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What actions need to be taken to ensure a successful industrial transformation process?

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Five key options for reducing GHG emissions in the industrial sector



1. Increasing energy efficiency

E.g. by utilizing waste heat

2. Increasing emission efficiency

E.g. by substituting coal with gas; higher electrification; CCS

3. Increasing material efficiency

- o In production, e.g. by reducing material loss during production
- o In use phase, e.g. by increasing recycling rates
- 4. Increasing product use efficiencyE.g. through more intensive use, as in the case of car sharing

5. Making consumption patterns more sustainableE.g. by travelling less or switching from car use to public transport

demand side (should not be neglected) Further research as well as intelligent policy mix needed to enable industrial sector decarbonization

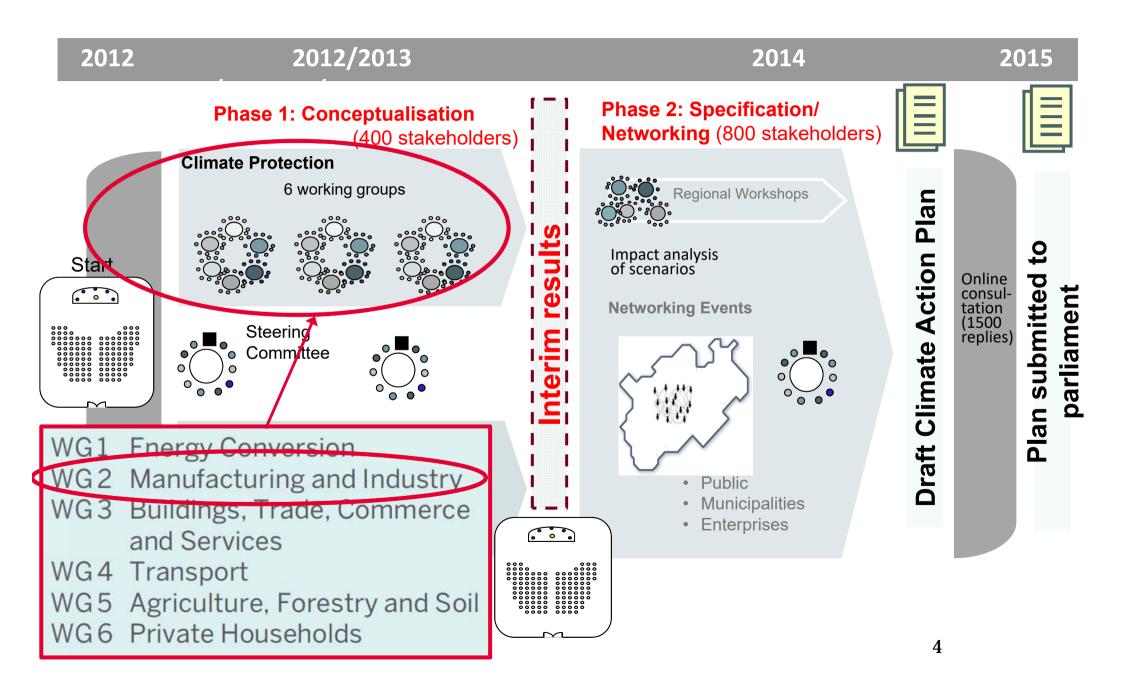


- Identification and (multi-criteria) assessment of potential "breakthrough" technologies/processes capable of contributing to deep decarbonisation
- Identification and implementation of adequate economic, infrastructural and institutional framework conditions required for developing innovative technologies, processes and products
- Identification and implementation of adequate market structures for creating investment dynamics, while ensuring a level playing field across countries
- Support for the development of individual mitigation roadmaps for companies and industrial clusters, based on broad stakeholder participation

 \rightarrow Roadmaps for NRW and for the Port of Rotterdam as examples

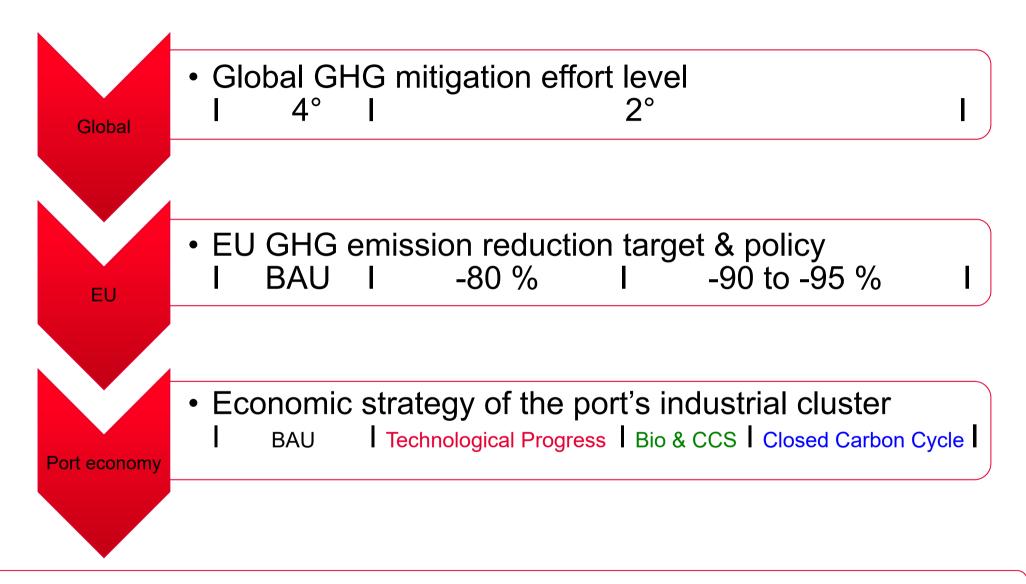
Structure of the participatory process for the preparation of NRW's climate protection plan





Study for the Port of Rotterdam industrial cluster: Stepwise approach to scenario definition





Development of scenarios and discussion of scenarios with stakeholders

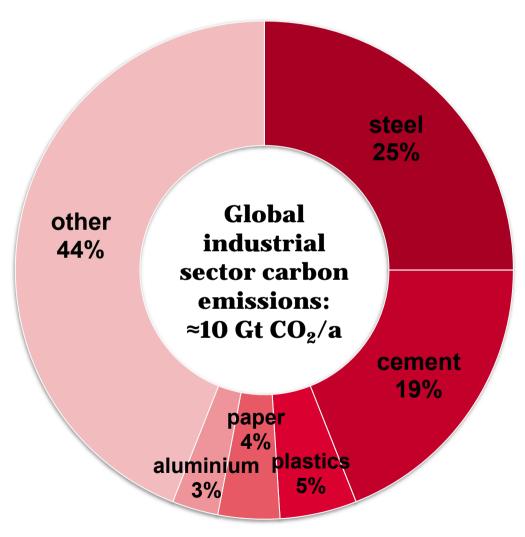
Further research as well as intelligent policy mix needed to enable industrial sector decarbonization



- Support for the build-up of new infrastructure (e.g. for hydrogen, powerto-x and – if necessary – CO₂)
- Strengthening the cooperation between industry and science for advancing the knowledge about ambitious transformation pathways
- Intensifying the debate and the exchange with civil society to help obtain the required support for investments and infrastructure build-up

At the WI we focus on the basic materials processing industries due to their high shares in overall GHG emissions Wuppertal Institut

Five basic materials are responsible for 20 % of global GHG emissions



Source: Own figure based on ETP 2017 (IEA 2017)



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Thank you for your attention

More information about our work on industry decarbonization can be found at: <u>https://wupperinst.org/en/topics/economy/energyintensive-industry/</u> and <u>https://www.researchgate.net/project/Low-Carbon-Basic-Industry</u>



Back-up slides

Examples of long-term mitigation roadmaps prepared in recent years for two industrial regions in Europe



Port of Rotterdam (2017):

Front Runner Region

Ambition to become European

NRW (2012/2013): Broad actor engagement for climate protection with focus on processing industries

The Paris Agreement makes it ver **NRW:** clear that we need to take significan steps towards decarbonisation of our **PATHWAYS TO A** economy by 2050. The Wuppertal Institute for Climate, Environment and 18 Mln. inhabitants Energy has formulated three possible **DECARBONISED PORT** decarbonisation pathways as well s one business as usual pathway for ~300 Mt GHG emis. the Port of Rotterdam Oslo : Helsi KLIMASCHU The pathways cover different levels of CLOSED CARBON CYCLE BIOMASS AND CCS TECHNOLOGICAL PROGRESS made in NRW A drastic shift towards 100% ambition and different technologies The energy system is fully decarboni by a radical shift to renewables. oth rapid implementation of (Spain: 340 Mt) renewable energy production and large best available technologies and Stockholm · No single pathway is an accurate Carbon from fossil feedstock is kept in scale CCS help virtually eliminate C rge scale CCS for p prediction of the future, the future a circular system of production a recycling. Both lead to a radical haul of the port-industrial cluster. aduation shifts from for will most likely be shaped by a com + 10% of EU heavy bingtion of them. and biobased) 98% 98% 75% industry Kopenhagen Joint scenario building Dublin (envisioning vs. still conflicting ideas) Amsterdam . Berlin • Warschau • üsseldorf Kiew Brüssel Luxemburg Prag Follow up Paris . 1.000 km project: Plattform Bern Industry and **Broadening discussion Climate NRW** and industry-specific LC-30% Monaco San innovation agendas Andorra Madrid Lissabon Ankara NCREASED SHARE OF RENEWABLE (Possibly) development Low Carbon of sector pathways/ Athen **Research Centre** roadmaps and concrete Current activities in the port such as fuel CO₂ transport an and power production, are major contri-butors to CO₂ emissions and require drastic is in a unique position to be frontrunne Nikosia **RIGHT HERE** (planned) steps rethinking. The transition towards a in this transition, because of its scale **RIGHT NOW** its location, its excellent infrastructure decarbonised economy offers many new Port of Rotterdam the companies already present, the com business opportunities such as offshore MAKE IT HAPPEN wind, biobased chemistry, demandbined available know-how and ambitions anagement and energy storage Will you join us?

Some of the roughly 400 stakeholders involved...







Positive

- Highly productive discussion culture achieved in working groups
- Stakeholders gained awareness for different perspectives
- Confidence built between stakeholders and ministries
- Policymakers learnt about the different positions of stakeholders
- Probably higher chances for successful implementation of mitigation measures
- Starting point for further dialogue with stakeholders

Negative

- Process is time-consuming and requires plenty of resources and expertise
- Stakeholders generally opposed to climate protection may be uncooperative

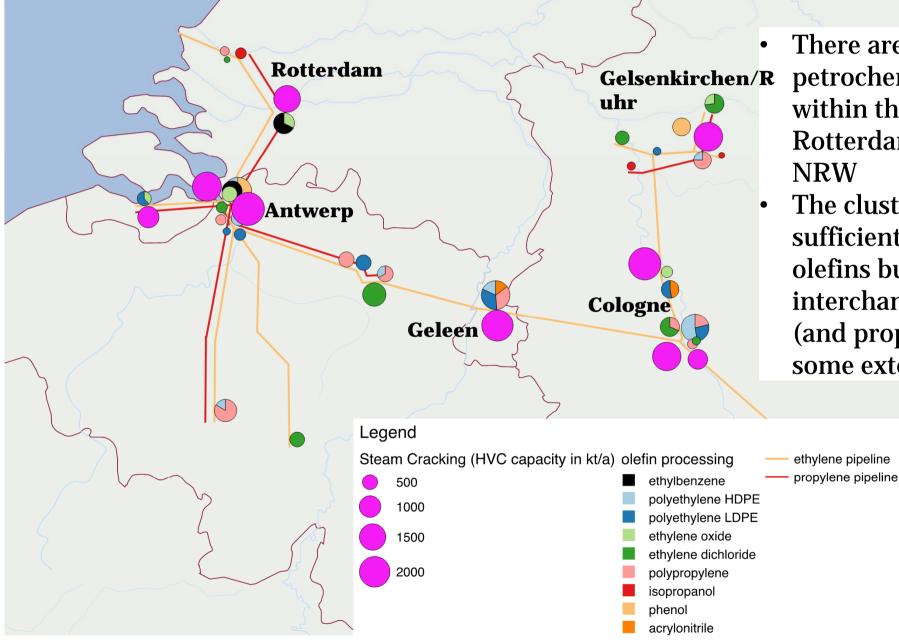


Preconditions for a successful participatory process

- Government needs to provide a clear framework for the process
- Enough time is needed for thorough discussions
- Scientific expertise important before, during and after the process

Petrochemical cluster NRW/Flanders/NL



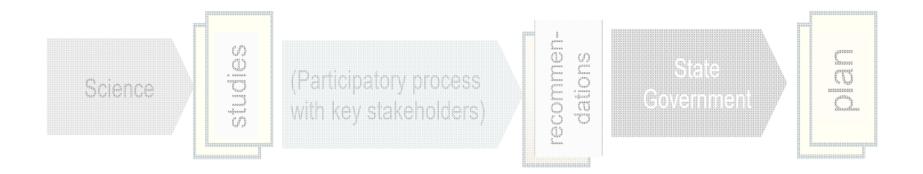


There are five petrochemical clusters within the region of Rotterdam/Flanders/ NRW

The clusters are selfsufficient in regard to olefins but can interchange ethylene (and propylene to some extent)

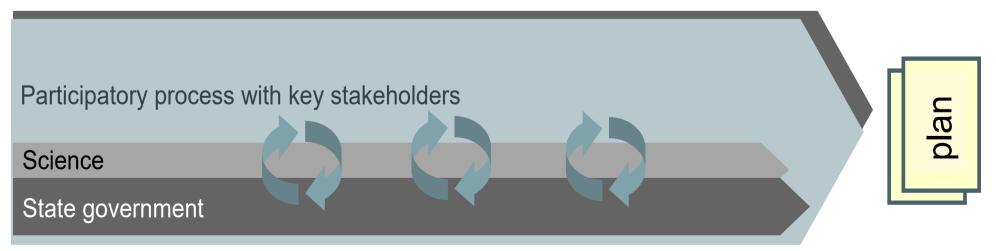
Idea of co-creation of long-term climate policy





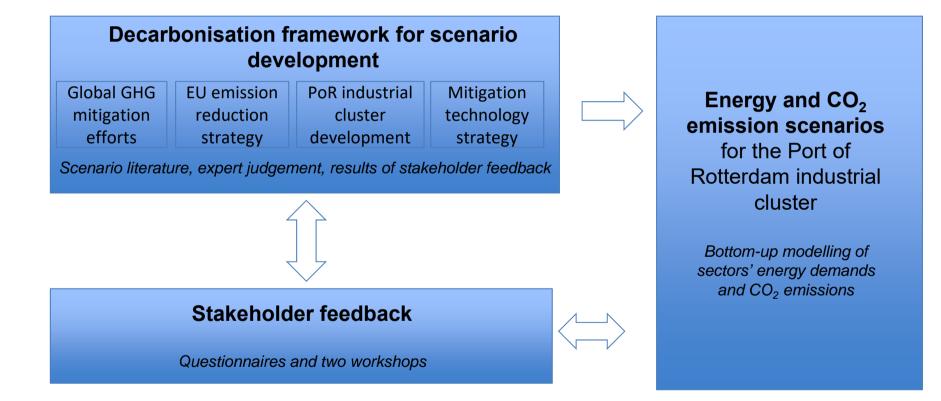
Aim: Explore an open, iterative process that empowers stakeholders, science & policy to co-create a new

position



Steps taken in developing the scenarios for the port's industrial cluster

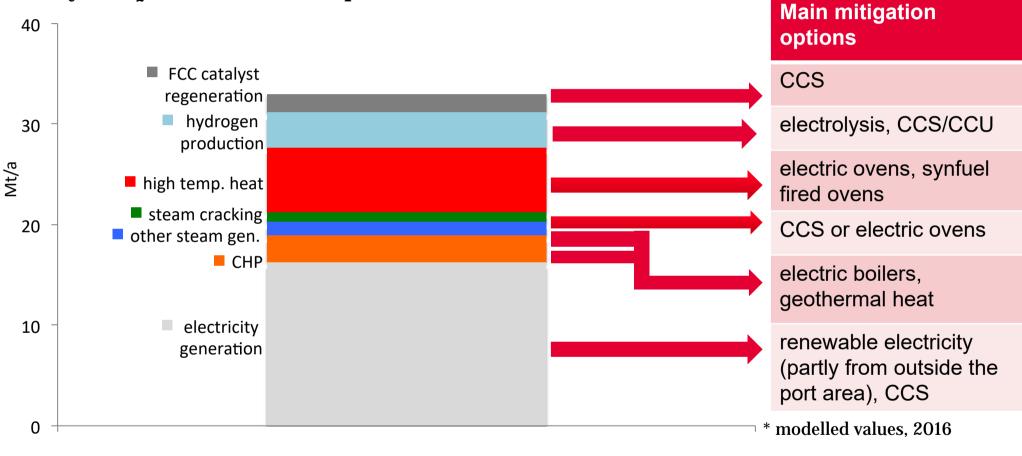




The challenge of decarbonisation for the Port of Rotterdam industrial cluster



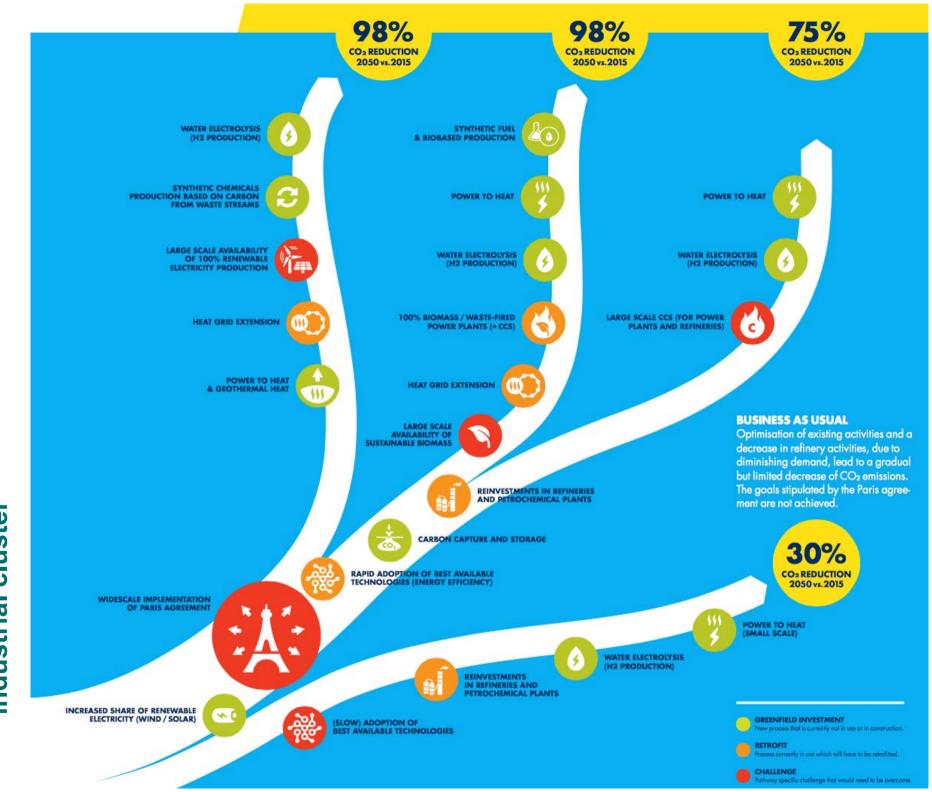
Source: WI (2016)



Today's CO₂ emissions* of the port's industrial cluster

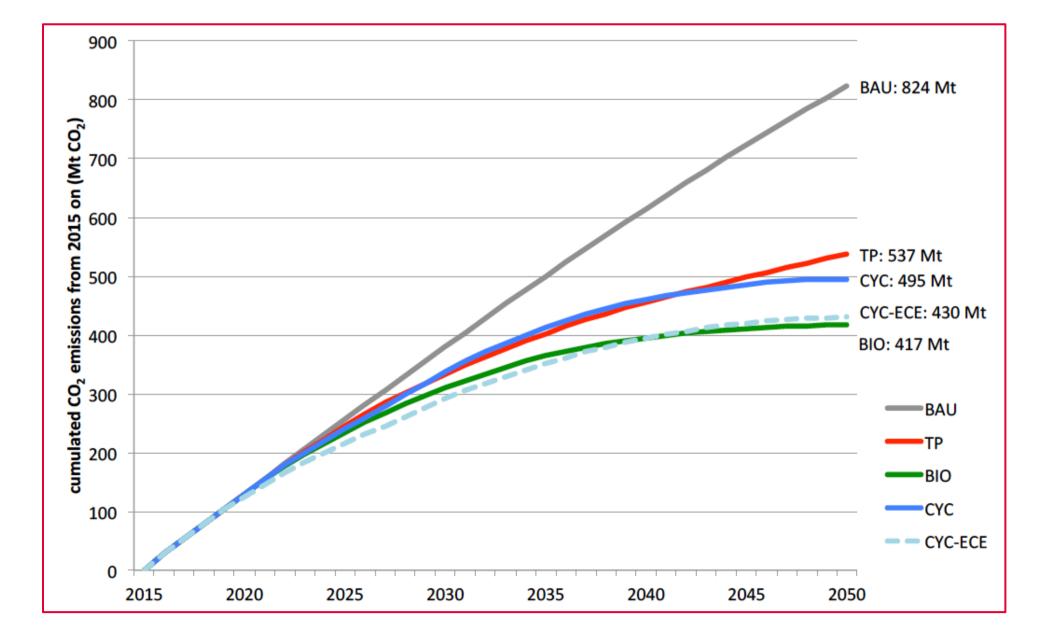
Additional key strategy in all areas:

energy efficiency



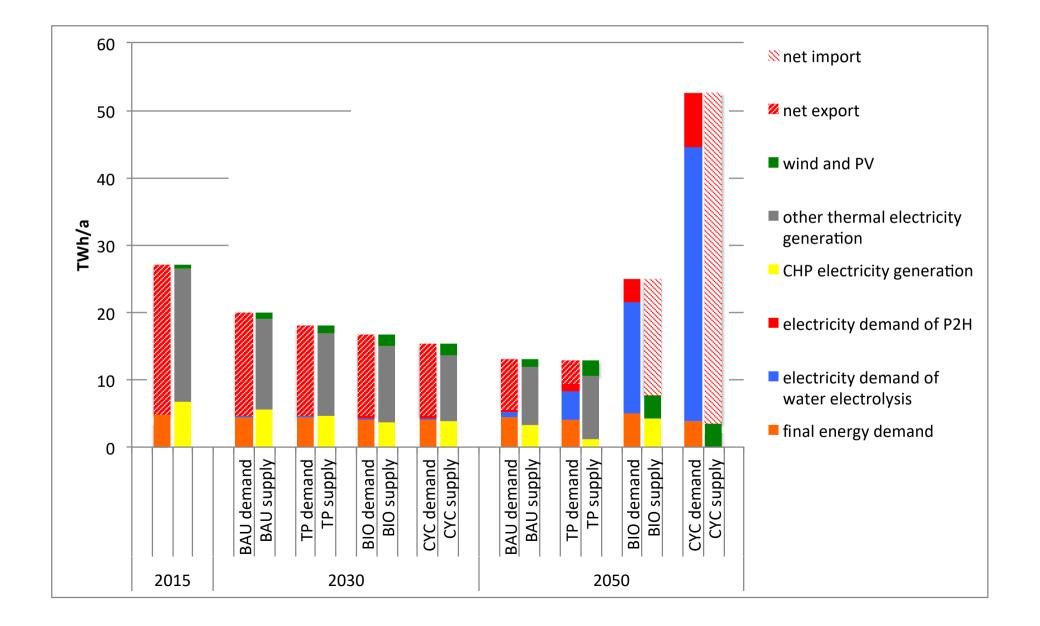
Comparison of <u>cumulative</u> CO₂ emissions of the port's industrial cluster in the four scenarios





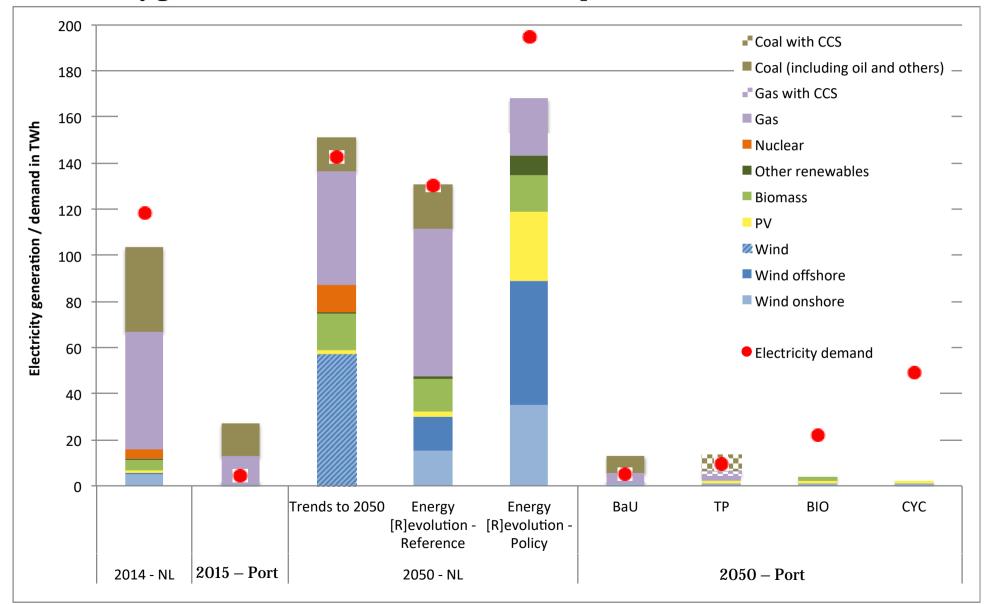
What does deep electrification mean for the port's electricity balance?





Where could net electricity imports come from?





Electricity generation in the Netherlands and the port area in different scenarios

Identified potential for new economic activity at the port in a decarbonising world



Potential new economic activity	Expected market potential			
	2020	2030	2040	2050
Offshore wind				
Bio-based chemistry				
Demand-side-management and energy storage				
CO ₂ transport and storage				
Use of waste				
Synthetic fuels				
Carbon-neutral primary steel production				