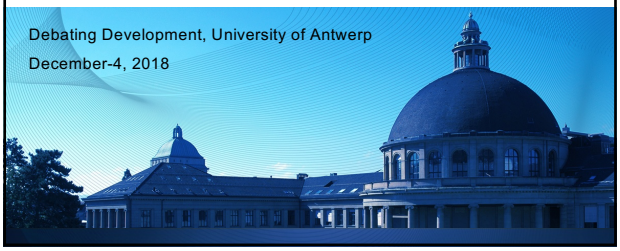
The next phase of the Energy Transition
A new kind of challenges?

Jochen Markard

Debating Development, University of Antwerp
December-4, 2018

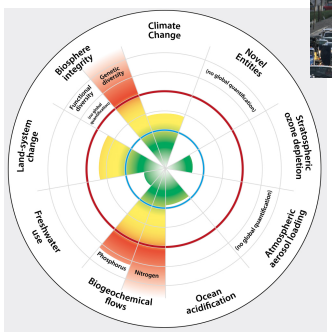


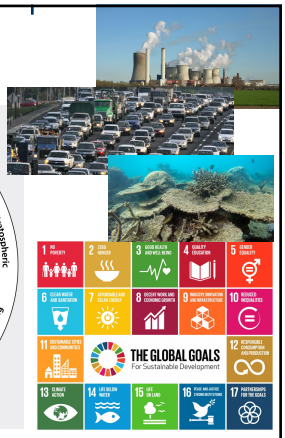
Outline

1. Grand challenges & sustainability transitions
2. Energy transition 2.0 – the next phase
3. Questions & Debate

1 Grand sustainability challenges

We are living at the edge





Grand sustainability challenges: anything special?

	Climate change	Flying to the moon
Problem characteristics	Complex, ill-defined, interdependent causes, multi-dimensiona , evaluative, socially constructed, moving target	Clearly defined, scientific and technological problem, shared understanding, stable target
Solutions	Technological and non-technical elements, broad array of potential solutions, no immediate tests, unwanted effects	Technical, based on science/ engineering, testable, supply-side
Scope	Global, sectoral or cross sectoral, several decades	National, technological, one decade
Actors & coordination	Broad range of distributed actors with conflicting interests, networks and coalitions	State as primary customer, hierarchy, defined roles
Public policies	Broad range of policy goals and instruments, policy interaction (policy mix) and potential conflicts, different levels	Public funding, R&D, national level

[George et al. 2016; Ferraro et al. 2015; Markard 2017; Reid et al. 2010]

Some characteristics of grand challenges

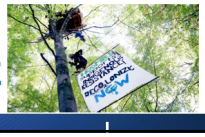
- Many solutions




- Change may take decades, inertia of infrastructures

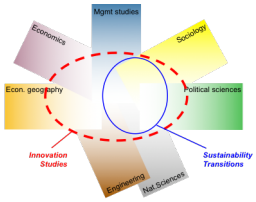

- Conflicting interests

RWE



Sustainability Transitions

- Long-term, fundamental transformation of existing sectors
  (e.g. energy, transport, food)
  towards more sustainable production and consumption
- Implicit normative assumption
  that *sectors have to change*
  e.g. to achieve SDGs
- Transition studies: Rapidly growing
  field of research in
  innovation studies
  with cross-overs into other disciplines



Historical transition example: automobile



Development of (core) technology

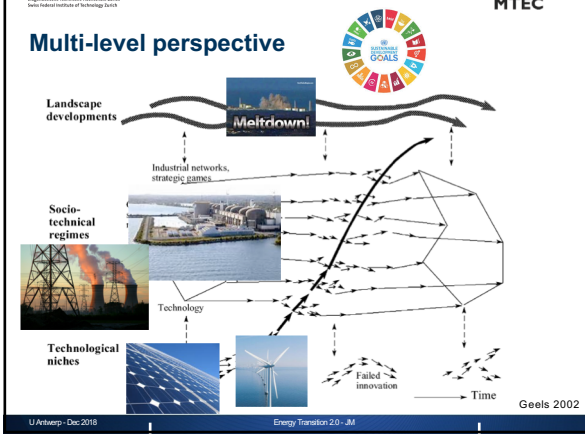

Development of infrastructure

Geels 2005

Systems approaches & technology central

- Socio-technical system:
  network of actors, institutions and technology; provides essential service for society
  (e.g. water, food, energy, transport) - *sector*
- Socio-technical regime:
  whole complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, established user needs, institutions and infrastructures (Hoogma et al. 2002) → emphasis on coherence & inertia
- Technological innovation system:
  network of actors and institutions that contribute to the development and diffusion of novel technology (Bergek et al. 2008; 2015) → highlights interdependence & relevance of institutions

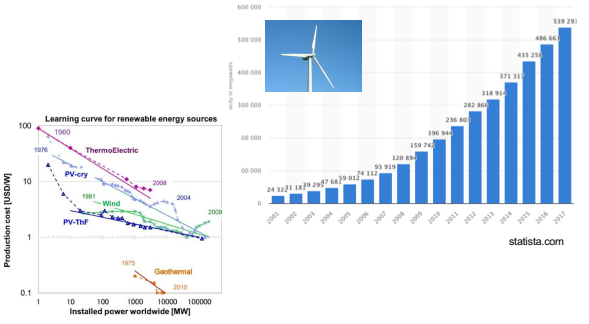
Multi-level perspective



Geels 2002

2 Energy transition

New renewable energies diffuse rapidly



Energy Transition 2.0

- In some places, we currently see a new phase of the energy transition with new phenomena
- The new phase comes with a set of new challenges
- These new challenges have implications for the conceptual frameworks we use, and for policy making

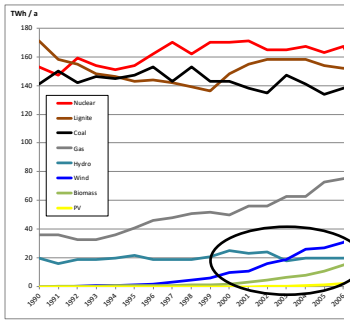

nature energy PERSPECTIVE

The next phase of the energy transition and its implications for research and policy

Jochen Markard

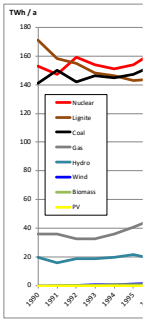
Germany: Earlier developments

Power generation in TWh (2017: 650 TWh total)



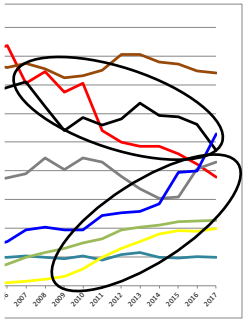
1st phase – emergence of renewable alternatives

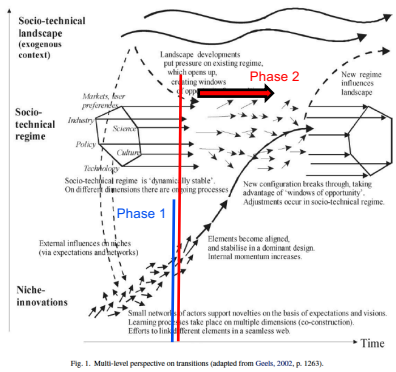
Germany: Last 10 years



Decline of established technologies

Accelerated diffusion of renewables





Geels & Schot 2007

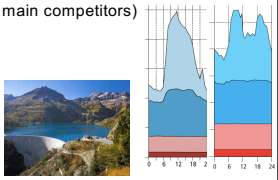
Fig. 1. Multi-level perspective on transitions (adapted from Geels, 2002, p. 1263).

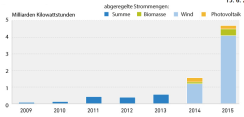
New challenges of the next phase

- Multi-tech interaction
- Decline
- Escalating struggles
- Sector level reconfiguration

3.1 Multi-tech interaction

- Past:
  focus on selected technology (and its main competitors)
  e.g. solar, wind, biogas, batteries
- New:
  - interplay of diff. technologies, complementarities, bottlenecks;
  - value chains / networks, context, sector boundaries



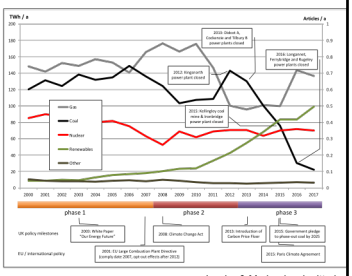


Source: AEE

3.2 Decline

- Past: could be ignored
- New:
  Important part of the dynamics
  - How long does it take?
  - How can it be accelerated?
  - Local vs. global issues
  - What implications?
  - How to compensate losers?

Coal decline UK



Isoaho & Markard, submitted

3.3 Struggles & politics

- Past:
  Ignored or simplified
  (e.g. newcomers vs. incumbents)
- New:
  Systematic analysis of
  strategies, positions, coalitions

Advocacy coalitions in the Swiss energy transition

Markard et al. 2016

Struggles over solar PV in the US

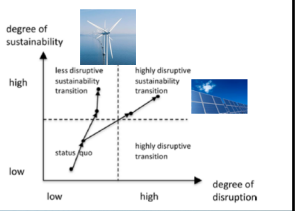
Pro Spending ($ Thousands) Total raised, followed by largest donors	Con spending ($ Thousands) Total raised, followed by largest donors
$1446 total: Mostly env. orgs	$1284 total: Excel, rural cooperatives (utilities)
$61,886 total: $49,581 S. Bing (film) $2043 V. Khosla (finance)	$94,404 total: $38,000 Chevron $32,824 Area Energy $9550 Occidental Oil & Gas $3025 ConocoPhillips

Hess 2016

3.4 Sector level reconfiguration

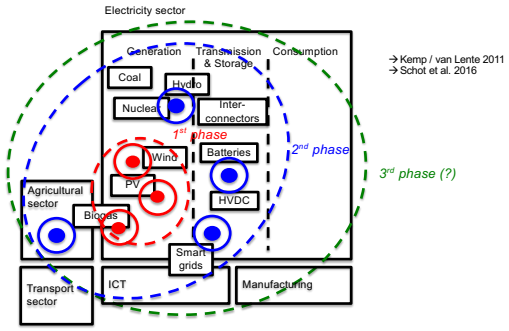
- Past:
  hardly affected
- New:
  "system integration"
  "sector level complementarities"
  system performance

configurational changes,
different pathways:
e.g. centralized vs. decentralized



Lindbergh et al. in press

Expanding scope of the transition



→ Kemp / van Lente 2011
→ Schot et al. 2016

3 Summary

Main lessons

- Grand sustainability challenges:
  highly demanding & complex, special approaches needed
  "transition studies" one such perspective
- Energy transition: In a new stage of development,
  new challenges:
  - multiple technologies
  - decline
  - struggles & conflict
  - sector level re-configuration