Drivers & barriers for next generation sustainability for cold stores

the role of policy and business environmental decision making

Carole Bond, *Carbon Data Resources*

Jonathan Radcliffe, *University of Birmingham*

March 17th 2021

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 691761.

- What are the policy & regulatory drivers for energy and climate change
- Why taking a strategic approach to energy and environmental challenges is key to success
- Barriers to adopting new technologies and business models - and how organisational enablers can help
- Key factors for successful introduction of new more sustainable technologies

Research background

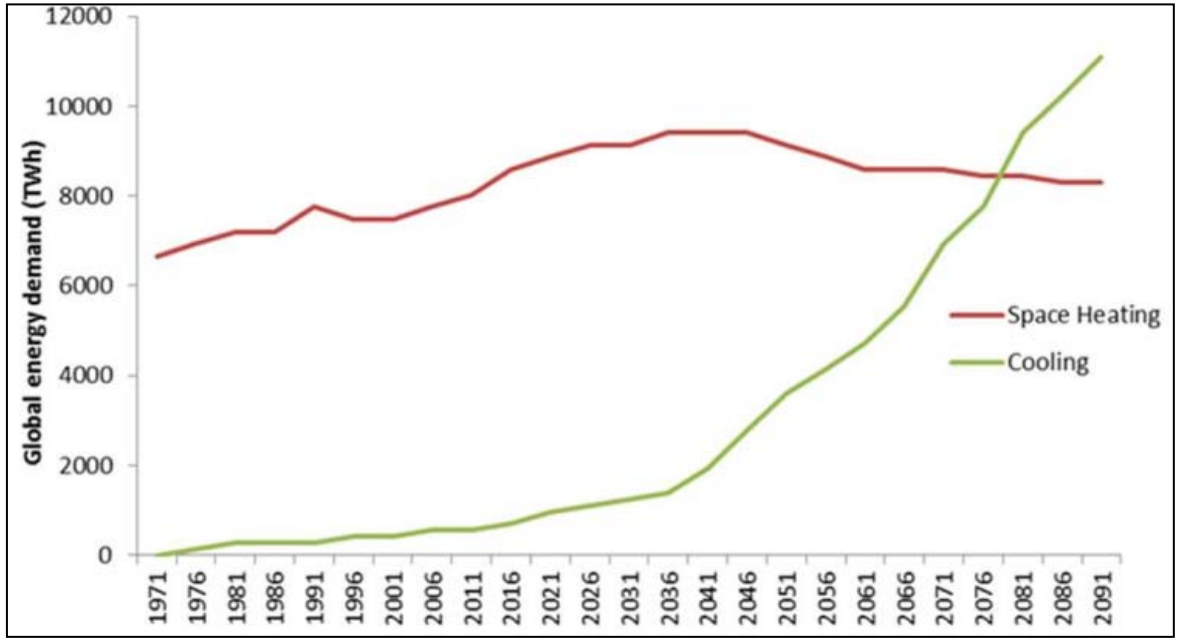
- Investigations to identify the non-technical, contextual barriers and enablers within the refrigerated warehouse and food processing sector in realising low carbon and sustainable working including the potential of renewable energy and energy storage technologies.

Demand

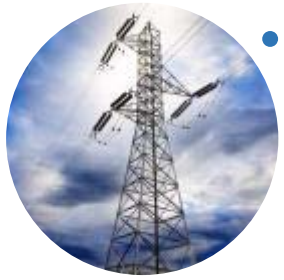
Heating and cooling are large users of energy and producers of carbon

Cooling demand is expected to:

- Grow 50 times by 2100
- Adding 100GT to 2050
- Equivalent to 0.5°C of additional warming.
- Incremental approaches to cooling efficiency are insufficient



Source: PBL Netherlands Environment Agency



The future landscape

UN Climate Action Summit/COP25 2019

- Reduce GHG emissions to prevent mean global temperature from rising by more than 1.5^{o}C above pre-industrial levels
- 65 countries plus EU pledged to cut GHG emissions to zero by 2050, agreed EU Green Deal
- EU promised to give a quarter of its budget to climate action in next year
- Climate Ambitions Coalition commitment to Net Zero by 2050 – 73 countries & 1214 regions, cities, businesses, investors

- *Global climate strikes began 2018 by Sept 20 2019 – more than 4m participants. Continued online in 2020*

The future landscape

EU Energy dependence

- The drive for energy security and independence from energy imports boosting domestic development of renewable energy schemes
- Energy security key driver for RE - 53.6 % of the EU-28's gross inland energy consumption in 2016 from imported sources
- Growth of primary production from RES 66.5% 11 year period 2006-2016. Exceeds all the other energy types.

The EU's Clean Energy Package

- Lack of coordination between national and legal planning and permitting authorities
- Focussing on delivering the stable legislative framework needed to facilitate the clean energy transition to Energy Union and on achieving the Paris Agreement commitments
- Incorporates 8 different legislative proposals including recast Renewable Energy Directive (REDII), Energy Efficiency measures and the Market Design Initiative (MDI)
- The integration of variable RE and flexible storage solutions is part of the MDI.

The future landscape

EU Interactive targets

- Existing, legally binding member state targets for RES (20% by 2020) and GHG emission reduction working in concert, and future ‘stretch’ targets for RES of 32% by 2030 (recast REDII)
- Policies aimed at improving energy efficiency (e.g. the Energy Efficiency Directive, Ecodesign)

Trends analysis to 2050

- Renewable energy trends anticipating ongoing growth in variable RES : 19% of total RES in 2020, 25% in 2030, 36% in 2050
- Planned investment in energy infrastructure transmission and distribution system 2020-2030 to allow for integration of more RES into the power system

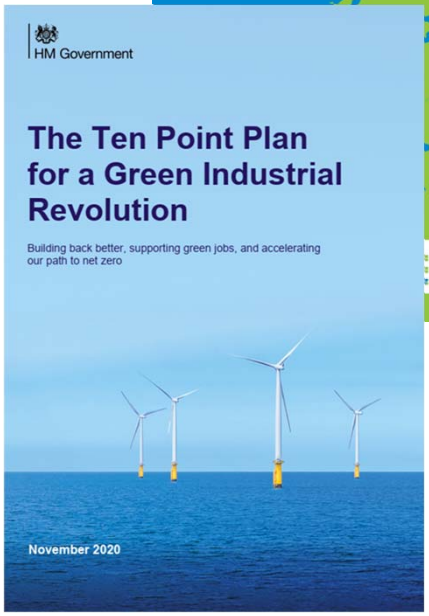
Energy storage

- The development and integration of energy storage as a key element of both the recast Renewable Energy Directive (REDII) and the Market Design Initiative (MDI)
- Raft of measures including insured grid connection, removal of barriers, freedom to build revenue value streams etc

The future landscape

UK Scenarios for net-zero in 2050

- **Resource & energy efficiency** to reduce demand
- **Electrification** – major expansion of renewables and low carbon power generation
- **Societal choices** eg reduced consumption of beef, lamb, dairy
- **Hydrogen economy** – replacing gas
- **Carbon capture and storage** (CCS) – 2020 budget x2 CCS plants in UK
- **Changes in land use** – more sequestration & biomass production



Common barriers to RES targets across EU

Political & economic framework

- Lack of coherence, unity and certainty in national RES policy-making
- Unstable and unpredictable political/legislative climate
- Poor access to finance and investment
- Uncertainty, instability and retroactive adjustment of support schemes

Grid regulation and infrastructure

- Lengthy, complex and costly grid connection processes and uncertain contracts
- Insufficient grid capacity and grid infrastructure investment
- Lack of certainty or compensation for curtailment conditions

Common barriers to RES targets across EU

Administrative processes

- Lack of coordination between national and legal planning and permitting authorities
- Complex and costly planning and authorisation procedures
- Competing public interests in spatial planning especially military and civil aviation radar and radio infrastructure installations

Market structure

- Lack of clarity regarding the future design of the electricity market

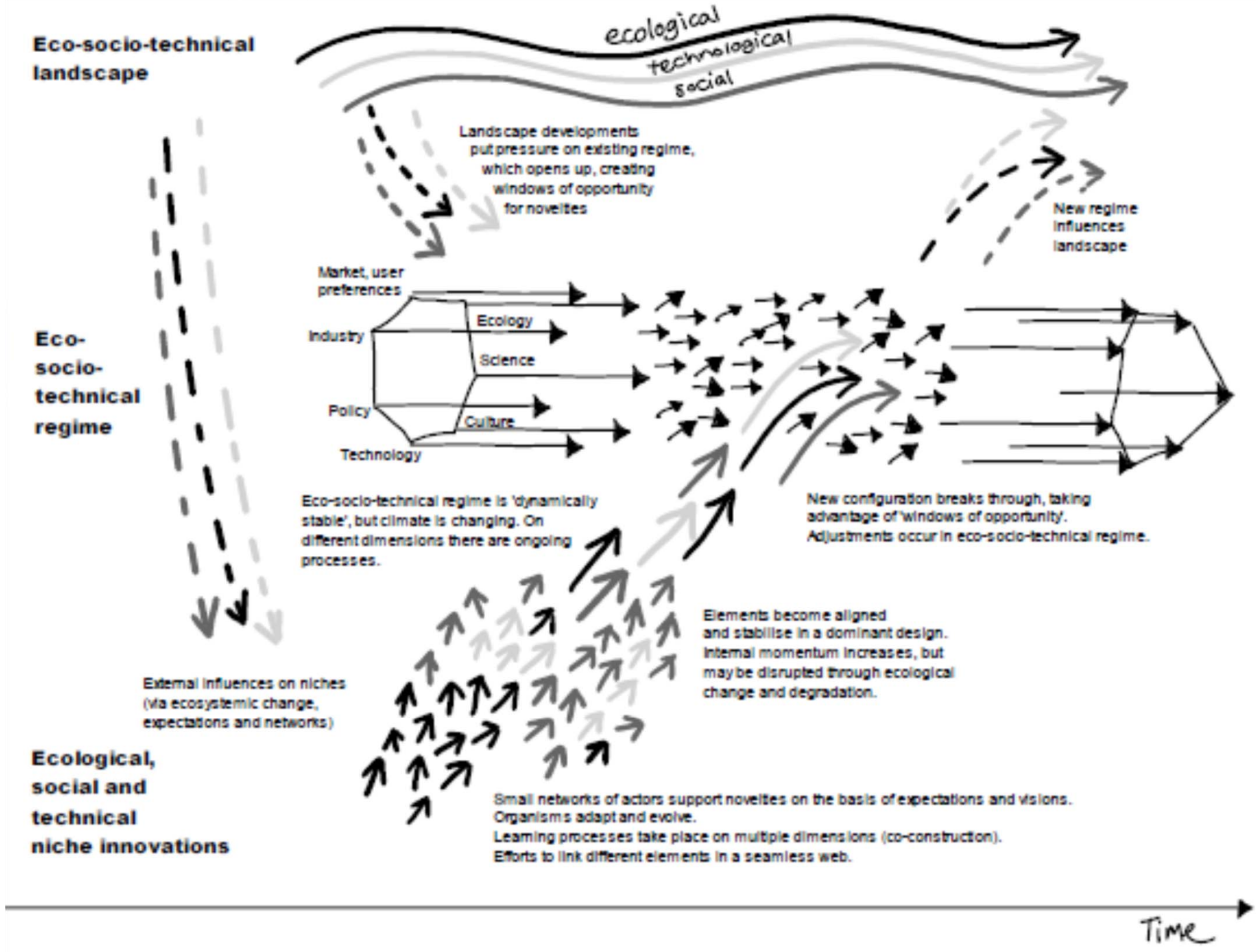
Public acceptance/social awareness

- Negative public perception of RES and political demonisation of producers
- Increasing local opposition and appeals against permits

Contextual barriers and enablers

A number of relevant approaches, models and change theories applicable to the adoption of renewable energy & low carbon & energy efficient technologies and practices in the cold storage and food manufacturing sectors:

- **Individual**
  - **Behaviour change theories arising** from dominant social psychology and economic traditions.
  - **Social practice theories** looks at the energy consuming actions themselves and the context around them.
- **Organisational**
  - **Complementarities theory** examines personal, skills related, cultural and sector-wide influences in an organisational change context.
- **System**
  - **Eco-socio-technical regimes** multi-level perspective which argues that transitions come about through interactions between processes at three levels:


Eco-socio-technical landscape
ecological
technological
social
Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties
New regime influences landscape
Eco-socio-technical regime
Market, user preferences
Industry
Ecology
Science
Policy
Culture
Technology
Eco-socio-technical regime is 'dynamically stable', but climate is changing. On different dimensions there are ongoing processes.
New configuration breaks through, taking advantage of 'windows of opportunity'. Adjustments occur in eco-socio-technical regime.
External influences on niches (via ecosystemic change, expectations and networks)
Elements become aligned and stabilise in a dominant design. Internal momentum increases, but may be disrupted through ecological change and degradation.
Ecological, social and technical niche innovations
Small networks of actors support novelties on the basis of expectations and visions.
Organisms adapt and evolve.
Learning processes take place on multiple dimensions (co-construction).
Efforts to link different elements in a seamless web.
Time

Company research

In depth interviews were undertaken with key members of staff at a number of food manufacturer, cold store and retailer sites in the UK, Belgium, Spain, France, Hungary and Bulgaria to capture detailed qualitative and quantitative information about each organisation covering:

- existing business and energy supply strategies
- attitudes & behaviours around energy efficiency & low carbon working
- **barriers to and benefits of** next generation sustainability measures such as the integration of renewable energy sources and energy storage.

Case	Benefits	Company barriers	Policy barriers
A	• Good environmental kudos. • Reduced electricity consumption. • Will allow us to meet our environmental objectives. • Satisfy our customer environmental objectives	• Capital cost of installation • Rate of return on investment • Technical difficulties of operation and maintenance • Not a desired core competence	• Don't know any barriers to CES.
B	• One of the means for us to reach 100% renewable energy consumption	• Don't know any barriers to CES	• Over-installation of renewable technologies limits grid feed-in potential
C	• To provide targeted power to freezer tunnels especially during daytime use. • To enable energy generated by PV during the day to be used during the night to help to lower storeroom temperatures to -25°C.	• Unfamiliarity with the technology • Can't distribute electricity around site because of regulatory restrictions on moving electricity under public roads (around 3 sides of the site).	• Encouragement of large-scale renewable energy would discourage local energy production • The absence of feed-in-tariffs
D	• Can be used to shift consumption of electricity from expensive periods of high demand to periods of lower cost electricity during low demand	• Safety • Cost • Payback • Easy to use or not	• Lack of policy incentives
E	• Use of a levy for grid connection would encourage local investment in alternative technologies	• Operational costs • Better locations for renewable generation	• Potential for grid feed-in levy
F	• By improving the overall efficiency of the power grid, we can use the storage to accelerate the broader adoption of renewable energy.	• Operational costs • Risk management • Flexibility of action	• Not aware of any policy barriers
G	• Load shifting to avoid high tariffs • Load shifting to avoid peak demands on refrigeration plant • Supports delivery of net zero carbon reduction objectives • Improving supply resilience	• Rate of return on investment • Integration with existing technologies very important • Getting buy-in from all stakeholders	• Removal of feed in tariffs • National energy policy ('holding us back because we are ahead of it') • Value of carbon
H	• Improving reliability of supply • Supports company's green branding	• Availability of technical support for service/maintenance • Rate of return on investment	• Grid permitting complicated and expensive

Thank you

Carole Bond

Carbon Data Resources

Twitter@carbon_data

e-mail: carole@carbon-data.co.uk

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 691761.