Transitions and climate change

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To play a leading role in the transformation of regional innovation policy and practice in Europe on climate change’

(Ritter, Nature Climate Change 2011).
Challenge platforms
European Union

- we will take a historic step towards …the transition to a low-carbon world economy.

- Manuel Barroso
- December 2007
‘the transition to a green and low-carbon economy is essential’ (Nov 2009)
‘mitigation pathways’
The European Union Roadmap for moving to a competitive Low Carbon Economy 2011
National transition policies

The UK Low Carbon Transition Plan
National strategy for climate and energy

Enabling the Transition to a Green Economy:

Flagship Report
World in Transition
A Social Contract for Sustainability

Energiewende
The new transitions policy discourse

- Policy recognition of the climate change ‘problem’ is accompanied by ‘solution’ through a low carbon transition
- Incorporation of ambitious targets for GHG emission reductions into national policy agendas
- Narratives of transformation innovation from margin to mainstream since 2000
Stern review 2006

- Climate change...is the greatest and widest-ranging market failure ever seen

- Policy challenge is managing the transition to a low-carbon economy
Policy roots: IPCC report on mitigation

- *transition* strategies to achieve...long-term social and technological changes

- *transition* from the world’s present energy system towards a less carbon-emitting economy
Die Energiewende ist möglich
Für eine neue Energiepolitik der Kommunen

S. Fischer

»Nur bei mehr Autonomie der Kommunen ist eine ökologische Energiepolitik möglich.«

Eine Publikation des Öko-Instituts Freiburg/Bz.
The Dutch school

- Major programme on transitions
- Multilevel perspective
- Historical transitions
- Transition management
- Governance of transitions
Academic roots: the Dutch school


Transities vanuit sociotechnisch perspectief

Frank Geels and René Kemp

Nov 2000
Conceptual sources

- 2 strands in the interdisciplinary field of Science Technology & Innovation Studies
- Economic - Evolutionary theories of epochal transformations - ‘technoeconomic paradigm’
- Sociological - Interactionist theories of innovation path creation – ‘social construction of technology’
A synthesis within innovation studies

- Seeks to bridge economic and sociological strands in STIS
- Dynamics of innovation in meso level sociotechnical systems
- Engaged with practice ‘managing/governing transitions’
A distinct meso level ‘lens’ or ‘gaze’

- Nor a ‘macro focus on a new principle of the economic system (mechanisation, information etc)

- Not a ‘micro’ focus on the new product or process

- The ‘meso’ reveals situated sociotechnical paths and choices
Sociotechnical transitions change the mode of innovation

- Intercontinental transport: sail – steam
- Domestic mobility: horse – automobile
- Sanitation: home based – civic sewage system
- Information: notepad – personal computer
The British public’s favourite – Turner’s picture of a sociotechnical transition
The Temeraire sociotechnical network

Woodworkers

Weather

Preserved food

Forests

Naval dockyard as innovator
Monarch sociotechnical network

- Business enterprise as innovator
- Coal mines
- Engineers
- Timetables
- Metal workers
- Fuel depots
The role of innovation

- the key to the transition to a green and low carbon economy is ‘significant innovation’

(COM(2011) 571)
What is innovation?

- the successful production, assimilation and exploitation of **novelty** in the economic and social spheres
A ‘distinctive approach to innovation’
Innovation Union (COM (2010) 546

- 3 principles
- challenge-led
- broad concept of innovation
- all actors and all regions.
‘challenge-led’

- Innovation - our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing,
- a break with the over-reliance on market based encouragement of technology driven innovation
- the 1980s shift from mission-oriented to diffusion-oriented innovation policy is no longer fit for purpose
‘broad concept’

- new territory outside technological innovation ‘induced’ by market incentives
- ‘demand’ pull from citizens and consumers as well as ‘supply’ push from universities and business
- innovation takes ‘many forms’ such as novel advances in organizations, services and business models
‘all actors and all regions’

- ‘wide partnership’ of social actors from ‘not only the business sector, but also public authorities at national, regional and local level, civil society organizations, trade unions and consumers’.

- radically shifts the agenda from a selective preoccupation with hi-tech regional clusters to a mainstream concern with all regions.
Climate change - a ‘comprehensive path’ 20/20/20 policy (COM[2008]30)

- new policies needed in addition to the traditional avenues of research based technology programmes or indirect market schemes.
- a range of actors which will involve consumers as well as producers
- a diversity of innovation to address ‘energy efficiency’ of everyday consumption as well as shift to low carbon energy production
Linear vs interactive models of innovation
Novel concepts about innovation

- Past 40 years of innovation studies has challenged the linear ‘science push’ model
- Interactive - Freeman, Rothwell SPRU
- User led – von Hippel
- Open – Chesbrough
- Actor networks – Callon, Latour
- Innovation commons – Lessig
- Sociotechnical transitions – Geels, Schot
From pipeline.....
....to network
A paradigm shift like the Copernican revolution
Figure 4 The Innovation Pyramid.

Source: Climate-KIC Business Plan
Different modes of innovation

- STI – Science, Technology & Innovation
- DUI – Doing, Using & Interacting

Lundvall et al ‘Forms of knowledge and modes of innovation’, Research Policy 2007
‘our economy will require a fundamental transformation within a generation’

‘producer and consumer behaviour’
Figure 23
Impact of standards on efficiency of 3 household appliances

- **Gas furnaces**
- **Central air conditioners**
- **Refrigerators**

Effective dates of national standards
Effective dates of state standards

Global carbon intensity

Global CO2 emissions

Transformative innovation

- **Transformative innovation** - full system redesign and culture change in the way people think about products and services, e.g. industrial ecologies or life cycle approaches to product design.

- **Incremental innovation** - small innovations, or improvements to optimise existing systems of knowledge, e.g. reducing packaging waste;

- **Radical innovation** - partial system redesigns, e.g. improvements in recycling which require innovations in product design and infrastructure for recycling;

**Defra’s Evidence Investment Strategy**
2010–2013 and beyond

Our purpose
‘to secure a healthy environment in which we and future generations can prosper’
Old narrative 1: a new ‘Apollo’ programme

- Martin Rees (President of the Royal Society)
- A ‘global response analogous to the Apollo programme’
- Editorial in *Science*, *August 2006*
- Ambitious public investment in more R&D for new ‘far from market’ energy technologies
Old narrative 2: a new industrial revolution

- Amory Lovins – US environmentalist & entrepreneur
- Peter Mandelson, former BIS minister
Old narrative 3: social reform

Analogies with government led programmes of welfare reform from the 20th century, e.g. Roosevelt’s New Deal.

A Green New Deal for Europe

A Green New Deal

Joined-up policies to solve the triple crunch of the credit crisis, climate change and high oil prices

The first report of the Green New Deal Group
Old narrative 4: moral crusade

- Analogies with anti-slavery & civil rights movements
- No halfway house on moral principles
- Carbon dependency moral equivalence
- Rhetoric of reaction

- James Hansen
  - Leading climatologist
  - Head of NASA Goddard Institute for Space Studies
# One dimensional narratives

<table>
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<tr>
<th>State</th>
<th>Big science (Manhattan/Apollo)</th>
<th>Green new deal</th>
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<tr>
<td>Individual</td>
<td>New industrial revolution</td>
<td>Moral crusade (slavery)</td>
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- Technology
- Society
A new transformative innovation narrative?

- How social and technological innovation interact with each other
- New routes for global institutions to effectively interact with established institutions of national governance
- Intersection of individual and collective
- Convincing approaches to the urgency of the climate change challenge
Systems innovation

- System wide changes in social and technological dimensions...and in their relations between different stakeholders
- Interventions need to address the ‘behavioural, technological, policy and business practices among the different actors in order to bring about system-level change’

OECD 2012
System perspective

Diagram showing energy flow from various sources to different sectors such as industry, transport, buildings, and other. The diagram includes numbers representing the amount of energy in terawatt-hours (TWh) for each flow.
Global energy flows 2005

Cullen & Allwood 2010
‘systems innovation’

- ‘system innovations’ involve different technologies, a variety of social/behavioural innovations, and a diversity of societal actors
- better seen as ‘sociotechnical’ innovations rather than either technological or social innovation
- most sustainability/innovation policy and practice remains focused on singular technologies and needs to be reoriented
Smart grid systems innovation
Biowaste energy system innovation

**Biogas system**

1 ha energy crops, e.g. maize, grain, grasses, 1.5 cubic metres per day. In energy terms, this equates to around one litre of heating oil. Regrowable raw materials supply between 6,000 cubic metre (meadow grass) and 12,000 cubic metre (silage maize/tether beer) biogas per hectare arable land annually.

**Digestion residue storage**

The resulting biogas is stored in the top ("head") of the fermenter, directly above the fermenting biomass.

**Gas storage**

In this tank, with light and oxygen excluded, the biomass is digested by anaerobic micro-organisms. This digestion process produces methane and carbon dioxide – the biogas.

**Gas treatment plant**

The methane content and the quality of the biogas are increased to make it like conventional natural gas.

**Combined heat and power station (CHP)**

In the CHP, the biogas is incinerated to produce electricity and heat.

**Natural gas network**

The treated biogas can be fed directly into existing natural gas networks. Biogas petrol station – or can be used as fuel.

**Biogas system**

- Energy crops of biowastes
- Livestock farming
- Biowaste
- Slurry or manure
- Feed
- Gas storage
- Biogas
- Gas motor
- Process heat
- Heat
- Electricity
- Natural gas network
- Biogas petrol station
- Gas treatment plant
Integrated mobility system innovation
Systems innovation

- OECD
- Climate challenge calls for new thinking on innovation policy
- Sociotechnical systems
- Demand side... behavioural, technological, policy and business practices among different actors
Multilevel governance

- DG Regio
- Regional and local authorities
- Transformative innovations and systemic change
- Far beyond the boundaries of one company or organisation
Radical efficiency

- NESTA
- Creation of new systems of different and better services
- Up to 60% improvement
- Localities as leaders of innovation
- Discontinuous rather than incremental efficiency gains
Marginalization of end-use energy innovation for climate protection

Policy implications – a change in the dominant mode of innovation

- Shift in focus from producer/technologies to consumers/use
- Attention to new social actors
- Engagement with new knowledge practices
New system actors

- leaders will be the institutions and organisations who deal with the key systems of mobility and household living.
- different to traditional product focused innovators
- regional players are well placed for this
- key responsibilities for transport, housing, waste and energy systems
- enable the participation of the diversity of actors involved in system innovation
New practice based knowledge

- more integrated and practice based than conventional academic science
- learning by doing - innovative approaches to mobility and household living in practice
- experimentation is often more feasible at regional - scale is manageable yet significant resources can be leveraged.
- challenge is to move from the specific to the general.
Transition - Principle 1

- National in scope based on global consequence
- Challenge led, not technology driven
- Specific long term environmental goals eg ghg emissions, biodiversity
- Translated into near term goals in terms of targets that fit real policy cycles around 5 years
- Given high status eg legal commitment
Transition - Principle 2

- Promotion of ‘use’ oriented networks
- Defined by broad areas of societal needs – food, shelter, mobility, comfort, communication
- Practice based social experimentation – ‘learning by doing’ given support comparable to science & technology budgets
- Develop new situated visions and expectations
Transition - Principle 3

- Ensure diversity of actors within innovation system
- Focus should be on ‘system’ oriented actors such as municipal and regional actors infrastructural actors civil society actors
- Support the rights of emergent sustainability actors eg green entrepreneurs
Transition - Principle 4

- National initiatives should form part of global endeavour
- Need for new pattern of international innovation
- Europe matters!
- Cross national learning and cooperation
Transition - Principle 5

- A new transformative discourse
- Alternative to the prevailing narratives will be more network oriented
- Breaks with the conventional ‘technology’ or ‘social’ framings
- Relocates innovation in a context of societal purpose by spanning boundary between environmental and innovation policy