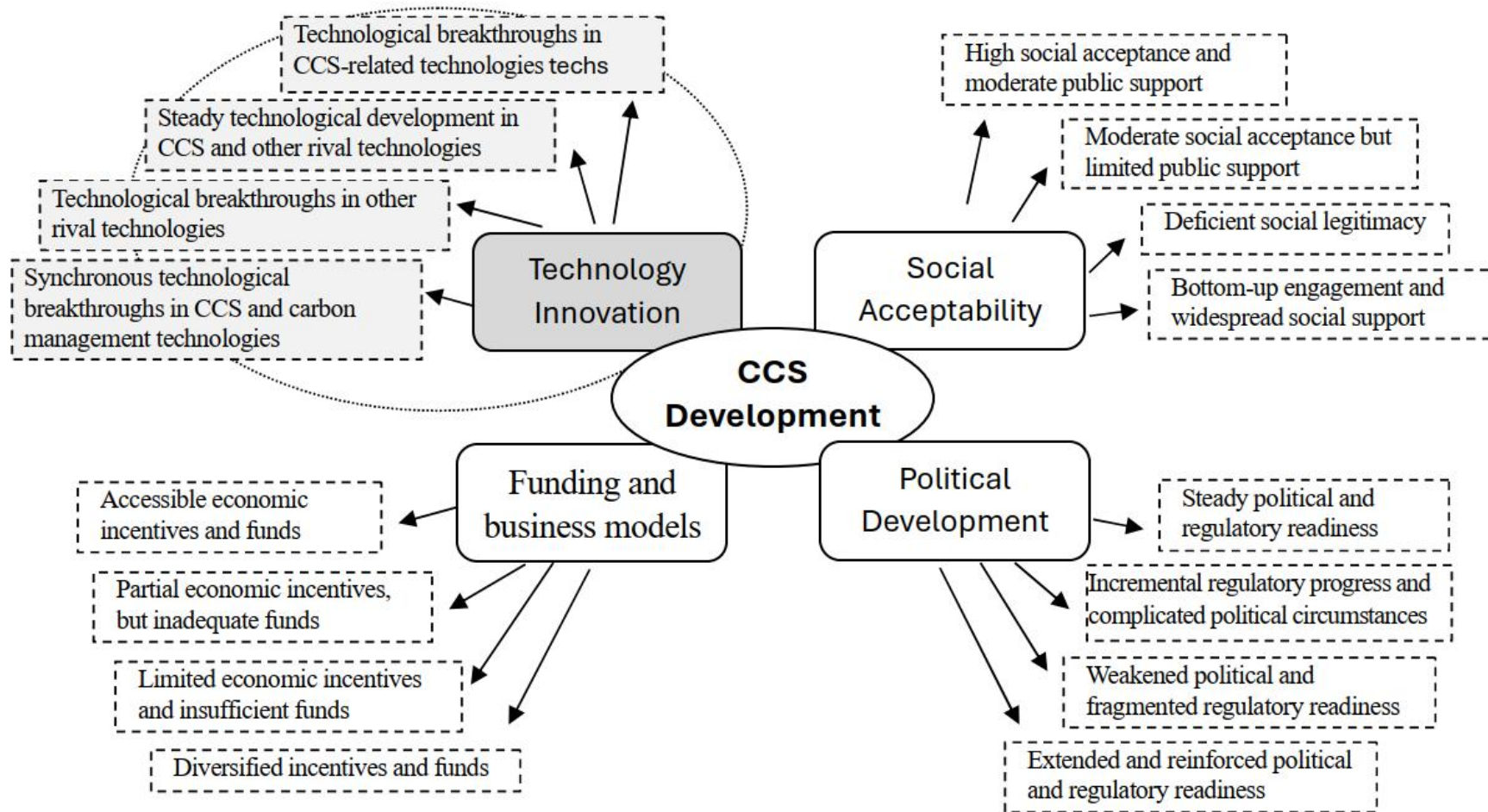
Uncertainty



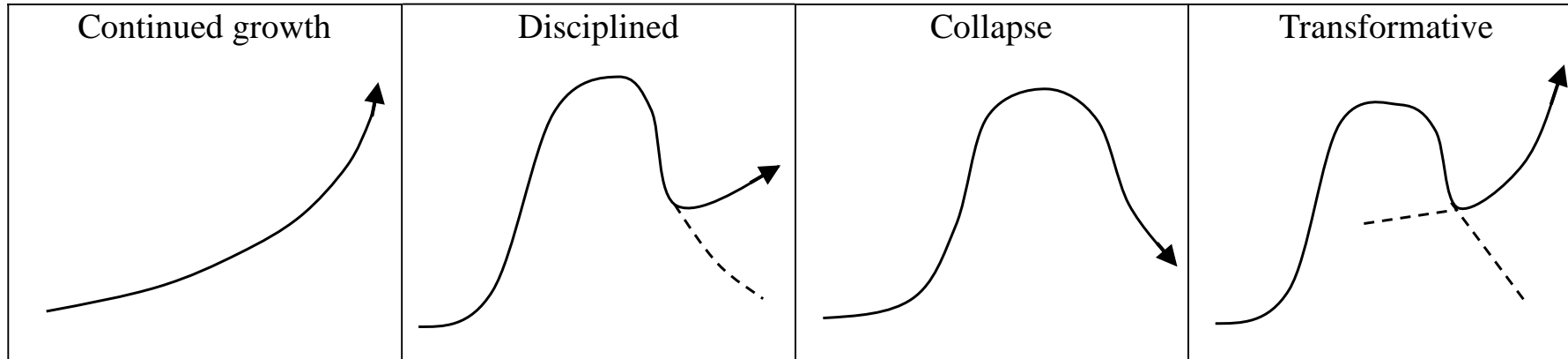
Funding and business models  
Social acceptability  
Political development

Importance

# Results: drivers and uncertainties



# Dator's Four Generic Alternative Futures


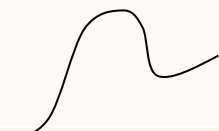

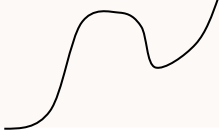


Dator (2009)

- 1. Continuation** (Consistent growth and continuation of current trends)
- 2. Limits and Discipline** (adapting to increasing internal or environmental constraints)
- 3. Decline and Collapse** (system degradation or failure as crises unfold)
- 4. Transformation** (socio-technical innovations disruptively alter the system)

# possible scenarios of carbon capture and storage technologies in 2050



No	Grow path	Scenario title	Main technological focus	Main climate strategy focus	Captured carbon MtCO <sub>2</sub> /year	Main trends (uncertainties) regarding Carbon Capture
S1	Continued growth 	<b>Seamless deployment</b>	<b>Storage: (CCS)</b>	Emission mitigation	80	Technological breakthroughs in CCS-related technologies High social acceptance and moderate public support Steady political and regulatory readiness Accessible economic incentives and funds
S2	Limits and discipline 	<b>Obstacle-ridden implementation</b>	<b>Storage and utilization: (CCUS)</b>	Emission reduction Carbon utilisation	56	Steady technological development in CCS and other rival technologies Moderate social acceptance but limited public support Incremental regulatory progress and complicated political circumstances Partial economic incentives, but inadequate funds
S3	Decline and collapse 	<b>Stagnation</b>	<b>Renewables Energy efficiency</b>	Emission prevention Zero-carbon alternatives	18	Technological breakthroughs in other rival technologies Deficient social legitimacy Weakened political and fragmented regulatory readiness Limited economic incentives and insufficient funds
S4	transformative 	<b>Negative emissions boom</b>	<b>CCUS DACCS BECCS</b>	Carbon removal Emission reduction Carbon utilisation	118	Synchronous technological breakthroughs in CCS and carbon management technologies Bottom-up engagement and widespread social support Extended and reinforced political and regulatory readiness Diversified incentives and funds

# Policy implications for the Nordic region



- 1. From top-down to bottom-up:** The Nordic region could serve as a prototype for participatory CCS policy, co-created with diverse stakeholders.
- 2. Uncertainties matter:** CCS strategies should account for a range of plausible uncertainties rather than relying solely on formal targets or single forecasts.
- 3. Security implications:** Ongoing security threats in the Nordic-Baltic region are likely to shift priorities, for example, toward onshore projects rather than offshore ones, in order to reduce the risk.
- 4. Portfolio approach for resilience building:** CCS policy should develop a robust portfolio of carbon management technologies tailored to geopolitical realities, capacities, and priorities.

# Thank you for your attention!



JYVÄSKYLÄN YLIOPISTO  
UNIVERSITY OF JYVÄSKYLÄ



[ehsan.e.marzban@jyu.fi](mailto:ehsan.e.marzban@jyu.fi)

