Industrial policy respecting the necessity of zero emissions
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IETS, DEEP DECARBONISATION IN INDUSTRY, VIENNA 9-11/10 2019
REALISING INNOVATION IN TRANSITIONS FOR DECARBONISATION

MEAT/DAIRY  PAPER  PLASTIC  STEEL

Understanding change from within the four key material sectors and across their value chains

Value chain perspective from primary extraction to consumption, end-of life and recycling.
Pathways towards decarbonization that range from less use to electrification and CCU/S.
Innovation database, sectoral mappings, workshops, 18 case studies, IAM scenarios, etc
2017-2020
Industry characteristics and innovation systems

- **Industry structure**: capital intensive, investment cycles, scale economies
- **Innovation strategies**: incremental process improvements, some products
- **Markets**: bulk commodities, cyclic, small margins (but some nichés)
- **Public policy**: safety, pollution, energy efficiency and *sheltered against disadvantages*
- **Systemic lock-in**: incumbents, no markets, no push-pull, CO₂-leakage

Insights on emissions intensive industry. Formerly known as the ‘hard to decarbonize sectors’

- Zero emissions is a liberating thought
- Industrial decarbonisation is about a broad societal and industrial development and requires a new industrial policy (not climate policy alone)
- It involves new sectoral couplings, value chains and business models.
- Power (e.g., MNCs in petrochemicals) and agency (e.g., hydrogen steelmaking) for different sectors and options.
- Materiality and geography matters (e.g., recycling and relocation of primary production).
- Economic impacts on final products are very small. Affordable yet difficult.
- Biogenic carbon scarcity remains a challenge.
- Infrastructure for electricity and CCUS important.

Miniatur Wunderland, Hamburg, June 2019
Carbon Ruins Exhibition at Eden, Lund April 2053

2026 Peak plastics, plastic production reaches 450 million tonnes annually.
2027 The European oil industry crashes, Equinor divests from fossil fuels, BP goes bankrupt, Total SA is taken over by EDF (Électricité de France). Shell, Eni S.p.A. and Repsol merge the year after.
2026 EU replaces the Common Agricultural Policy with a sustainability-based agriculture subsidies and tax system called Transitional Agricultural Policy (TAP).
The United Nations Framework Convention on Plastics (UNFPC) is set up and the Juklu Protocol on plastics is agreed on.
2024 The carbon bubble bursts. ExxonMobil loses 10% of its value as it is forced to write off large shares of its assets. Its credit rating drops to a substantial risk level (CCC-)
2028 Plant-based milk outsells dairy-milk in some Swedish supermarkets.
2027 The European oil industry crashes, Equinor divests from fossil fuels, BP goes bankrupt, Total SA is taken over by EDF (Électricité de France). Shell, Eni S.p.A. and Repsol merge the year after.

Transition years – leave it in the ground, leave fossil behind 2015-2045

2045 Sweden as the first developed country in the world reaches net-zero GHG emissions and thereby achieves its Climate Policy Framework and Climate Change Act objective stated in 2018.
2043 Sweden reaches its 2030 goal to develop a 100% renewable energy system by 2045.
2042 The very last blast furnace in Sweden is closed. Swedish steel is now fossil free.
2039 The international crude oil price drops below US$10 per barrel since 1985 as China and EU in a joint agreement declare a total phase out of all active combustion engine driven vehicles.
2037 Production of bio-based plastics overcomes fossil-based plastics. Half of the plastics are from recycled material, while overall demand still decreases.
2036 The Dukla new Power Station in Poland is shut down, at the time the biggest CO2 emission source in the EU.
2038 Peak steel production from iron ore, from now on more than half of steel is produced through recycling. The world’s first commercial direct reduction plant using hydrogen is inaugurated in Luleå, Sweden.

Curated by Johannes Stripple, Alexandra Nikoleris, Roger Hildingsson, Ludwig Bengtsson and others
Decarbonisation option categories

- Demand reduction, e.g., sufficiency in m2, goods consumption and car travel
- Materials efficiency, e.g., light-weighting and lifetimes
- Circular economy, e.g., micro, meso and macro recycling and symbiosis
- Energy efficiency. This is always important, also in a fossil-free industry
- Electrification and hydrogen, e.g., H-DRI
- CCUS, e.g., a closed loop biogenic carbon economy and thermochemical recycling
• PLASTICS
  – Around 100 kg per person
  – Packaging, buildings, cars, electronics
  – Low recycling

• PAPER
  – Around 150 kg per person
  – Packaging, printing paper, hygiene
  – High recycling

• STEEL
  – Over 300 kg per person
  – Construction, cars, machinery
  – Around 12 ton per person in stock
  – Very high recycling

Current use in the EU
Sector highlights from REINVENT research

- **PLASTICS**
  - No vision among “molecular managers”
  - Several (partly conflicting) pathways
  - Incumbents taking more control of VCs

- **PAPER**
  - Decarbonisation relatively easy
  - Next biorefineries and closed loop biogenic carbon economy
  - Ambivalent about decarbonisation (e.g., CCUS)

- **STEEL**
  - Visions are forming (from CCS to H2)
  - Lean circular economy important
  - Mature sector, incumbent change agents
Policy ideas for industry, examples

- **EU draft Master Plan for EIl:s (2019)**
  - Markets (create demand, carbon price), Solutions (RD&I), Resources (energy and feedstock)

- **Carbon Market Watch (2019)**
  - PA compliance test, foot-printing, no free allocation, public procurement, increased funding

- **HYBRIT op-ed (09/2019)**
  - Electricity, share risk, carbon price, permits

- **CEPS (2018)**
  - Create markets, handle competition, support MS and industry partnerships

- **Climate strategies (2018)**
  - Recycling, market and phase-out gaps (several proposals)

- **Europan Environment Agency (2019, all sectors)**
  - Experimentation, diffusion, reconfiguration, cities, finance, direction, policy coherence, monitor risks, build capacity

- **Corporate Leaders Group Europe (2019)**
  - Direction, innovation, investment, market demand, circularity, other infrastructure (energy/CCUS)
Thinking about policy (both general and bespoke)

- **Direction**
  - Visions, roadmaps, pathways and strategies for zero emissions. Whole economy and value chain approaches. Pick potentially winning approaches

- **Development and system innovation**
  - Experimentation. Co-evolution with other systems, new value chains and sectoral couplings, markets, norms, regulations and business models.

- **Diffusion and upscaling**
  - Demand articulation. Risk sharing, de-risking and financing (political, market and technical risks). Market demand pull policy. Institutions including permit procedures.

- **Institutional capacity**
  - Government expertise and ability to manage policies, including phase-outs and sunset clauses. Including social dimensions. Methods for evaluating transition policy. Permit procedures.

- **International policy coherence**
  - Carbon leakage, UNFCCC (NDCs), sectoral leadership approaches, free trade, Leadership Group on Heavy Industry, Mission Innovation?

Partly based on Grillitch, Hansen et al (2019), Innovation policy for system-wide transformation: The case of strategic innovation programmes (SIPs) in Sweden
Thank you for listening

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Energy intensive basic materials

- Metals (e.g., copper and steel), minerals (e.g., limestone and silicon) and different organic compounds (e.g., cellulose and plastics) in a circular economy, and nitrogen fertilizer.

- Abatement options in primary production:
  - Carbon capture and storage
  - Biobased feedstock and fuels (biogas, charcoal, wood chips, etc.)
  - Electricity and hydrogen/carbon dioxide for producing hydrocarbons (e.g., methanol)

- Few, if any, co-benefits but mainly more expensive materials (from 30% for steel, 100% for cement, to 300% for plastics)

- Potentially very high electricity demand (+1000-1500 TWh in EU or about half of that?)