

Analyzing “green” transition in the bio-economy – examples from Norway



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Three cases

1. Turning to biogas in **public transportation** – institutional changes and niche technology
2. Developing sustainable feed in **aquaculture**
3. Transition towards zero emission in **agriculture**

Here: Focus on case 1.



Case 1: Turning to biogas in public transportation

– institutional changes and niche technology



- **General development** ca. 1990-2009: Biogas for handling “public waste”. Internal use. No commercial use. Sweden a forerunner on biogas in transportation.
- Around 2009: Initiatives for **upgraded use**, e.g. public transport in the Trondheim region (case).
- Use side: **Miljøpakken in Trondheim** 2009 – change from fossil liquid fuel (diesel) to liquid gas as fuel. First LNG (fossil), then LBG (2015). Same combustion technology.
- Supply side: Biokraft AS (2009). Process to establish a **large-scale biogas plant** near Pulp & Paper (P&P) factory in the region (Norske Skog). By-products from aquaculture and P&P. Public transportation in Trondheim (buses) foreseen as main customer.
- Challenge: **Cheap fossil gas vs. expensive bio gas**. Negotiations Trondheim commune, Sør-Trøndelag county and state authorities 2011-2015. Cancel of exemption on tax on fossil gas for transportation in 2015. Decision to build the factory.
- **Swedish biogas production technology**. Developed since 1996. R&D: Testing of innovative combination of by products as input (aquaculture and forestry).
- Use of **existing actors/technology** in the value chain (e.g. liquidation of gas, distribution, combustion).

Analysis - lessons

- Green shift (transition). In this case: Sum of many small steps. **Evolutionary**.
- The crucial role of **networking** – establish relationships to actors, identify relevant technology and suppliers, influence institutions (regulation, support).
- Utilize resources and competence **across sectors**. Exploit and contribute to biological cycle.
- **Profit** as a “positive” motivation.
- The significance of an **actor** (coordinator, “front runner”).
- Identify **niche innovations** – not necessarily in your own country.
- The critical role of **institutions** – incubator for transition. Benefitting from legal and economic instruments.
- This case: Shift in a **regime** on local/regional level: public transportation in Norway’s third biggest city.
- Example of **reconfiguration transition**: moderate landscape (external) pressure and niche technology already developed (see figure next slide).

Forms of transition

Niche innovations / Landscape pressure	Not developed	Developed
Moderate	<p>Transformation</p> <p><i>Key words:</i> Gradual innovation from existing technology. Gradual adjustments in regime rules. Pressure (interest groups, scientists, outsider firms).</p>	<p>Reconfiguration</p> <p><i>Key words:</i> Adoption of niche innovations to solve local problems. Distributed sociotechnical systems with multiple technologies. Cumulative changes in basic technological architecture. Major regime changes over time.</p>
Strong	<p>De-alignment and re-alignment</p> <p><i>Key words:</i> Sudden landscape changes. Regime quickly under pressure. Destabilization. Development of multiple innovations. Recreation of regime around one of the new technologies.</p>	<p>Technological substitution</p> <p><i>Key words:</i> Major tensions in the regime. New solutions from competition between old and new firms. New technological architecture gradually replaces old. New regime substitutes old.</p>

Source: Geels et al. 2016

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