



Report on: *Regional Studies Association Research Network on Green Regional Innovation, Entrepreneurship & Governance (GRIEG)*

Title: Climate Change and Eco- Innovation: Regional Perspectives

Date: November 12, 2008

Location: Aalborg University School of Development & Planning, Denmark

The workshop entitled ‘Climate Change & Eco-Innovation: Regional Perspectives’ was held on November 12, 2008 at the Aalborg University School of Development & Planning in Denmark. It was hosted by the Regional Studies Association, and the Dynamics of Markets & Institutions in Europe (DIME) project, through the Centre for Advanced Studies at Cardiff University. There were approximately twenty participants in attendance who were a range of policymakers, academics, and stakeholders.

The topic for the day was based on current, worldwide interest in climate change and solutions to our dependence on non-renewable energy. There is a certain privilege bestowed upon social scientists and citizens living at this point in time when the deep, propulsive resource that fuelled every technological paradigm since the onset of the Industrial Age seems itself to be in question. Under the hypothesis that Climate Change and so-called ‘peak oil’ explain the possible future demise of hydrocarbons as main energy providers to economic evolution, the workshop was designed as a forum to consider the present conjuncture alternatively, and more boldly speaking, as a new post-hydrocarbon ‘socio-technical landscape’

The workshop was divided into sections, ranging from green entrepreneurship to alternative energy producing technology, which contributed to the title for the day. There were ten speakers in all, with varying expertise, from within the European Union:

- **Birgitte Gregersen**, Department of Business Studies Aalborg University
- **Bjorn Johnson**, Department of Business Studies, Aalborg University
- **Jesper Lindgaard Christensen**, Dept. of Business Studies Aalborg University
- **Maj Munch Andersen & Mans Molin**, DTU Management Engineering, The Danish Technical University
- **Anne Nygaard Madsen**, Department of Management Engineering, Technical University of Denmark
- **Søren Kerndrup**, Department of Development and Planning, Aalborg University
- **Fernando Diaz Lopez**, TNO Built Environment and Geosciences, Delft
- **Åge Mariussen**, NIFU-STEP, Oslo
- **Arne Remmen**, Department of Development and Planning, Aalborg University
- **Philip Cooke**, Centre for Advanced Studies, Cardiff University & Aalborg University

The remainder of this report will be a section-by-section analysis accompanied by brief explanations of the individual presentations.

I.

The first session of the day focused on Entrepreneurship, Innovation and Development. The presenters during this section were Birgitte Gregersen, Bjorn Johnson, and Jesper Lindgaard Christensen. **Birgitte Gregersen** presented first on ‘Local entrepreneurship and local ownership as drivers for renewable energy – learning from the case of Samsø’. This presentation was based on a 1997 Danish government competition for local municipalities or islands to propose a realistic plan for how to convert to 100 percent renewable energy within a period of 10 years. The

idea behind the competition was to investigate how renewable energy could be implemented within a limited geographical area using existing technology. Local involvement by different actors was considered an important aspect as well.

The small Danish island, Samsø, with 4300 inhabitants, won the competition. Today, in 2008, the island has a 100 percent renewable energy supply mainly based on wind energy and the island has become an exhibition window for renewable energy technology and carbon neutral society. The presentation discussed main ingredients for success in this case: a common vision; local entrepreneurship, competences and expertise; economic incentives; political support and support from strong local coalitions; local democratic participation and local ownership.

The second presentation was by Bjorn Johnson on 'Cities, systems of innovation and economic development'. Bjorn's presentation emphasized innovative cities as necessities for the economic growth and development of countries. At the same time, however, social and environmental problems related to city growth can be serious threats to the full realisation of the socio-economic contribution that cities can make. His paper argued that the notion of a "system of innovation" is helpful in understanding the factors that shape the processes of innovation and that determine the extent to which problems related to city growth may be solved. He also argued that it is in cities, especially big cities, that the power of innovation to promote economic growth and development will be tested, and that in this context, institutional innovation and political innovation as compared to technical innovation are of special importance.

Jesper Lindgaard Christensen's presentation was the final one for this section. The presentation entitled 'Cities, systems of innovation and economic development?' emphasized the growing interest in the clean-tech market. The pace of investment in clean-tech companies is accelerating, and the market is seeing its first successful initial public offerings and mergers and acquisitions. The question is if the present trend in investments into the clean-tech industry is just another 'hype', maybe even a case of herding behaviour of venture capitalists?

Denmark has had a long tradition for investments into environmentally friendly technologies, but has until now not succeeded to the same extent as in several other countries to attract notable private capital to the clean-tech industry. The paper is mapping the investments and assesses prospects for the future development of the industry in Denmark.

II.

After a short coffee break, the early afternoon session got underway, with the focus on the Greening of Technologies and Regions. There were two presentations during this session: Maj Munch Andersen and Anne Nygaard Madsen. The first presentation was by Maj Munch Andersen, based on a paper by Andersen and Mans Molin on 'The greening of the innovation system – nanotechnological perspectives'. Many studies on innovation systems focus on how they perform rather than form and transform. This paper proposes to study the greening of innovation systems from a strong paradigmatic approach. The paradigm discussion is first of all important because it puts emphasis on the radicality and path dependency of the greening process and the cognitive structures underlying the economy. The green paradigm change is of a very fundamental character and it is likely to have pervasive and disruptive impacts on the economy.

The paper argued that in order to understand techno-economic paradigm change we need to situate these greening trends in a specific historical and structural context. In analysing the greening of innovation systems focus should be on how new greener

search rules are caught up by organisations (firms), science, technology and institutions within given innovation systems.

Empirically the paper focuses on the greening of nanotechnology within the Danish innovation system. Nanotechnology is a special case, both because of the very early stage of technology evolution and also because it is a technology which seems to have considerable eco-innovation potential but also possibly environmental risks. It therefore provides a good opportunity for studying real time co-evolutionary processes. Some early empirical findings from nanotechnology in the Danish construction sector are brought.

This was followed by Anne Nygaard Madsen's presentation on 'Regions' role in the formative phase of a Hydrogen Fuel Cell innovation system'. The concept of a hydrogen economy captures the high expectations that hydrogen and fuel cell (HFC) technology may bring for the future. According to hydrogen economy supporters, this emerging technology will be able to bring radical changes to all parts of the energy sector through its many application types within transport, stationary and portable devices. If the hydrogen is produced from renewable energy sources, this new energy carrier can help in reducing one of our times' biggest environmental challenges – the emission of CO₂. However, as an emerging and disruptive technology, HFC faces severe challenges on its development path before it will be able to compete with incumbent energy technologies. The vision of a hydrogen economy is reflected in the political support HFC technology has received in the last decade. Not only from a national (or supra-national) level (in particular USA, Japan, and Europe) but also the regional (sub-national) level seems to play an important role in driving the development (e.g. North-Rhine Westphalia, Germany; Tees Valley, UK; Aragon, Spain; California, USA; Central Jutland, Denmark). Development activities within HFC technology seem to be embedded in regional economies. Within the last decade, regions throughout Europe and across the world have promoted the HFC technology area by hosting and supporting demonstration activities, and building cluster-like networks in order to strengthen the region's engagement in HFC technologies. The presentation provided understanding the regional impact upon the emergence of HFC.

III.

The post lunch session focused on Frameworks of Innovation and Regulation and included three speakers including one of the coordinators Soren Kerndrup, followed by Fernando Diaz Lopez and Age Mariussen. Soren's presentation entitled 'Innovation and Renewable Energy - an integrated approach. Lessons from the windmill sector' started the afternoon session. The presentation highlighted the windmill sector of Denmark focusing on regional development and entrepreneurship. To bridge Soren's windmill session with the upcoming presentation by Age Mariussen on Carbon Capture Storage technology, Fernando Diaz Lopez presented a paper entitled 'Niche Experimentation and Innovation: Towards a Novel Framework for Regional Innovation Strategies' which was based on a paper co-authored by L. Coenen, F. Diaz Lopez, and T. van Bree. This paper developed a framework for tailored regional innovation strategies that foster niche developments and emerging technologies and innovation from within the region. Against this context, sustainable energy technologies provide an important thematic point of entry given the future importance of the energy sector and the high level of uncertainty and diversity vis-à-vis technological developments. This offers plenty of scope for regions to develop specialised innovation capabilities in line with the specific resources available in the region.

In the face of major sustainability challenges for the 21st century (e.g. climate change

& rising oil prices), there is a vast attention for securing a sustainable energy economy. In the 'Dutch Energy Transition' a broad set of options and platforms are explored (e.g. bio-based new materials, energy in the built environment, new gas, etc.) in collaboration with a range of stakeholders from government, industry, science and NGOs.

To finish this post lunch session, Age Mariussen discussed 'Carbon Capture & Storage: The Norwegian Experience'. The Norwegian carbon capture and storage strategy is an attempt to mutate the Norwegian petroleum region, specialized in producing oil and gas from the North Sea into saving the world, by providing China the capture and storage technology it need to radically cut its CO₂ emissions before 2020. Yet, carbon capture and storage still does not have a market. Even worse, it is not yet defined as a globally accepted technological paradigm. Accordingly, to pull off this mutation, an attempt is made to mobilize a global movement in defining the parameters of the paradigm, and create the epistemic and scientific transnational communities which one day, hopefully, will be able to move the Chinese future market actors into the right position. In this process of mobilization, contacts are made with the EU-China link. However, the Norwegians have their own approach. The regional industry uses its deep contacts into the tripartite institutional framework which defines the Norwegian business system: the alliance between the government, the unions, and the large corporate sector, with major players such as Aker and Statoil. The Norwegian government is deeply involved in two ways, first in the creation of this global market through lobbying for institutions promoting the solution to the problem of global warming (global taxes on CO₂ emissions), and also, recently, by funding the first large scale test of this technology, through the decision made 2.6.2008 setting up Gassnova, a state owned company responsible for the first in the world large scale test factory which may remove CO₂ emissions from the point of emission of gas based energy industries. In this way, the tripartite coalition is working towards national industrial strategies which, so their story goes, will save the world from disaster in 2050. The paper explained the background of the strategy, its current achievements, and lay out the way ahead.

IV.

After the coffee break, the final session of the day commenced. This session, entitled 'Transition models and future challenges' had the two final presenters of the day, Arne Remmen and another workshop coordinator, Philip Cooke. Arne's presentation on 'Green Markets and Clean Technologies- A Project for the Nordic Council of Environmental Ministers' focused on the Nordic mobile phone industry. Several major mobile phone companies have headquarters in the Nordic region. Taking this into account, as well as the resources, process chemicals, and energy consumption that are required for mobile phone production and subsequently impact the environment, Arne's presentation focused on the environmental impact and strategies to clean up the mobile phone production process.

Philip Cooke finished the day with a presentation on 'Transitional Models: Advantages of a Regional Innovation Systems Perspective'. In considering the step-change in theory necessary to capture not simply another emergent technological paradigm, notably post-hydrocarbon technologies, but a meta-shift that presumes an end to the burning of hydrocarbons, we find the conceptual cupboard almost bare. The main or only candidate is a rather threadbare system innovation or co-evolutionary transition model evolved by authors such as Kemp, Smits, Geels et al. Their approach is in principle highly compatible with the innovation systems approach, which is both

evolutionary and Schumpeterian in inspiration. In this presentation, an attempt is made to assess the system innovation.

Model, indicating three main weaknesses, but also a number of strengths with a view to strengthening our capability to operationalise the meta-thinking involved in a supra-technological paradigm perspective for research and policy purposes. It is well-known the transition model in question proposes that eco-innovation inspired by the profit-seeking and or ethical objectives of minimising production of greenhouse gases (GHGs) hence moderating anthropogenic global warming consists of three related elements. First, firms experiment to find a profitable way to market eco-innovations in 'niches'. Second, when 'niches' coalesce the result is a (green) technological regime. Finally when that regime has become accompanied by co-evolving social, economic, political and cultural systems the result is a new meta-level transition 'landscape'. At that point hydrocarbons would either be redundant or, if utilised, carbon-neutral due to Cleantech innovation. The problems are a certain linearity of reasoning, an absence of agency, particularly governance as agent of change, and an absence of spatiality. Regional innovation systems thinking has solved these problems and empirically demonstrated the importance of proximity in the emergence of 'green innovation', 'green clusters' and 'green governance'. The presentation indicated how 'Transition Regions' are hypothesized to work.