

## Europe's challenge-led broad-based innovation policy revolution: a convoluted and contested transition



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 DTU, 20 April 2012



EUROPEAN COMMISSION

## Green Paper on Innovation

December 1995

### Innovation – a broader approach

- the successful production, assimilation and exploitation of novelty in the economic and social spheres
- a multi-faceted phenomenon:
  - 'process' and 'results'
  - products, processes or services
  - all sectors
  - interaction & networks

### How broad?

- the technological component is normally present, if not the determining factor
- mastery of the scientific and technical skills is essential
- to generate the technical advances
- to understand and use the new technologies, whatever their origin
- The firm's capacity for innovation, and support for it from the authorities - essential

### Policy priorities

- place science and technology base at the service of industrial competitiveness and the needs of the market
- dissemination, transfer and industrial application of research results
- develop technology monitoring and foresight to illustrate the situation in EU and major rivals
- strengthen the mechanisms linking basic research and innovation

### The challenges of innovation

- growth, maintaining employment and competitiveness
- the European paradox –high science achievement - lower innovation performance
- public services need major innovations

## COM (2003) 112

Innovation policy in context of Lisbon strategy

- Multidimensional nature of innovation
- Technological, organisational, business model, presentational
- The enterprise is at the heart of the innovation process
- Innovation models – from linear to systemic view
- Successful innovation policy will reduce gap with US

## Policy relevant concepts

- 'Technoeconomic paradigm – Freeman & Perez
- Schumpeterian evolutionary theory of innovation
- Epochs defined by 'lead technologies'
- Firm specific capabilities
- The 'knowledge society' OECD
- Ergas 'diffusion oriented' v 'mission oriented'

## 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

## European Union

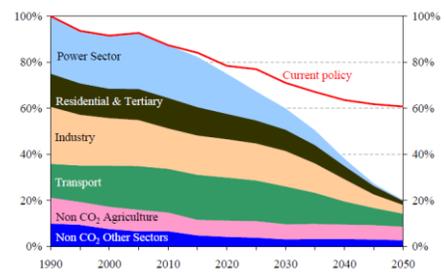


- we will take a historic step towards ...the transition to a low-carbon world economy.
- Manuel Barroso
- December 2007

'the transition to a green and low-carbon economy is essential' (Nov 2009)



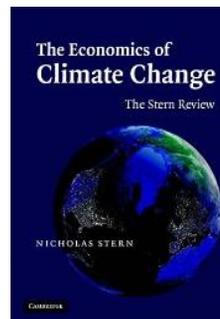
## The European Union Roadmap for moving to a competitive Low Carbon Economy 2011



## Transition, transformation, innovation

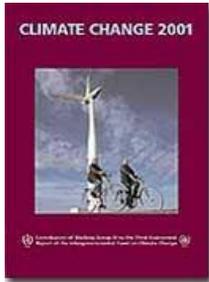
- the need for a 'transition to a low carbon economy' (COM(2011) 112)
- the key to the transition to a green and low carbon economy is 'significant innovation'. (COM(2011) 571)
- 'our economy will require a fundamental transformation within a generation...in producer and consumer behaviour'. (COM(2011) 571)

## Stern review 2006



- managing the **transition** to a low-carbon economy
- radical change may not be delivered by the markets
- technology-specific early stage deployment support
- governments must accept that some technologies will fail.

## 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**

## Academic roots: the Dutch school

Kemp, René (1994), 'Technology and the Transition to Environmental Sustainability. The Problem of Technological Regime Shifts', *Futures* 26(10): 1023-46

Geels, F.W., 1999, 'Technological transitions and socio-technical scenarios', in: Dolfsma, W., Geels, F.W., Kemp, R., Moors, E. and Rip, A., 1999. *Management of technology responses to the climate change challenge: Theoretical elaboration of the co-evolutionary 'technology-in-society' Perspective*.

### Transities vanuit sociotechnisch perspectief

Frank Geels and René Kemp<sup>1</sup>

Nov 2000

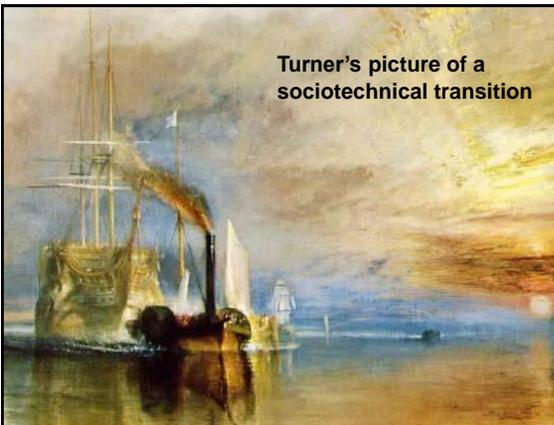
## Conceptual sources

- 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'

## Sustainability transition needs system 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

Turner's picture of a sociotechnical transition

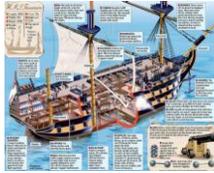


## Transition in sociotechnical systems associated with a transformation in innovation governance

- new types of innovation actors
- new types of knowledge

### Sailing ship sociotechnical network

Woodworkers



Weather

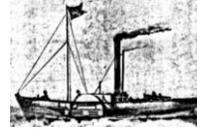
Preserved food

Forests

Naval dockyard  
as innovator

### Steam ship sociotechnical network

Coal mines



Business enterprise  
as innovator

Engineers

Timetables

Metal workers

Fuel depots

### A new policy agenda – the transition to a low carbon/green economy

- Narratives of transformative change have moved from margin to mainstream since 2000
- Policy landscape has changed from climate science 'problem' to low carbon innovation 'solution'
- Challenge of climate change is expressed as ambitious policy targets of emission reduction

### The policy opportunity

- New policy initiatives increasingly recognise the importance of socially situated practices
- Yet policy advice remain dominated by economics (the market) and psychology (the individual)
- Sociological approaches to science, technology and innovation studies need to assert themselves much more effectively in the policy domain

### The new sociology of innovation

- Networks
  - Interactive - Freeman, Rothwell
  - Actor networks – Callon, Latour
- Actors & practices
  - User led – von Hippel
  - Consumption – Shove, Warde
- Knowledge
  - Mode 2 - Nowotny
  - Innovation commons – Lessig
- Change
  - Sociotechnical transitions – Geels, Schot

### Implications for innovation policy

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

## New place based 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.

## A different type of innovation policy?

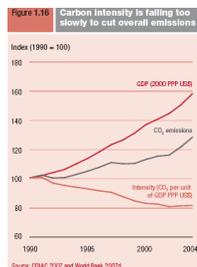
- Innovation in systems of practice and provision not single innovations in products and processes
- A mixture of social and technological change, 'socio-technical' innovation not just new technologies
- Transformative not incremental innovation

## New capabilities needed

- Understanding of systemic (not singular) innovation
- 'Learning by doing' - sociotechnical experiments
- Framing goals in terms of societal outcomes rather than technical inputs
- Promoting 'bottom up' innovation to complement the 'top down' carbon market
- Need for new interdisciplinary boundary spanning competences

## Incremental innovation is insufficient

- Relative improvements in resource use & pollution impact eg: household appliances, cars, aeroplanes
- Yet, environmental impact of household and personal transport continue to increase - the 'rebound effect'



## Transformative innovation – a new focus

Defra's Evidence Investment Strategy 2010–2013 and beyond

for James  
"to secure a healthy environment in which we and future generations can prosper"



- 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;
- 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.

**WBGU**  
German Advisory Council on Global Change

**Flagship Report**

**World in Transition  
A Social Contract for  
Sustainability**

### Committee on Climate Change – Innovation Challenge 2010

We distinguish between technologies that the UK should *develop and deploy*, versus *deploy*, versus *research and develop*.

Based on our assessment of technology portfolios required to deliver climate objectives, current stages of technology development and the UK's research and industrial capabilities, we recommend that the UK should:

- Develop and deploy offshore wind, marine, carbon capture and storage (CCS) for power generation, aviation technologies, smart grids, and electric vehicle technologies.
- Deploy nuclear power, advanced insulation materials, heat pumps and CCS for energy intensive industries (there may also be scope for UK participation in demonstration of industry CCS).
- Research and develop hydrogen fuel cell vehicles, technologies in agriculture and industry, 3rd generation solar PV technologies, energy storage and advanced biofuels technologies

### Harness Science and Technology to Address the "Grand Challenges" of the 21st Century

- US National Economic Council
- Complete DNA sequencing of every case of cancer
- Solar cells as cheap as paint
- A light-weight vest for soldiers and police officers that can stop an armor-piercing bullet.
- Educational software that is as compelling as the best video game
- Intelligent prosthetics
- Biological systems that can turn sunlight into carbon-neutral fuel,
- An "exascale" supercomputer capable of a million trillion calculations per second –

A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs

2011

### 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

### The science community

- Increase investment in 'science and innovation'
- Focus on excellent people
- 'well-defined global challenges can pull science towards shared goals. Identifying problems protects the space for free enquiry by asking the scientific community to identify solutions that meet societal needs'



## Climate KIC Pioneer Cities

- Birmingham, Frankfurt, Wroclaw, Bologna/Modena, Castellon Valencia.
- So far, we have identified 76 existing low carbon innovation projects
- Investment €1500m
- Aim is to ensure that they contribute effectively to the transition to a low carbon society

## Pioneer Cities – project goals

- Establish platform for societal challenge and demand led innovation
- Identify the socio-technical innovation required for low carbon transformation
- Explore innovative solutions for systemic change within cities
- Draw on existing practice and expertise in major conurbations
- Demonstrate the feasibility of rapidly progressing EU energy & climate targets at local level

## Transition platforms, arenas & experiments

- **Platforms** – broad areas defined by ‘end use’
- **Arenas** - specific sociotechnical systems within the platforms which embrace a cluster of experiments
- **Experiments** – innovation projects which address a societal challenge, engage with system innovation and enable reflexive learning

## Transition Platforms

We have defined three major platforms

- Buildings
- Energy Networks
- Transport

These express major areas of persistent GHG emissions as shown in the European low carbon road map

## ‘transition platforms’

- not defined by specific technologies
- user oriented arenas of practice with the potential for low carbon system innovation
- do not prejudge the importance of different technologies or social solutions
- create generally applicable knowledge about the process of system innovation for climate change mitigation
- practice based learning by doing and interdisciplinary knowledge about innovation.

## Buildings

- Arena 1: enhancing the energy efficiency of buildings through design or retrofit
- Arena 2: enabling the users of buildings to actively manage their demand for energy consumption

## Local energy networks

- Arena 3: combining the generation of heat or cooling with power
- Arena 4: connecting the biowaste stream with energy production

## Transport

- Arena 5: developing low emission vehicle systems
- Arena 6: integrating multiple modes of mobility to reduce car dependence

## Broad based & challenge led innovation governance

- A continuing and contested process
- Needs a fundamental reconfiguration of the domain of innovation policy
- The 'science system' decentred to become part of a more diverse innovation system led by 'system actors'



Regional Innovation Implementation Community (RIC)