Decarbonization of industry – Impact on energy

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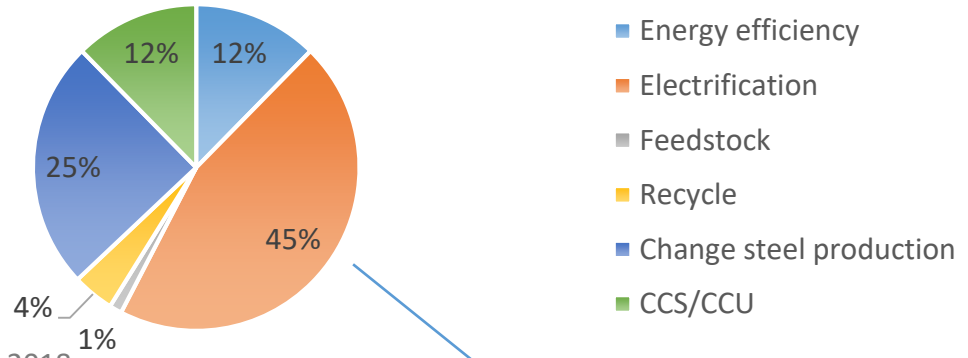
Industry is facing a decarbonisation challenge

- Climate Agreement and EU policy have set targets:
  - 80-95% less CO2 in 2050
  - 40% reduction in 2030

- Investors are warned about risks of fossil investments
  - Bank of England as the first to warn for fossil legacy, in 2015
  - Blackrock institute in 2016 outline the market change
  - Nederlandse Bank 2018: energy transition is a risk, start now changing your investments step by step

The new game for investors: shares with revenue will suddenly loose value. When to sell? Who will buy?

McKinsey scenario 60% reduction CO2 in 2040 NL



Source: McKinsey 2018:
Energy transition : Mission (im)possible for industry? A Dutch example

Can we double the grid in 20 years?

The investment in efficiency, electrification, CCS, hydrogen and new production processes demand much capital. Will it be earned back?

Distributed assets will be a major part of energy systems in 2030

EVs and smart charging will be prevalent will the automotive industry shifting mass production to electric vehicles.

Demand-side management will be widespread, driven by connectivity in sensors, devices, assets and buildings. The rise of machine learning and artificial intelligence will process and analyse data, enabling demand-side management without significant impacts on customers.

Batteries will be in large proportion of new vehicles and will be prevalent in homes and the distribution network.

Installed cost of distributed generation such as solar PV will continue to fall.

Heat will be increasingly decarbonised. The form of decarbonisation will vary by market. Generally, more and more heat will be electrified. Heat networks will grow in urban applications. Green gases will grow as an energy vector for heat and a critical enabler of ever increasing intermittent renewable generation.

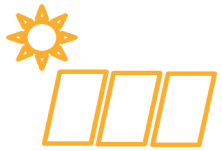
In 2030: flexibility has more value then volume (selling energy will no longer be a business model)
The residential market will be smart homes trading on a real time exchange – and the industry will follow

Distributed assets for industry need a digitally organized interaction

Distributed Asset Trend

Demand-side management will be widespread, driven by connectivity in sensors, devices, assets and buildings.

Batteries will be in large proportion of new vehicles and will be prevalent in homes and the distribution network. Industrial storage can be batteries, hydrogen, chemical, thermal etc.



Installed cost of distributed generation such as solar PV will continue to fall.

Small scale chemical plants, steel production, greenhouses, assembling facilities etcetera

Heat will be locally produced, geothermal, industrial heat pumps and cascaded with neighbouring industrial or residential demand

Digital Challenge and Opportunity

Ensuring data/signal accuracy is important to harmonize demand-side with supply. **Measurement & verification** (M&V) of demand side performance paramount to ROI (based on mega-watts; energy saved)

Storage on hourly basis, days, months and seasonal level will be part of the industrial decision making process, driven by ROI and **scheduling** demands

Extreme **surplus** of solar on certain moments will change cost models for hydrogen, alternating means of heating and production processes that fluctuate with the actual price

Production facilities will be more loosely coupled from the specific product it was meant for. The ability for **instant change of production** creates new market

Heat management integrating actual prices of different sources, heat demand of different users and **optimizing** on result and price.

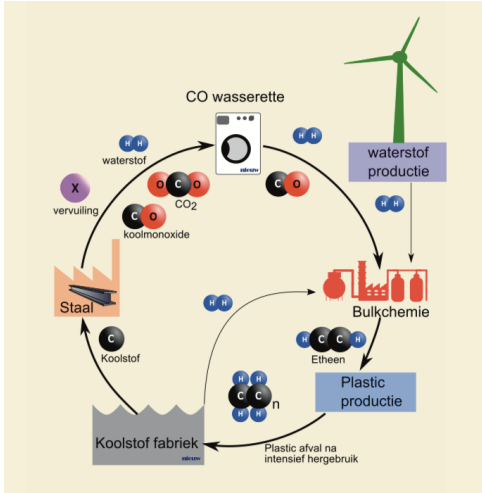
Decarbonisation combined with digital and circular create the new business model

In order to meet investors demands, industries must have a **decarbonisation plan**.

At the same time, there is a challenge on:

- **Digital** transformation (integration throughout the value chain, AI, 3D printing)
- **Circular** economy (raw materials)

- **Local integration** of systems: hydrogen, CO2, heat crossing the borders of a single plant
- **Redesign** production processes, modular products, rethinking geography
- The price of energy will be part of the design of the production process. The **flexibility** in changing the time of usage will lead to significant lower energy cost



The industrial production processes will be dynamic in a digital controlled interaction with its environment

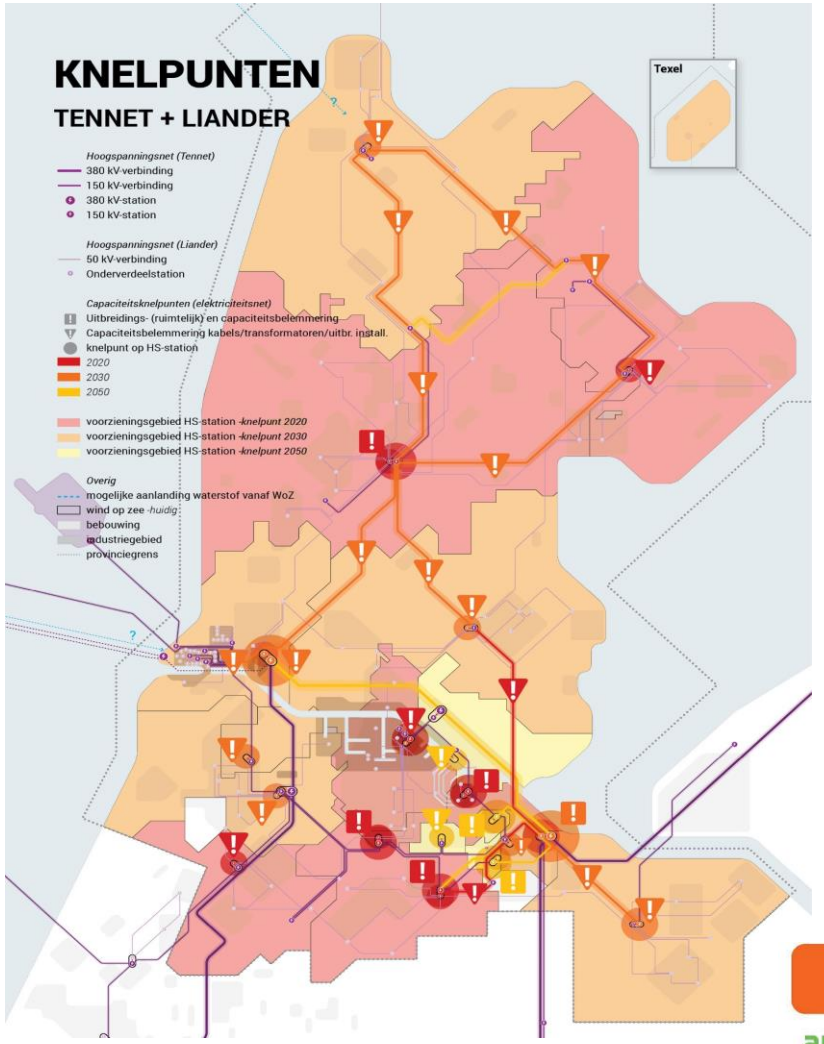
The sudden growth will push investments beyond doable range

Example of the province of Noord-Holland

- The use of electricity will grow with 100-400% in the period until 2050

- This means doubling the capacity network in 15 years and again between 2030-2050. Power grid will have many bottlenecks at high, medium and low voltage.

- Current policies will create bottlenecks in 2050 at
  - 90-95% of the 150kV-stations and some of the HV connections. These issues are in 85% on the demand site
  - 35-50% of the substations
  - 60-80% of the medium voltage rooms



The energy market will shift to platforms that manage local balance for power, gas, heat and hydrogen

The **physical limits** of the energy system in handling all the energy flows will become more critical to manage.

- Shift in value to the **timing and location** of energy demand and production.
- **Optimizing energy** at local, regional and national levels to ensure the overall stability of the energy system.
- Distributed and central **assets will be connected**, in front of and behind the meter.

Taking full advantage of the system

- Increased **communication** and cooperation between all market parties is necessary; optimised systems will require cross-sector and cross-vector integration
- **Platforms** can provide a place for all to communicate with each other, engage in new business activities and optimize on a system level through (price) incentives.
- Market parties can use the available **data** to offer more choice to end consumers and to optimise the energy system.