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# Governance of energy sector integration in Germany

Challenges and Strategies

Workshop: Exploring multi-system phenomena in net-zero transitions

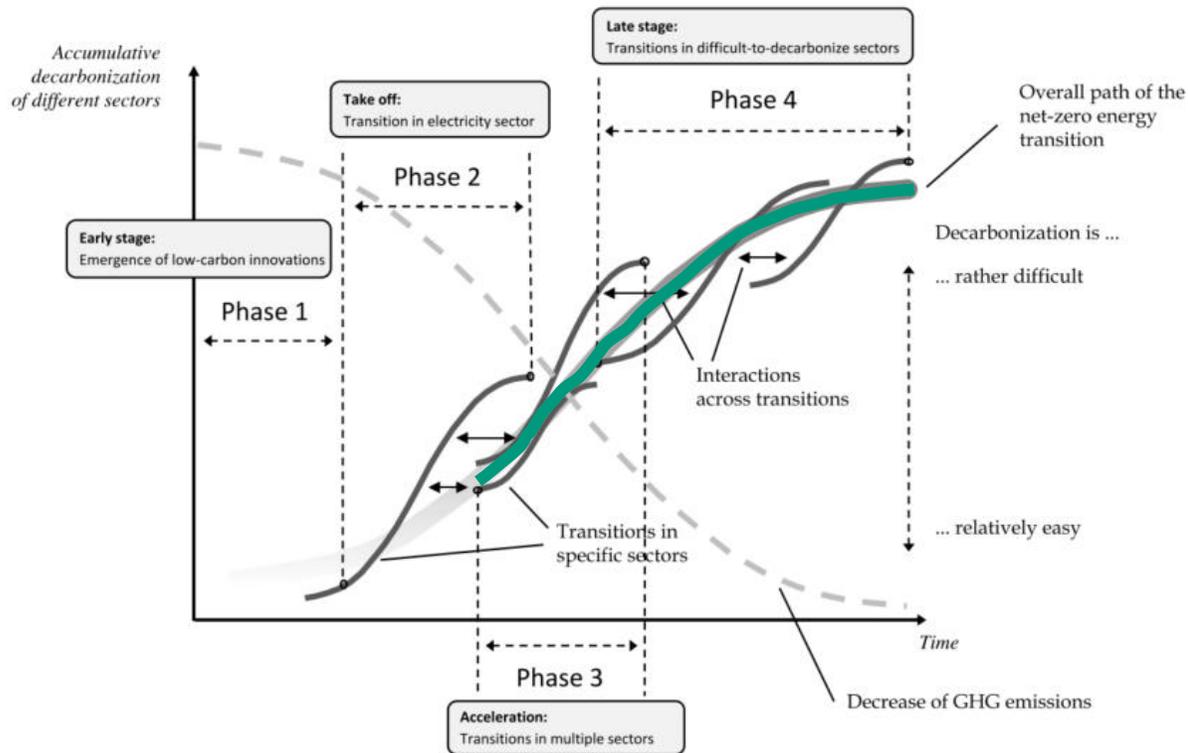
Chair of Sustainability and Transitions Research

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Oslo, May 2023



# Importance of sector integration for the (German) energy transition



(Markard; Rosenbloom 2023)

- ESI describes „the connection of electricity, heat, mobility and industrial processes, as well as their infrastructures, with the aim of decarbonization [...].” (Robinius et al. 2017, pp. 2f.)
- ESI as essential part of Phase 3 and Phase 4
- My focus: transition in the *energy system*

# Political strategy of the *Energiewende*

Guiding principles for the German energy transition:

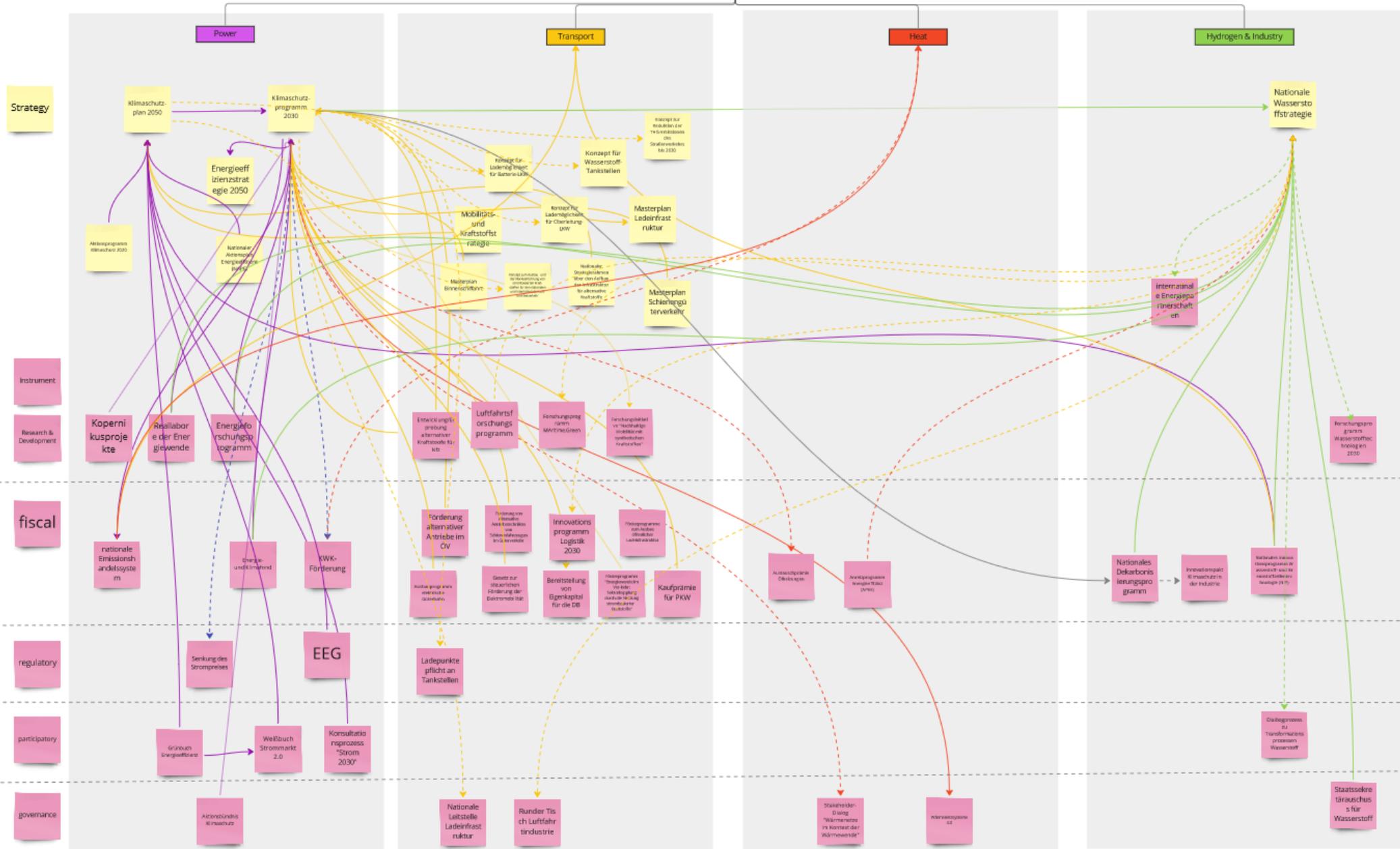
(BMU 2016: 39; BMU 2019: 89; BMWi 2019: 62)

1. Efficiency first: reduction of the energy demand
2. Direct use of renewable energy sources in all sectors
3. **Sector coupling** through the efficient use of RES-E in the heating, mobility and industry sectors;

Sector coupling through the use of green hydrogen and its secondary products for cases in which direct electrification is not possible (BMWi 2019: 15; BMWi 2020: 2)

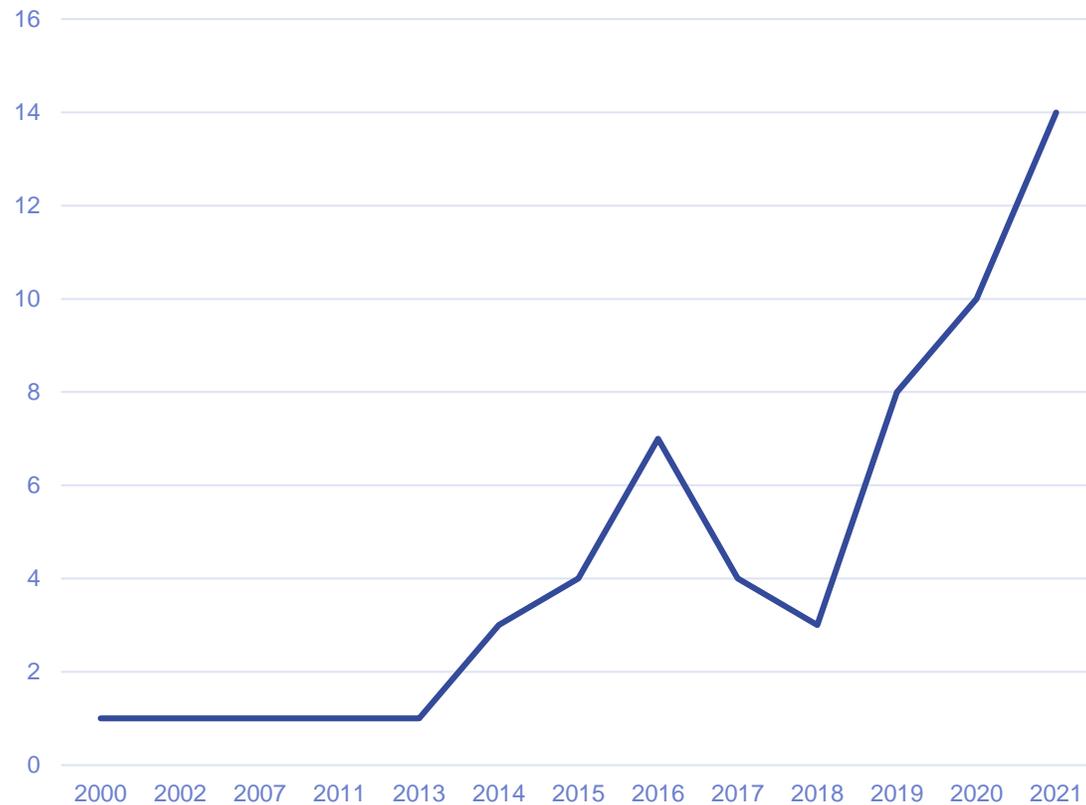
Forward-looking policy strategies are considered as necessary for a cost-efficient energy transition and to reduce negative social consequences and economic risks (BMU 2016)



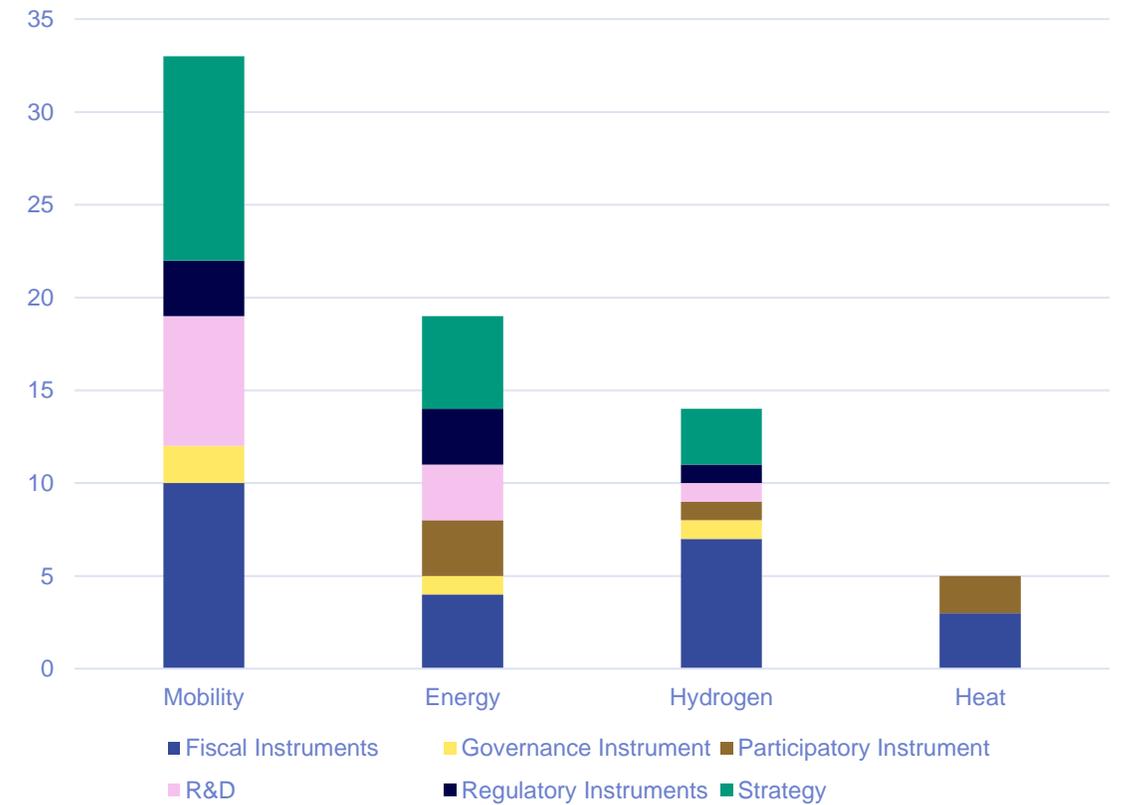


# Despite the prominence of ESI in the German energy policy, there is no overarching political strategy for ESI

Introduction of policy elements over time



Policy elements in the different sectors



# Difficulties regarding ESI – Need for system building?

## 1. Competing possible system architectures

### Difficulties

- There are multiple possibilities how ESI can be achieved (Naegler et al. 2021; Scheller et al. 2023)
  - Competing technological solutions and possible system architectures
- These competing system architectures differ in their degree of sustainability

### How these are addressed in the policy mix

- Qualitative transition pathways
- These are sometimes connected to quantified RES expansion goals
- Modelling to evaluate future demand of technologies, or to evaluate saved GHG emissions

# Difficulties regarding ESI – Need for system building?

## 2. Developing (missing) system elements

### Difficulties

- Through ESI, the power sector is to become the backbone of the energy system (Bogdanov et al. 2021), but a stagnation in the power transition can be observed
- New challenges emerge in the power system with an increased share of RES-E (Sinsel et al. 2020)
- Missing elements for a functioning energy system based on RES only (e.g. for decarbonising the aviation sector)

### How these are addressed in the policy mix

- R&D programs to develop missing elements
- real world laboratories to test possible system configurations

# Difficulties regarding ESI – Need for system building?

## 3. Managing ESI

### Difficulties

- investment cycles can reinforce fossil-fuel lock-ins
- Avoiding new undesired path dependencies

### How these are addressed in the policy mix

- Steer investment choices to avoid fossil-fuel lock-ins
- Use of bridging technologies or postponing decisions when alternatives are not available yet
- Combine old with new system elements (e.g. gas infrastructure with hydrogen)
- Consider multi-system interactions (e.g. impact of e-mobility charging infrastructure on power demand and power grid)

# Difficulties regarding ESI – Need for system building?

## 4. Competing actors interests

### Difficulties

- Competing actors interests as different actors favour different transition pathways and possible system architectures (Ohlendorf et al. 2023)

### How these are addressed in the policy mix

- Stakeholder dialogs

# Implications for research

- Taking a multi-sectoral perspective is necessary to account for the challenges of ESI
- With increasing degree of ESI, systemic questions of the transition in the *energy system* arise that are not yet addressed by research
- New difficulties through ESI and multi-sectoral interactions
  - Coordination between the sectors
  - Scarcity of resources such as RES-E and green hydrogen
- Through which policy mix can such difficulties be addressed?
- Is an overarching strategy for ESI needed/possible/desirable?
  - How can such a strategy look like?
  - What can the sustainability transitions community contribute to such a strategy?

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