UK-INNOVATION RESEARCH CENTRE

# International Energy Cooperation for Radical Innovation

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# The Background

"Global challenges" – large, planet-scale problems that require innovative solutions and multilateral collaboration. These include climate, energy, resources, urban infrastructures, health, food security.

Today: how does innovation policy relate to the energy challenge? Obviously we need international cooperation for energy innovation – but how to approach it?

# Two areas of (unconnected) work

- Innovation studies: what determines the rate, direction, and character of innovation? Over the last three decades innovation has been much more explicitly studied – new journals, new research centres and programmes, new data sources, etc.
- Energy economics – much work on carbon taxation, subsidies, energy pricing, transition problems. But generally weak treatment of innovation.
- How can we bring these two fields together? What can innovation studies tell us about energy issues? In UiO, TIK energy/innovation group is working on this.

# Innovation studies and technological ‘regimes’

- Technologies are complex systems: they are technical functions that integrate many different artifacts, forms of knowledge, scientific bases, engineering practices, resource use, business models, policy support and social patterns of use.
- There are regimes for transport (cars, air), photography (digital imaging), energy (the hydrocarbon system) etc.

# Modes of innovative change

Three forms of ‘regime change’:

- *Incremental* – small scale change that improves performance or quality within the existing regime (such as improved fuel economy in cars).
- *Disruptive* – changes in technical function that leave much of the regime intact (electric versus manual typewriters; digital versus film imaging)
- *Radical* – Innovations that ultimately replace the existing regime (steam power versus wind or water; digital versus electro-mechanical processes)

# Characteristics of radical innovations: what do we know?

- Very long time horizons
- Very great risk and uncertainty (technological and financial)
- Complexity in knowledge bases and use of scicence
- Complexity in technological components
- Major infrastructure requirements
- Lack of economic signals to innovators
- Need for significant incremental improvements over time
- Major roles for government

# Why have governments been so heavily involved in radical innovation?

- They can identify large-scale socio-economic missions and opportunities
- They can deploy large financial and personnel resources
- They can commit for long periods
- They can bear, distribute and manage risk
- They can coordinate, especially beteen the science system and business
- They can compel support

# The Energy Innovation Picture

- We have substantial incremental innovation affecting energy efficiency (GDP energy coefficients are falling over time) and conservation. But this is *within* the hydrocarbon regime. The main policy instrument here is carbon pricing.
- We have a range of disruptive technologies – mainly renewable of all kinds (PV, geothermal, wind, hydro, etc). Currently there are substantial obstacles to the diffusion of these technologies
- We have very little in the way of programmes for radical innovation (fusion, storage, etc).

# Prospects for radical energy innovation

- Climate, and the environment generally, is a global public good.
- There is no real prospect for national governments to solve the relevant problems alone.
- But there is of course no global government
- What is required therefore are new forms of multilateral collaboration in energy innovation.

# Models for collaboration

- Ultimately the problem here is to manage a collective property resource
- In economics, the usual approach to this is via the “tragedy of the commons” – solved either by state control or privatisation
- There are alternative collective management approaches that have been shown to work on a small scale – mountain pastures in Switzerland, fishing rights in Sri Lanka, aquifers in Western USA.
- The problem before us is can this approach be scaled up to the level of nation states for large-scale investment in energy innovations??

# Challenges for collaboration

- Current policy is too focused on economic instruments such as carbon taxes.We need to create the scientific and technological bases for radical change in the energy regime.
- We have a major problem of institutional design.
- Current international agencies are not appropriate.
- The problem is to design a collaborative programme that can identify opportunities, formulate search strategies, and resolve the distribution of investment and benefits
- This is essentially a problem of political leadership which will not necessarily come from large countries

# A final thought …

We need to develop a solid conceptual approach to the global collaboration problem, and a credible implementation framework.

The best country to undertake this challenge is Norway … !