

# Feedbacks and social tipping: A dynamic systems approach to rapid decarbonization

Sibel Eker <sup>1,2</sup> & Charlie Wilson <sup>2,3</sup>

April 2024

EGU24-20483

Session ITS4.1/CL0.1.7 - Earth resilience, tipping points, planetary boundaries and human-earth system interactions in the Anthropocene (room N2)

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2 International Institute for Applied Systems Analysis (IIASA)

3 Environmental Change Institute (ECI), University of Oxford, UK

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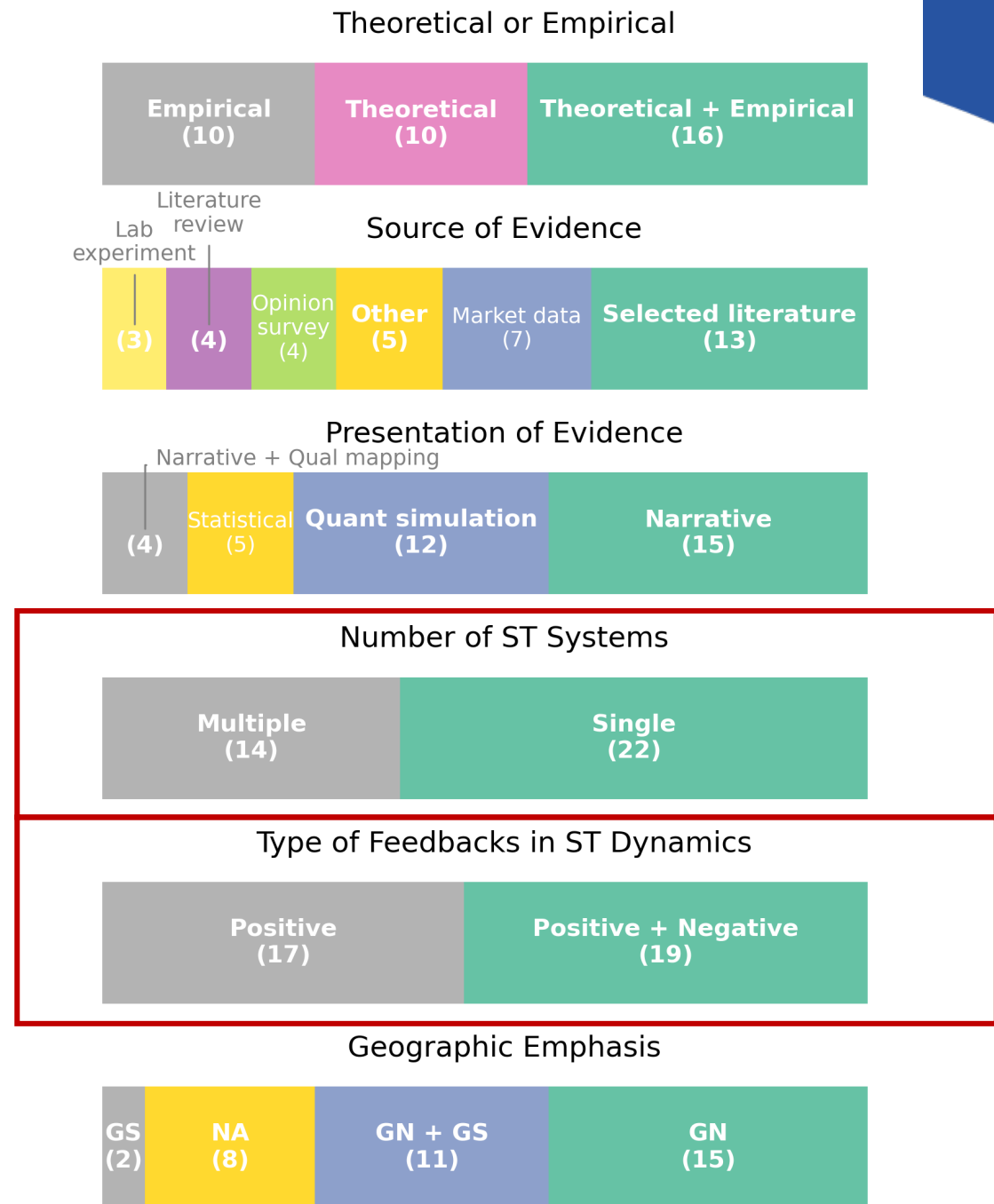
*For further details:*

Eker, S., C. Wilson, N. Höhne, M. S. McCaffrey, I. Monasterolo, L. Niamir and C. Zimm (2023). A dynamic systems approach to harness the potential of social tipping. arXiv. <https://doi.org/10.48550/arXiv.2309.14964>

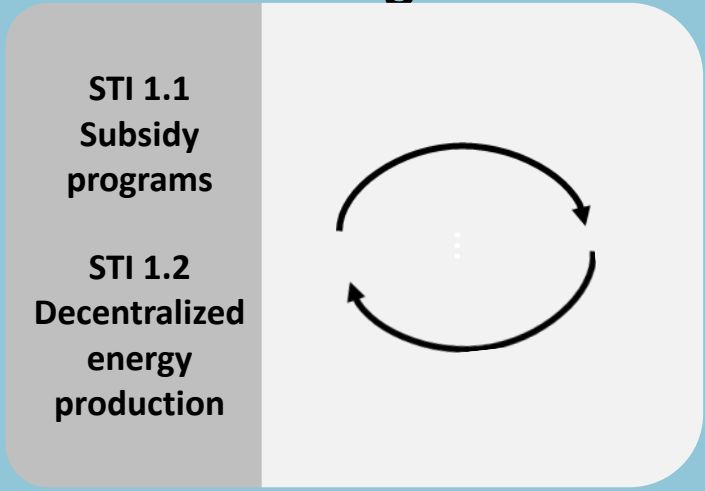
Eker, S. & C. Wilson (2022). System dynamics of social tipping processes. IIASA Report. International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria. April 2022. <http://pure.iiasa.ac.at/id/eprint/17955/>

# Social tipping literature (n=36)

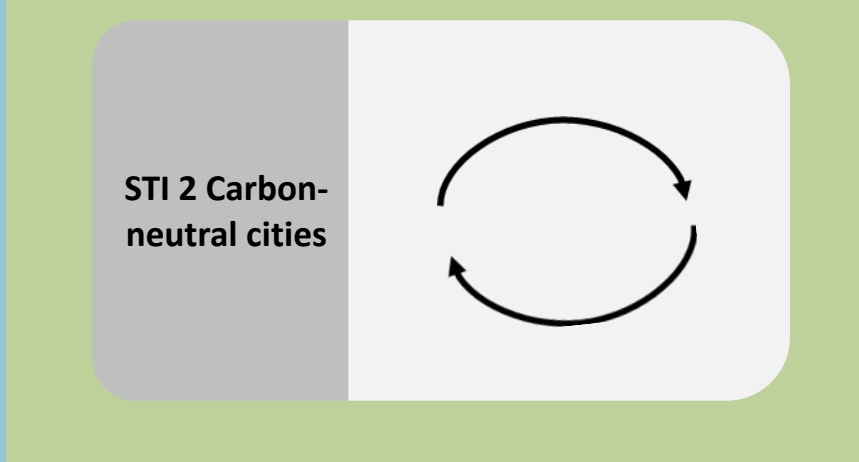
Tendency towards studies of single systems and only positive feedback loops



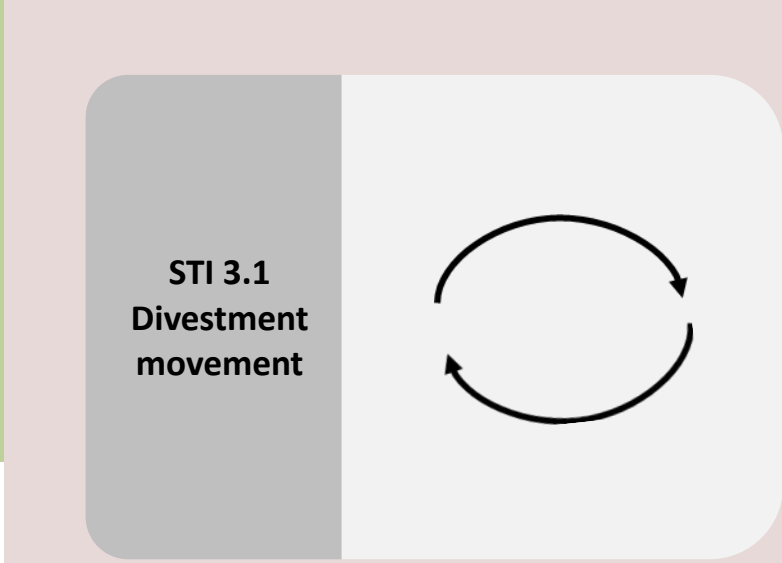
# STE 1 : Energy production and storage



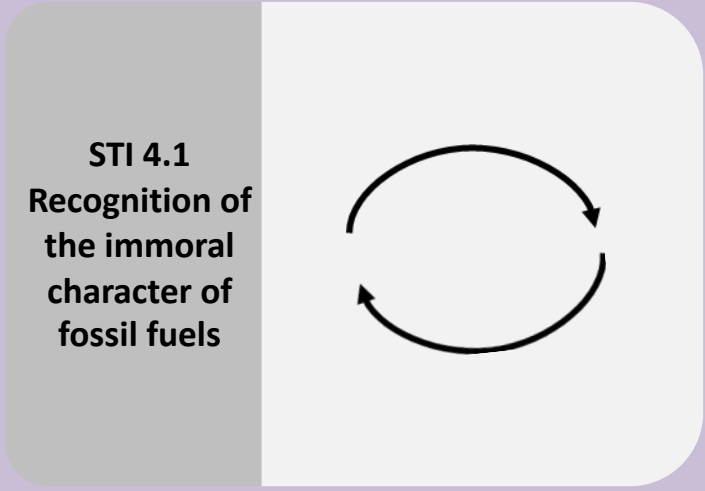
# STE 2 : Human settlements



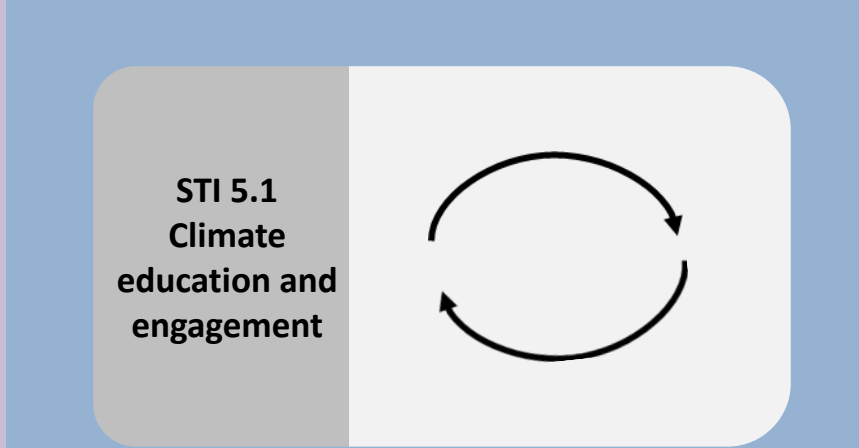
# STE 3 : Financial market



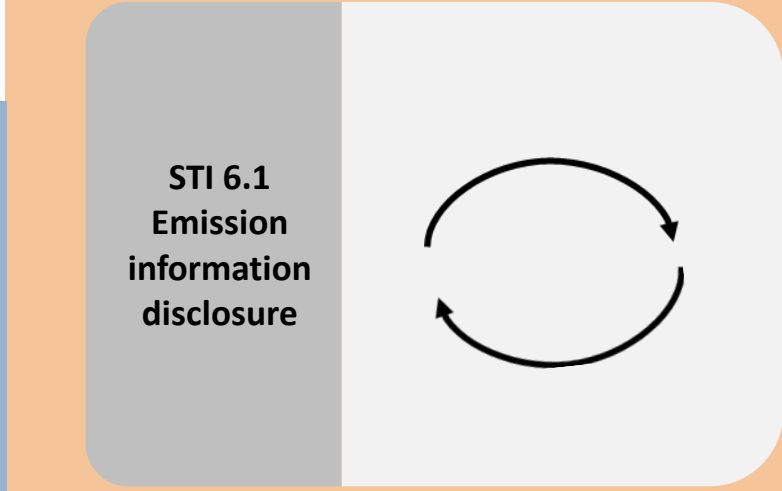
Global GHG Emissions



# STE 4 : Norms and value systems



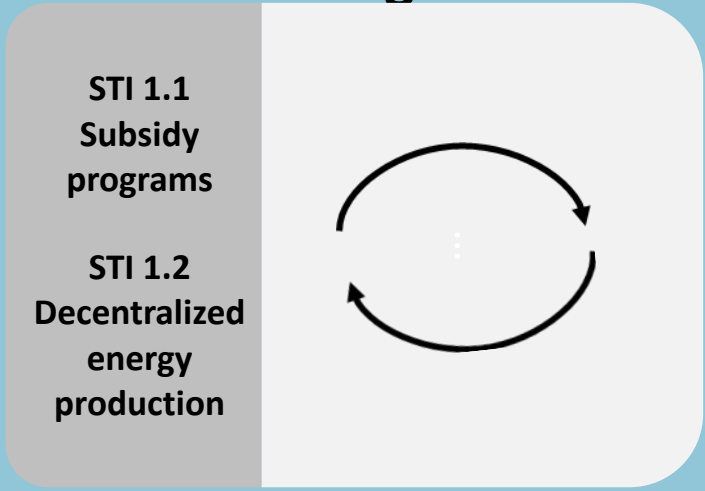
# STE 5 : Education system



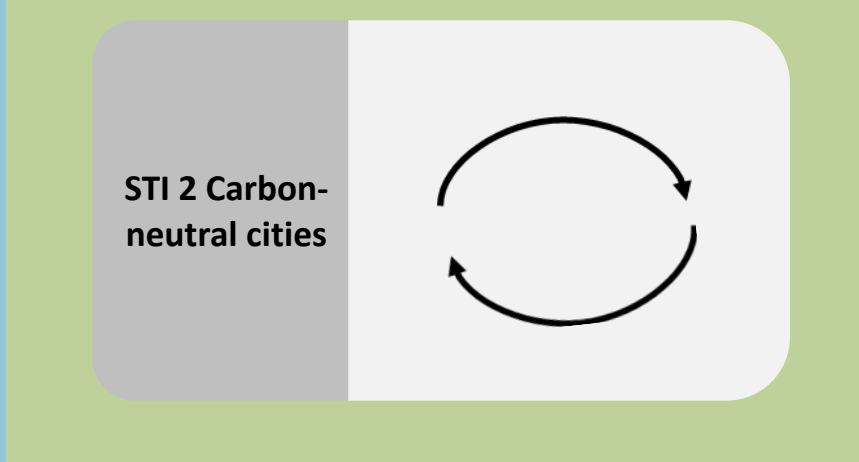
# STE 6 : Information feedback



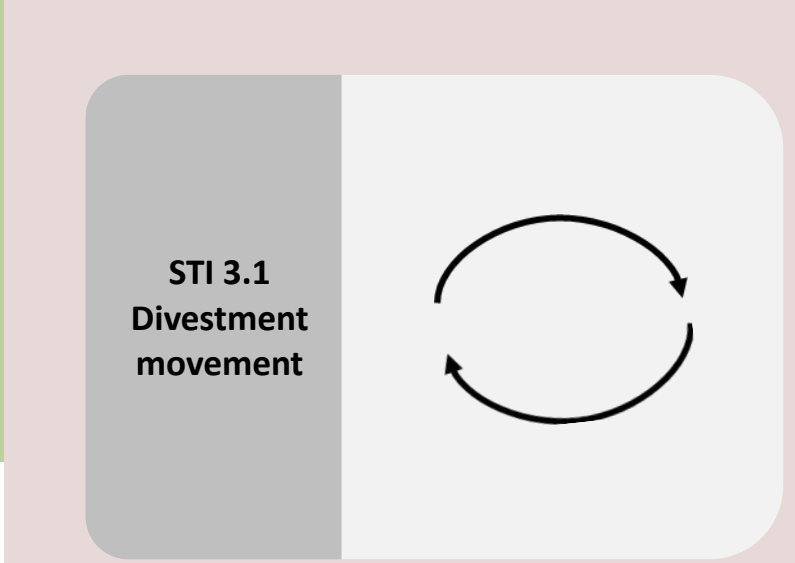
**STE 1 : Energy production and storage**



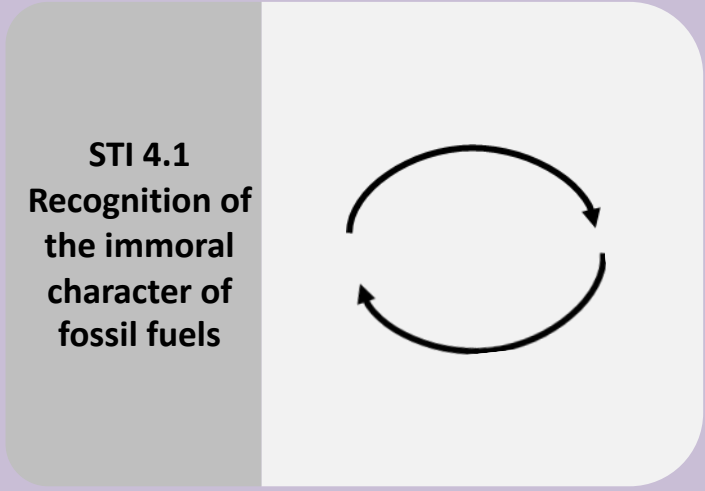
**STE 2 : Human settlements**



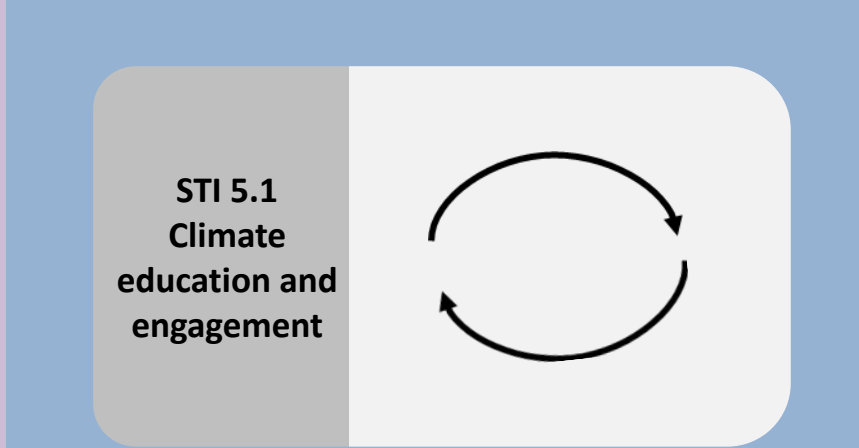
**STE 3 : Financial market**



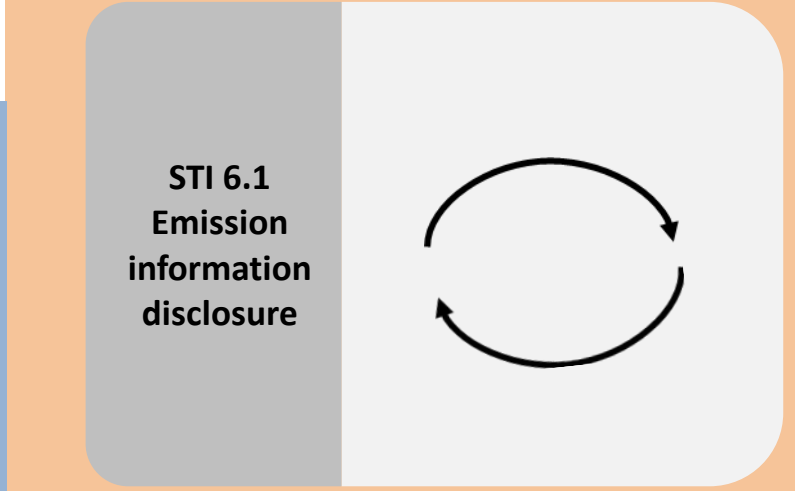
**Global GHG Emissions**



**STE 4 : Norms and value systems**



**STE 5 : Education system**



**STE 6 : Information feedback**

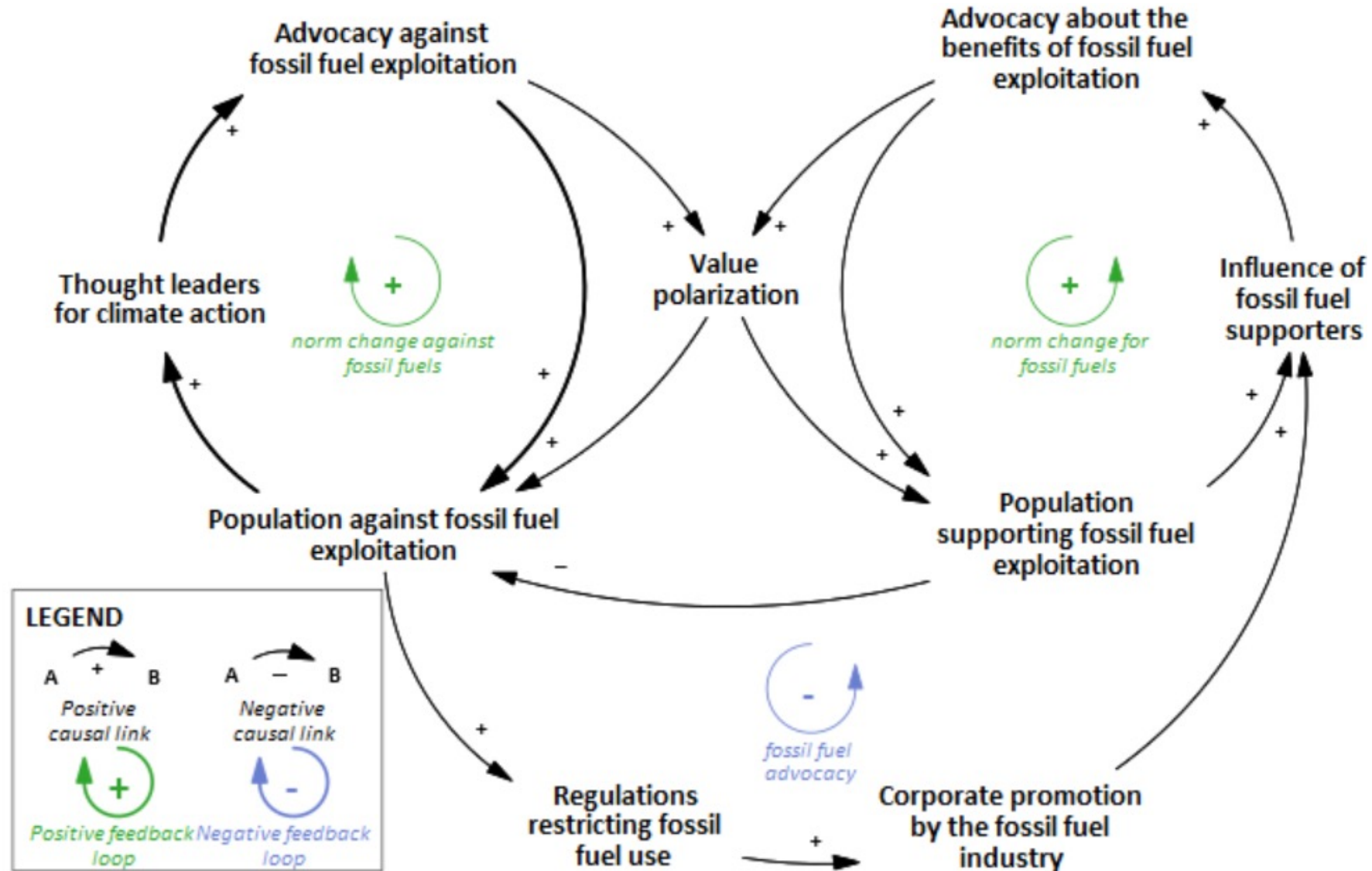




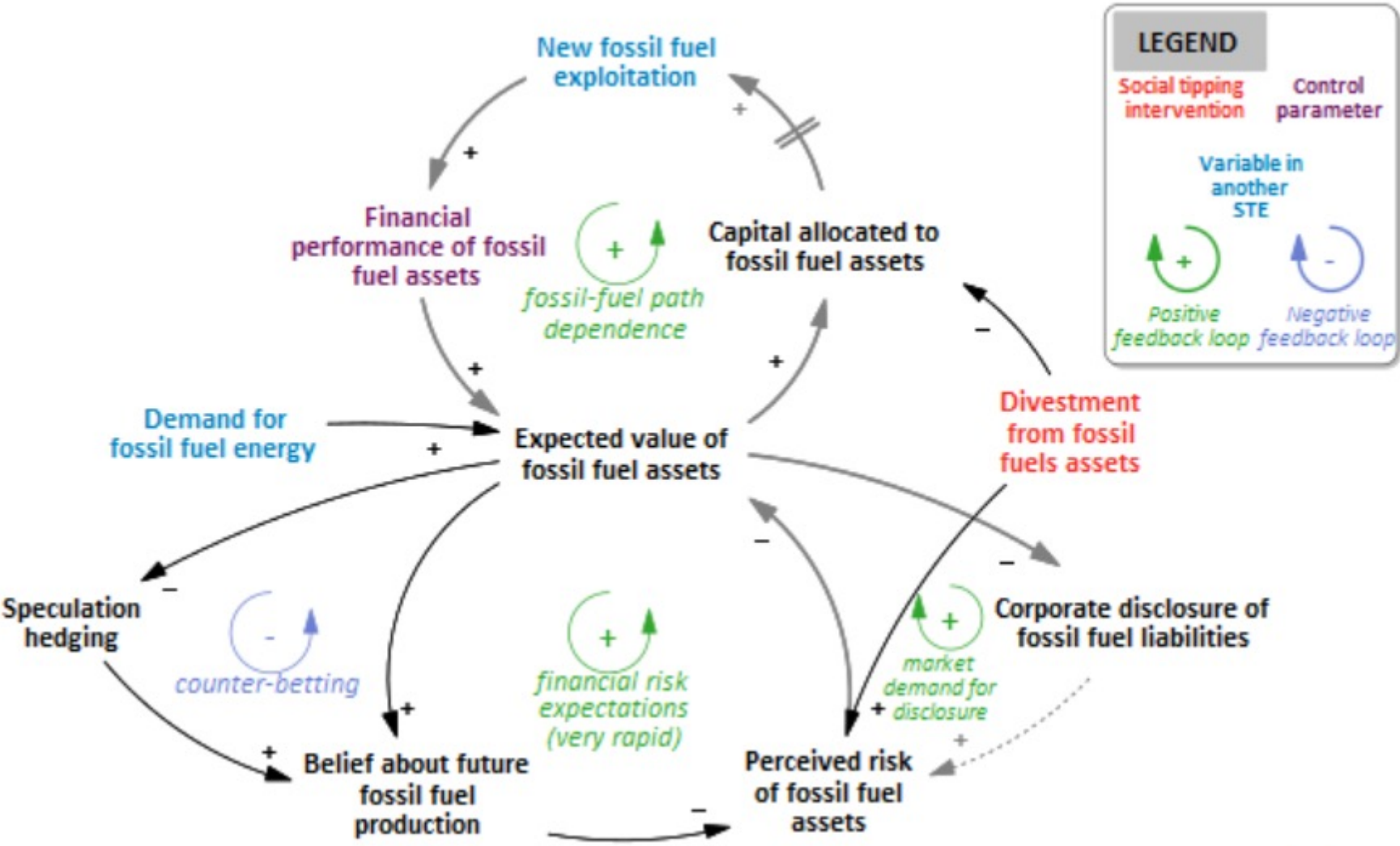


Single systems:  
feedback loops in tipping processes

# Single system: norms & values



# Single system: finance



# Multiple systems: interactions between tipping processes

**Fossil fuel  
energy supply**

# Multiple system interactions: Energy + Finance + Norms + Education + Urban

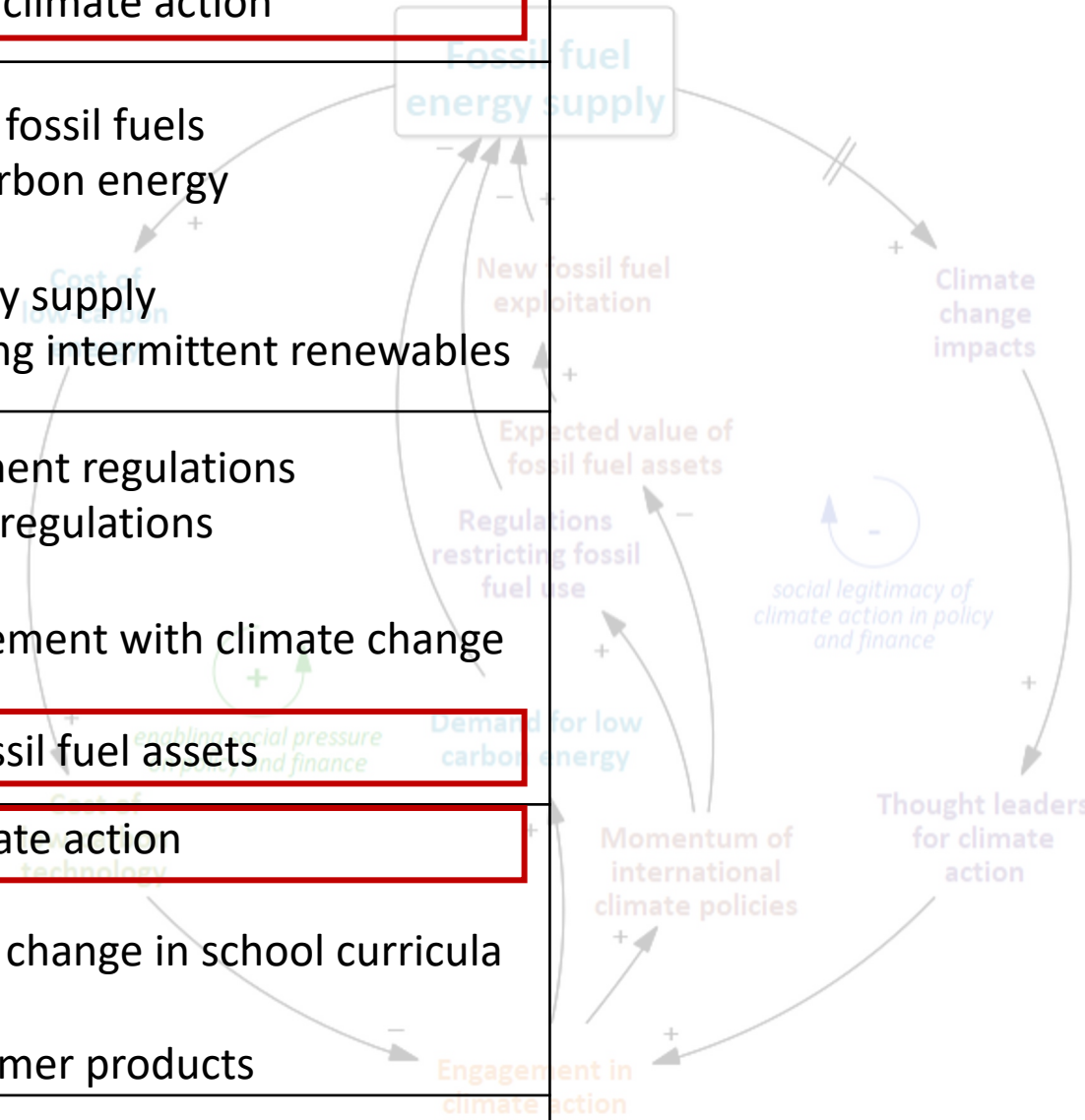
**LEGEND**

- Norms
- Energy
- Finance
- Education
- Urban
-  Positive feedback loop
-  Negative feedback loop

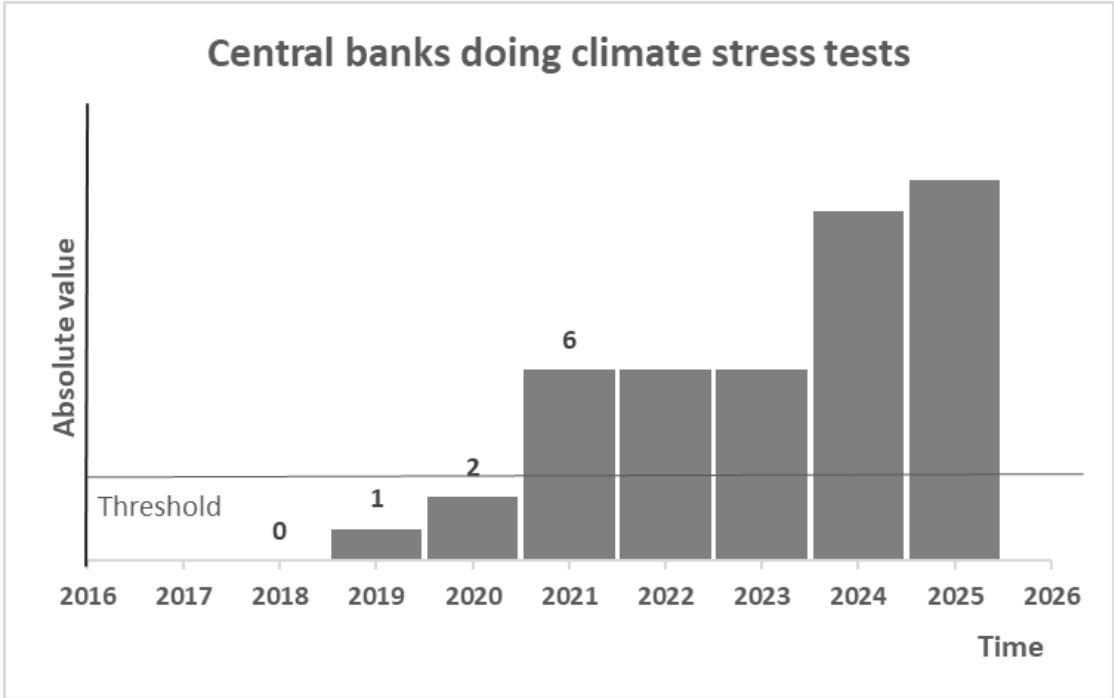
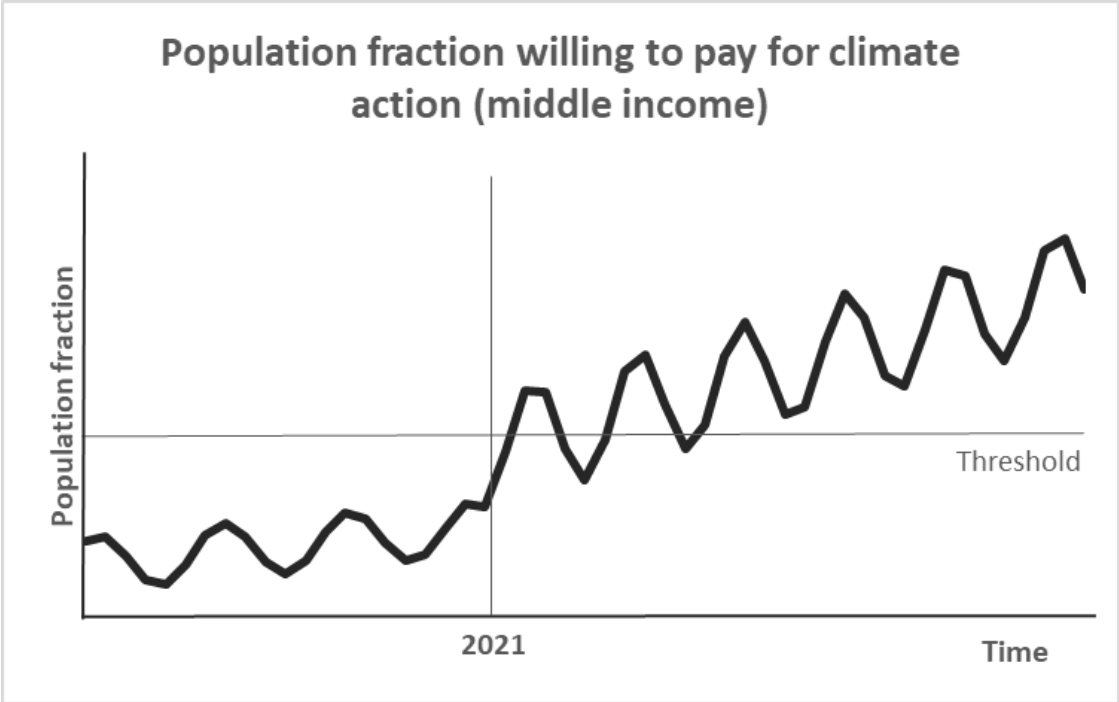
Fossil fuel  
energy supply

# Multiple systems: interactions between interventions & monitoring variables

Systems	Tipping interventions (select examples)
<b>Norms and Values</b>	Thought leaders for climate action
<b>Energy Production</b>	Subsidy removal for fossil fuels Subsidies for low-carbon energy Decentralized energy supply Market rules enabling intermittent renewables
<b>Finance</b>	Climate risk assessment regulations Financial disclosure regulations Central bank engagement with climate change Divestment from fossil fuel assets
<b>Education and Information Feedback</b>	Engagement in climate action Coverage of climate change in school curricula Disclosure on consumer products
<b>Urban Infrastructure</b>	Demonstrations of carbon neutrality in cities



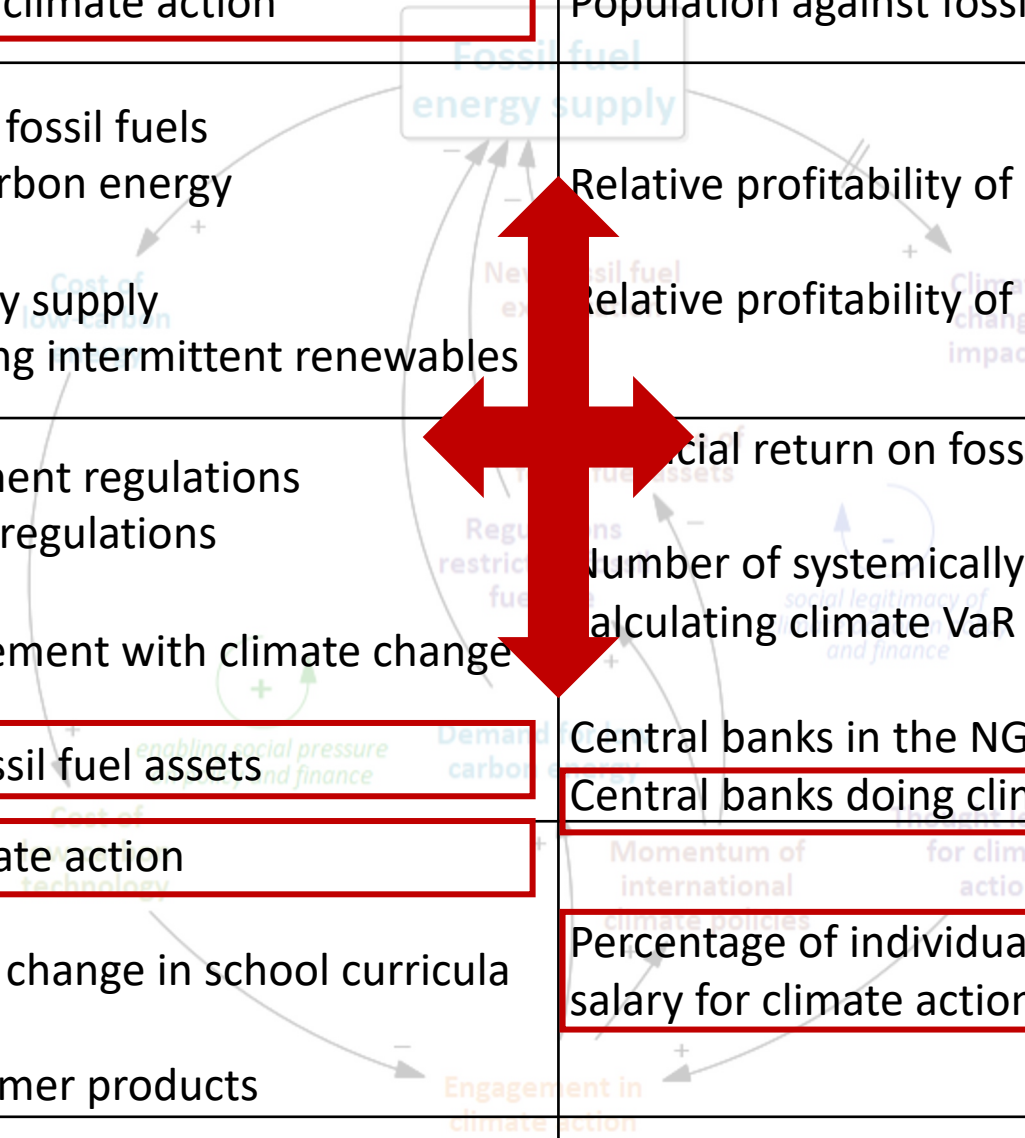
# Monitoring variables for potential tipping processes





Systems	Tipping interventions (select examples)	Monitoring variables (select examples)
<b>Norms and Values</b>	Thought leaders for climate action	Population against fossil fuel exploitation
<b>Energy Production</b>	Subsidy removal for fossil fuels Subsidies for low-carbon energy Decentralized energy supply Market rules enabling intermittent renewables	Relative profitability of low-carbon energy Relative profitability of decentralized energy
<b>Finance</b>	Climate risk assessment regulations Financial disclosure regulations Central bank engagement with climate change Divestment from fossil fuel assets	Financial return on fossil fuel investments Number of systemically important companies calculating climate VaR in risk assessments Central banks in the NGFS <b>Central banks doing climate stress tests</b>
<b>Education and Information Feedback</b>	Engagement in climate action Coverage of climate change in school curricula Disclosure on consumer products	<b>Percentage of individuals willing to pay more than x% salary for climate action</b>
<b>Urban Infrastructure</b>	Demonstrations of carbon neutrality in cities	Use of low-carbon technology in cities

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Norms and Values	Thought leaders for climate action	Population against fossil fuel exploitation
Energy Production	Subsidy removal for fossil fuels Subsidies for low-carbon energy Decentralized energy supply Market rules enabling intermittent renewables	Relative profitability of low-carbon energy Relative profitability of decentralized energy
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Education and Information Feedback	Engagement in climate action Coverage of climate change in school curricula Disclosure on consumer products	Momentum of international climate policies Percentage of individuals willing to pay more than x% salary for climate action
Urban Infrastructure	Demonstrations of carbon neutrality in cities	Use of low-carbon technology in cities



# Next steps

- Identifying which feedback mechanisms contribute most to tipping dynamics when accounting for cross-system interactions
- Identifying effective tipping interventions

**Empirical evidence**

**Semi-quantitative modelling**

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