

# The Sustainable Industry Lab



**Power, Hydrogen and Fuels in the Netherlands**  
*or: Aspects of A Plan That Adds Up*

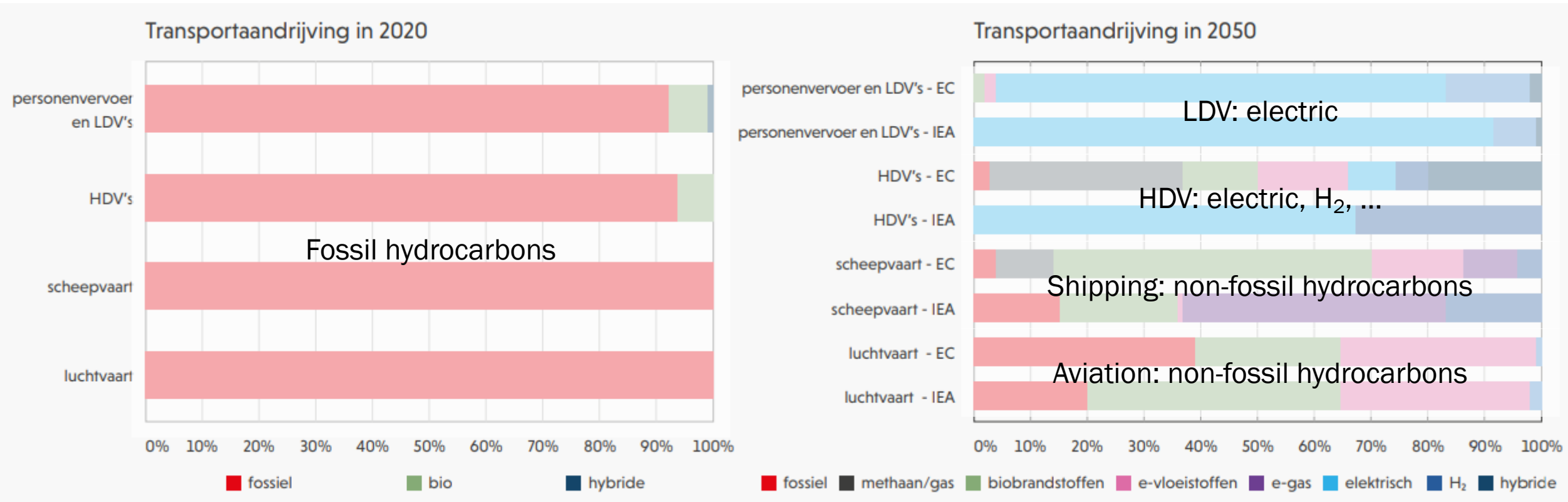
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Sustainable Industry Lab

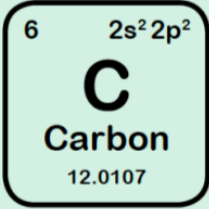
Pathways to Sustainable Mobility  
20 May 2022

# The Future of Fuels




Source: *Het potentieel van low-carbon liquid fuels in de Nederlandse raffinage in 2050* (VNPI)

# The Sustainable Industry Lab – The Future of Dutch Industry



The Dutch carbon cycle



Renewable energy for industry



Social earning capacity and sustainable investments



A fair sustainable industrial transformation



Governance for the industrial transformation

Anchored in the physical realities of NL; relative scarcity of both green energy and of 'circular carbon'

Profitable industry and a contribution to green production

Normative aspects

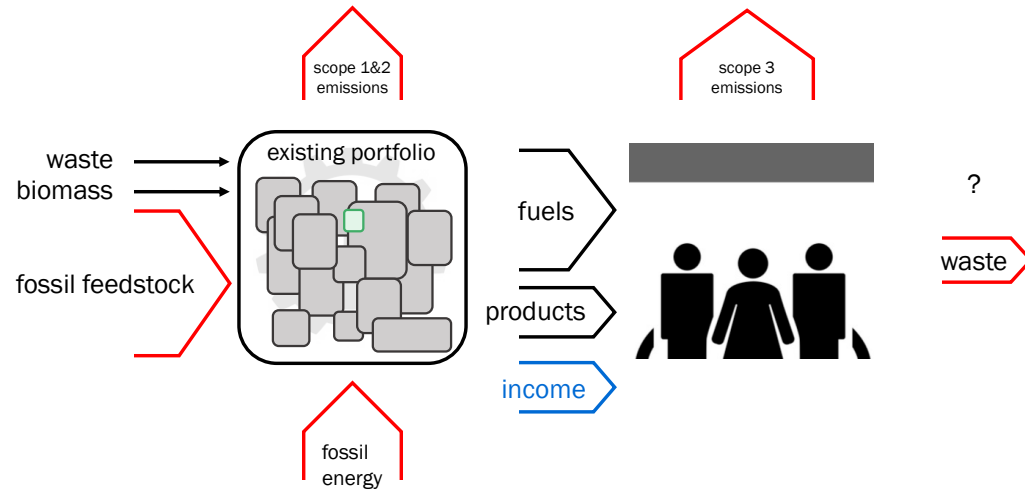
How to; 'Green industrial policy'

A clear view on an

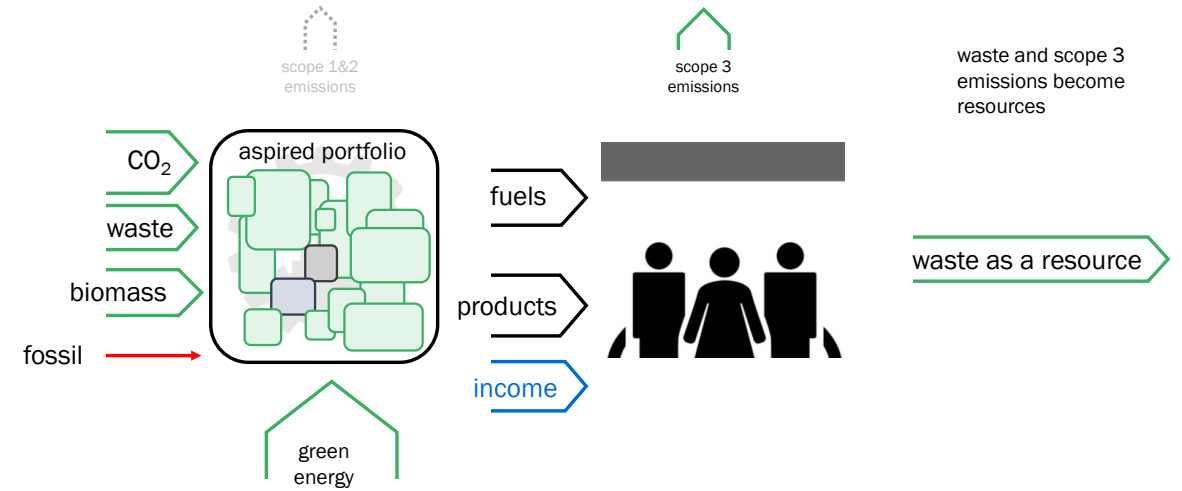
*aspired portfolio*

of Dutch industrial activity ca 2050

# From our present portfolio...



# ...to an aspired portfolio



**from**

- resource abundance
- resource importer
- “conversion-only” industry

**to**

- resource constraints (green energy; circular carbon)
- focus on local resources first
- Industry based on conversion and production

‘technical efficiency’ will be the main guiding principle

# The challenge of energy and industrial transformation in context

We tend to underappreciate the energy demand of society.

The energy that is 'close' to us (houses, cars, offices) is a minority share of the energy system:

- Fuels for transport
- Gas for houses and buildings
- Electricity for appliances

25% of energy use;  
80% of GDP



# The Dutch challenge of energy and industrial transformation

There is an outer shell, much larger, and removed from our daily lives that is much bigger.

It provides the material basis to sustain our modern lives.

- Energy for industry & agriculture
- Chemical feedstock
- Fuels for international logistics

75% of energy;  
20% of GDP



# The Dutch challenge of energy and industrial transformation

We have an open economy. We produce for the world market; the world produces for us.

Because of geography, the Dutch industry portfolio is heavy in basic industry and international logistics.

Our production-based footprint is larger than our consumption-based footprint.



# The Dutch challenge of energy and industrial transformation

Three lenses on the long-term future

- Green energy (power and hydrogen)
- Circular carbon (biomass and waste)
- Time (interim solutions, CCS)

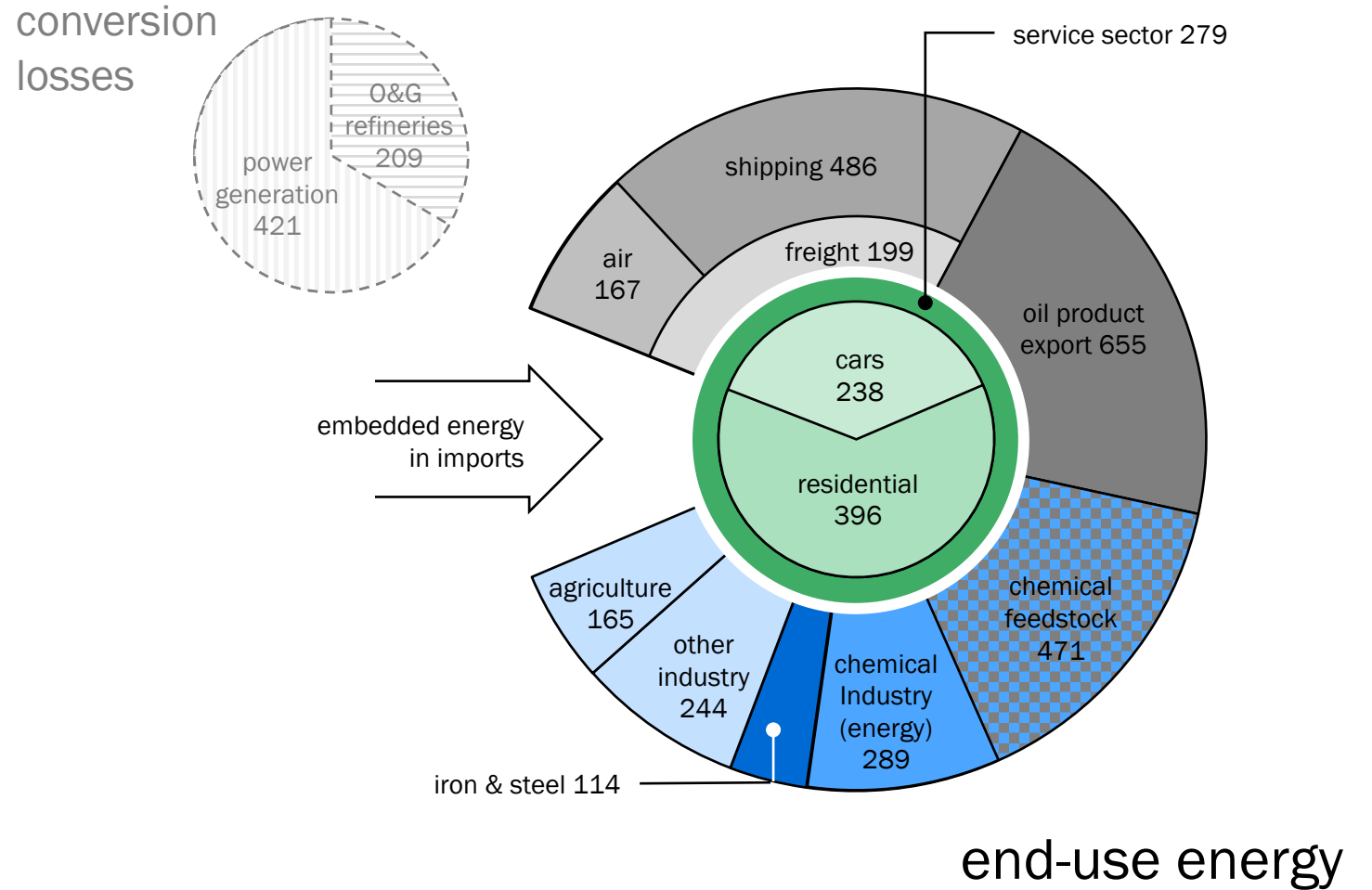
The lenses are also *constraints*





# Today's energy system and the challenges it presents

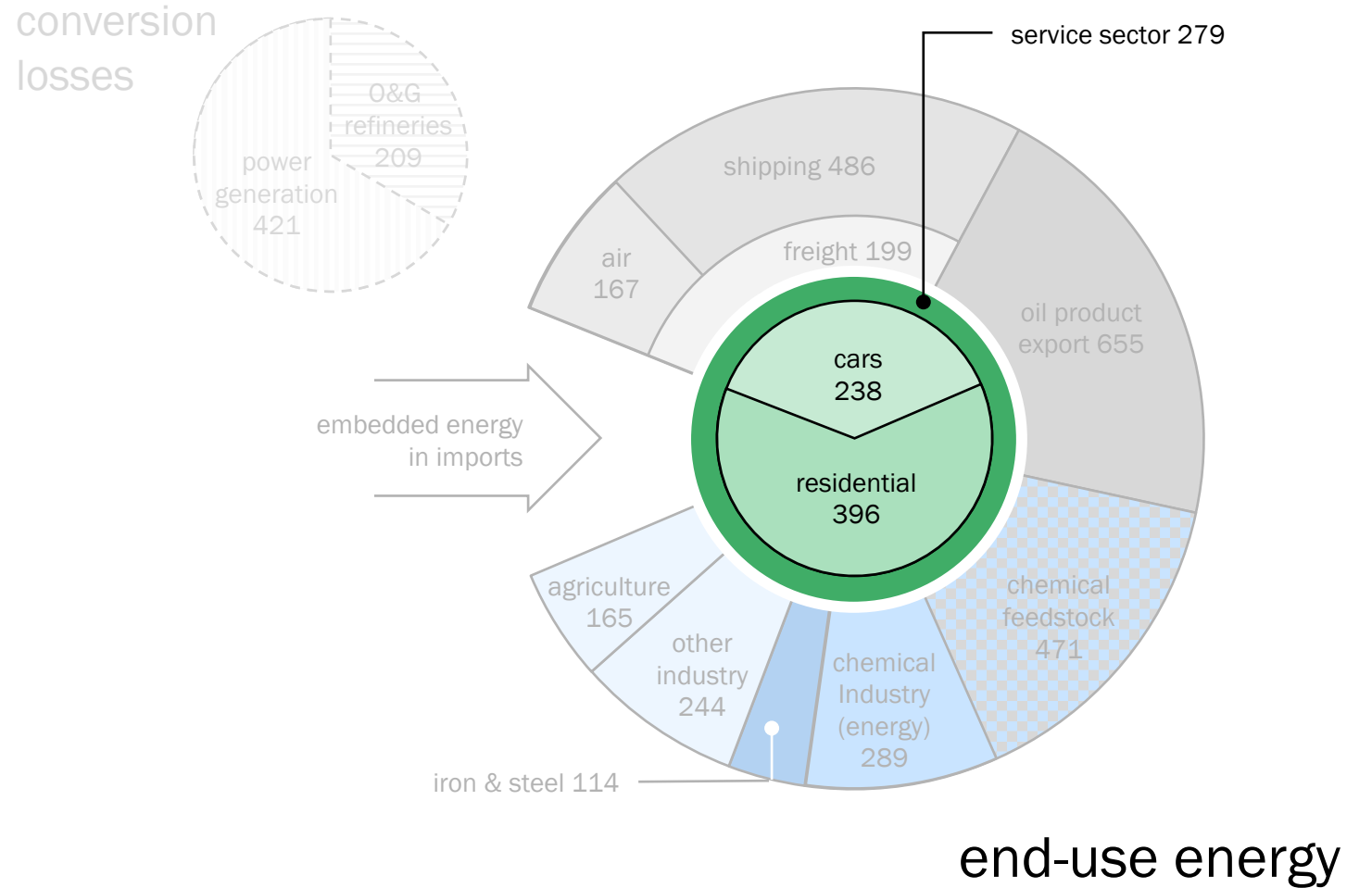
3 challenges



# Today's energy system and the challenges it presents

## 3 challenges

personal energy use and the service sector

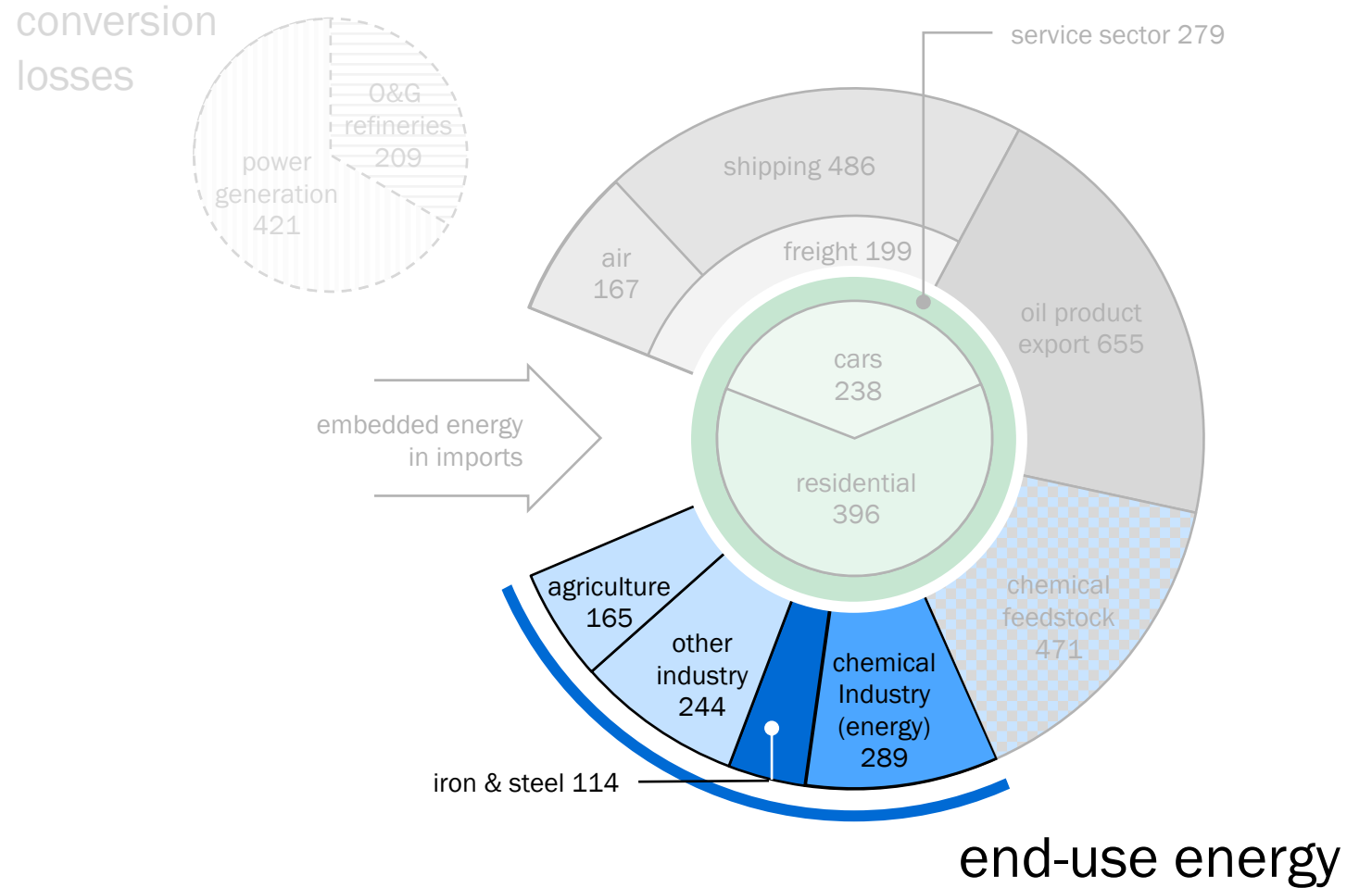


# Today's energy system and the challenges it presents

## 3 challenges

personal energy use and the service sector

energy for industry



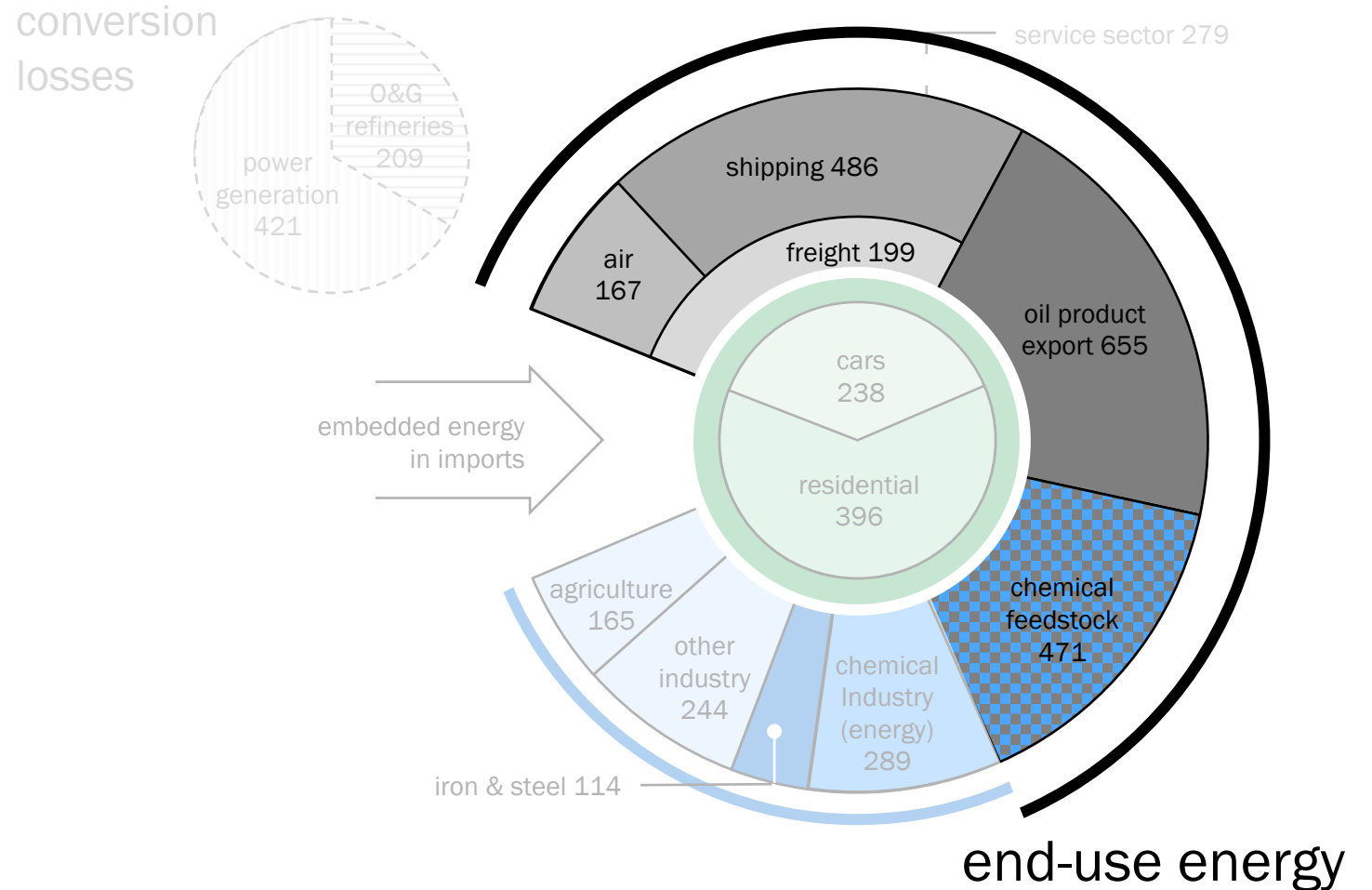
# Today's energy system and the challenges it presents

## 3 challenges

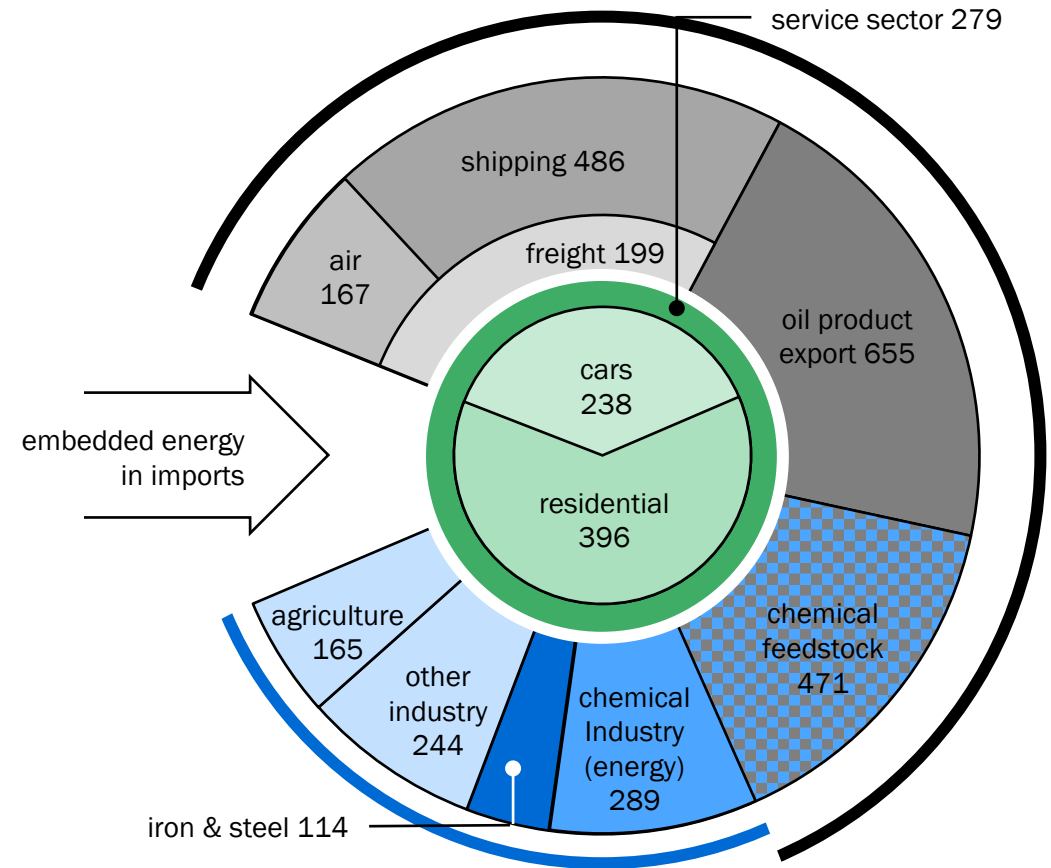
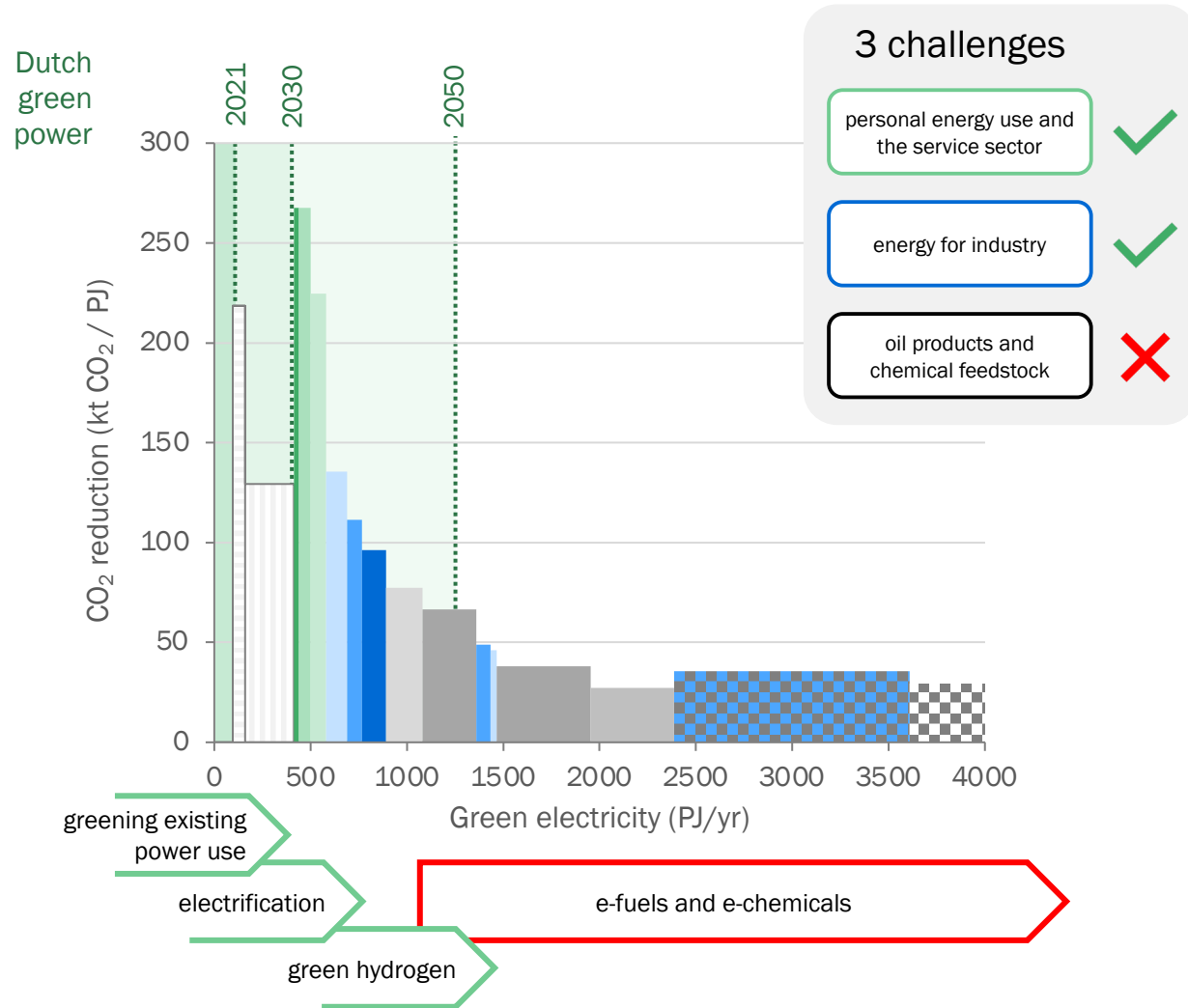
personal energy use and the service sector

energy for industry

oil products and chemical feedstock

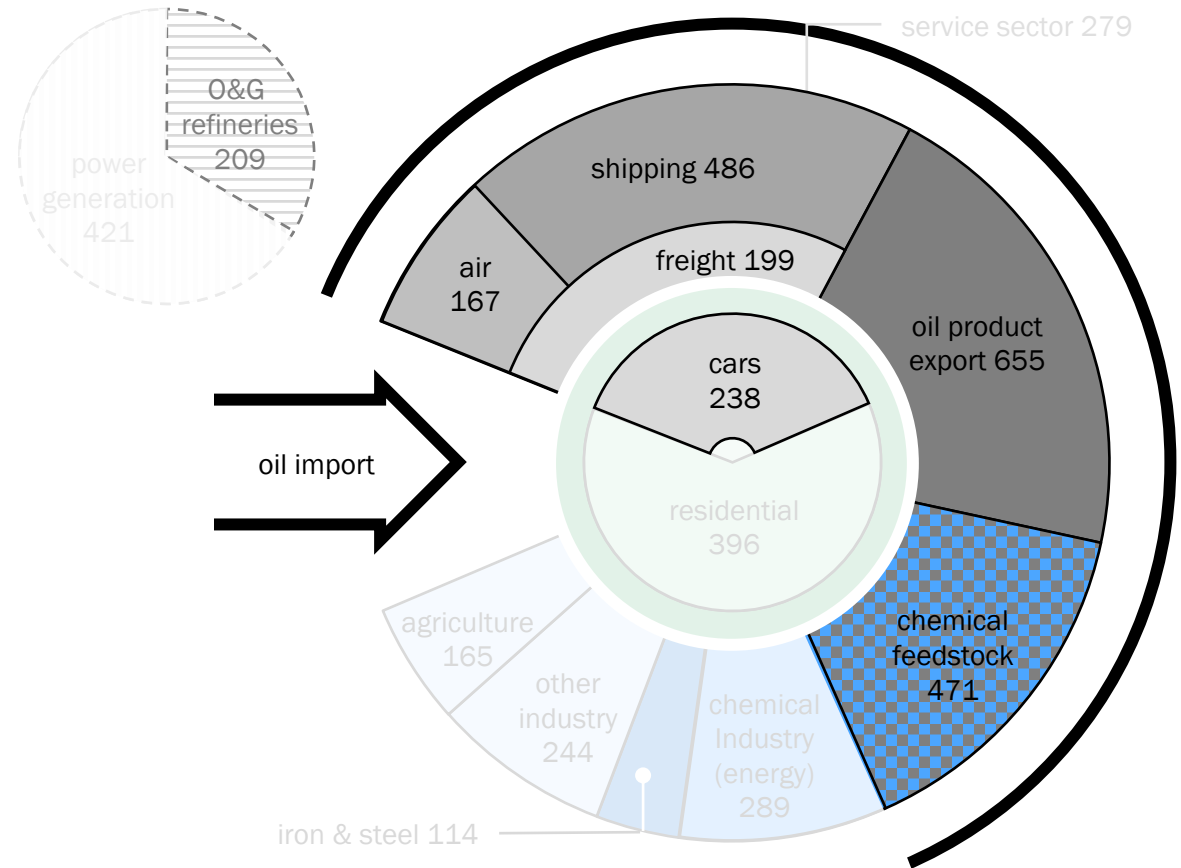
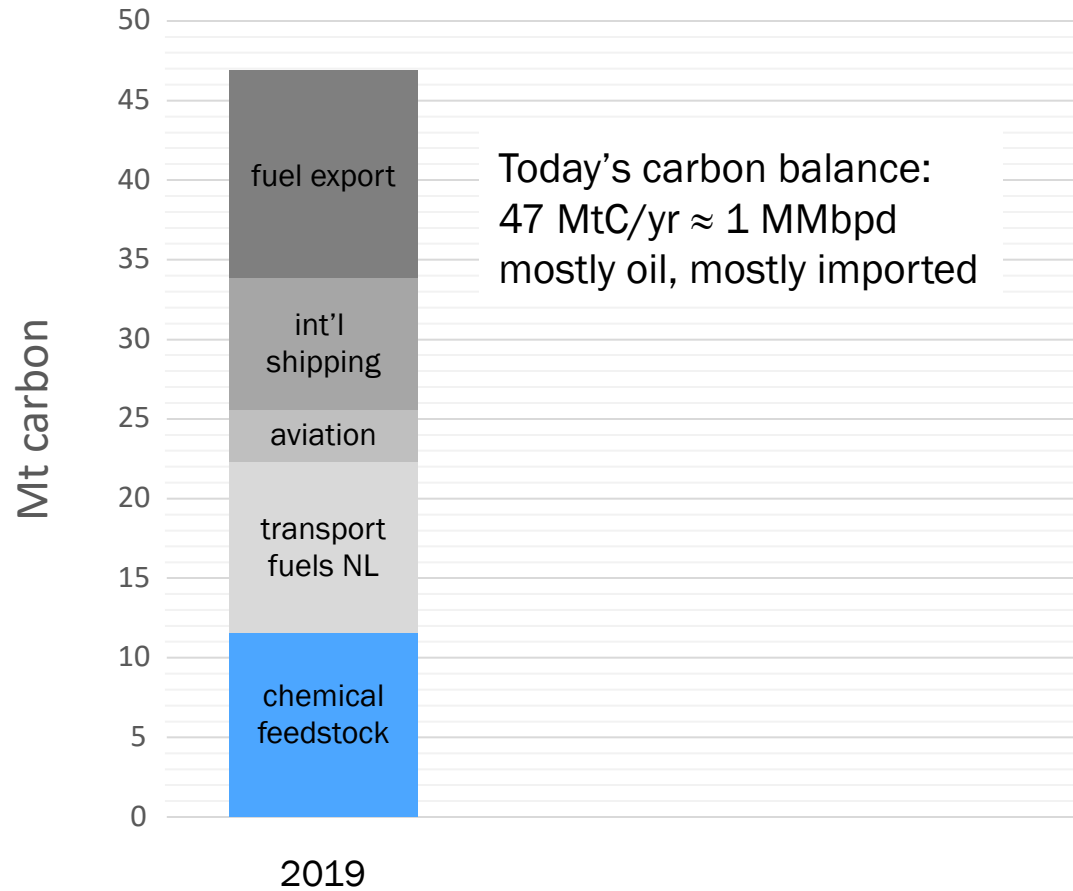


# Green power, green hydrogen & e-fuels\* and e-chemicals\*



\* e-fuels and e-chemical are synthesized from CO<sub>2</sub> and green hydrogen

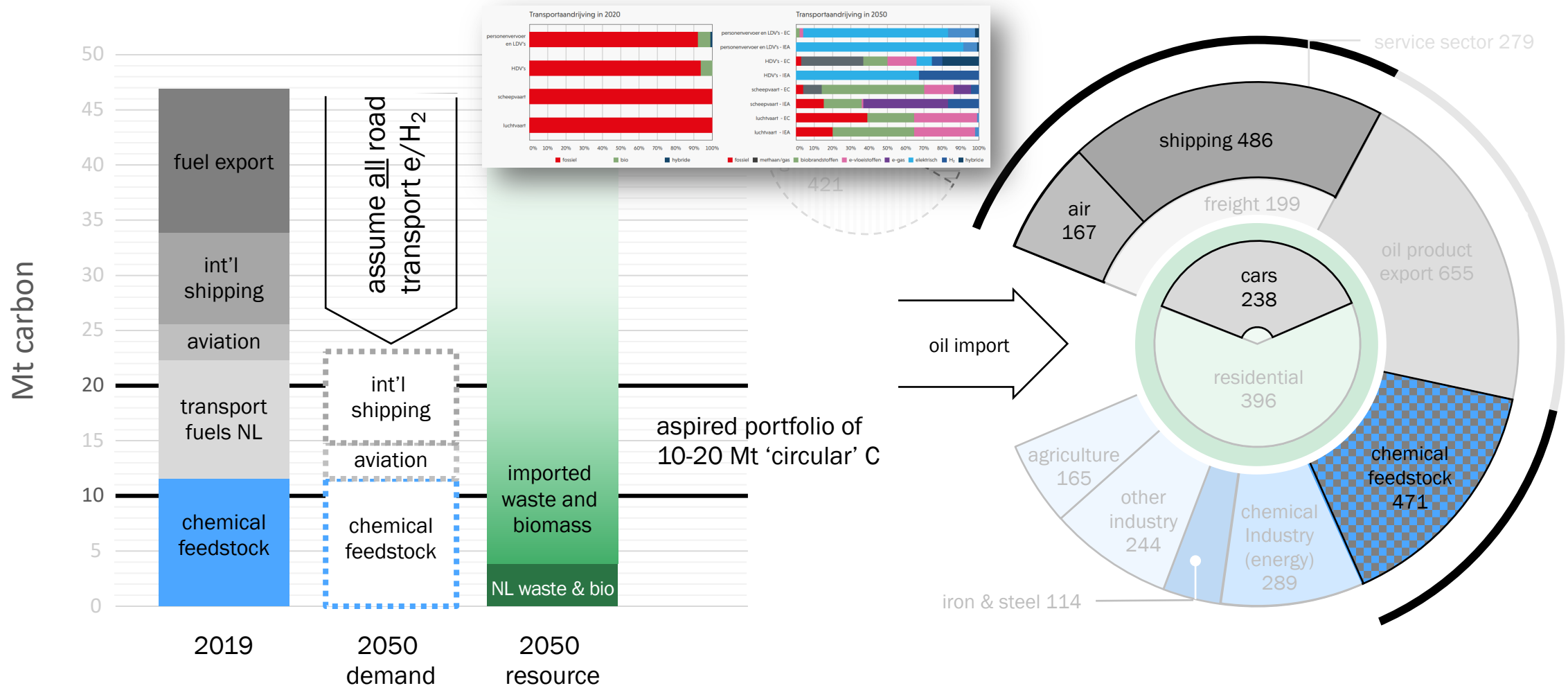
# The quest for 'circular', i.e. non-fossil carbon



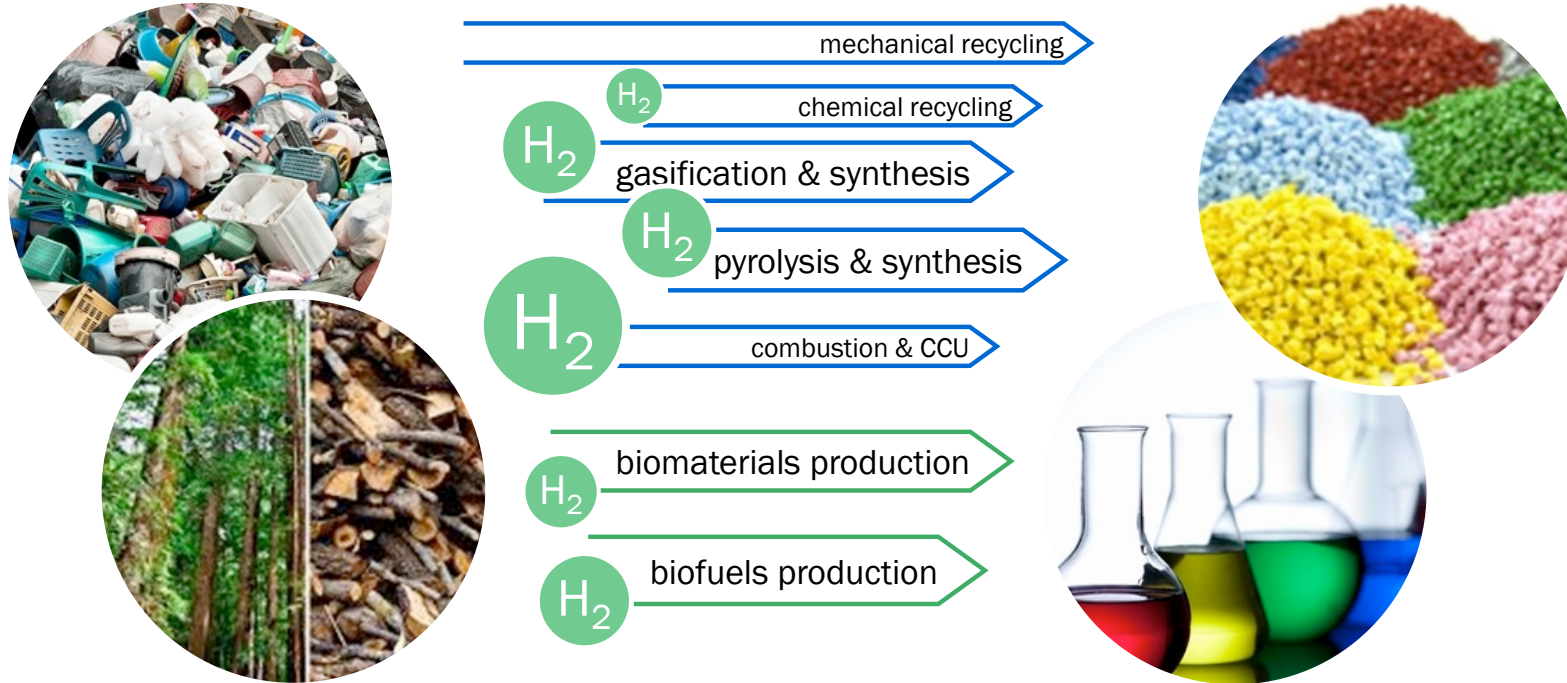
For reference: Shell Rotterdam Energy & Chemicals Park 20 MtC

Data: CBS 2019; Analysis SIL team

# The quest for 'circular', i.e. non-fossil carbon



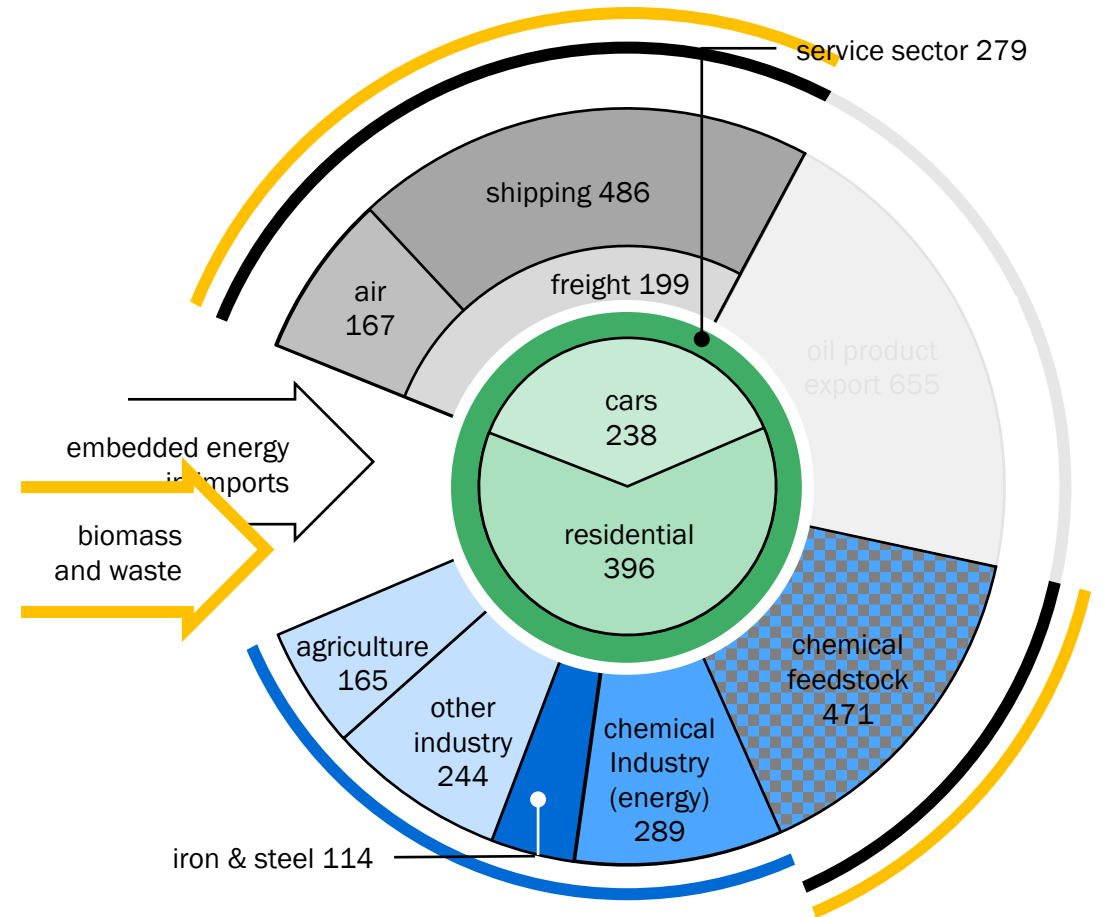
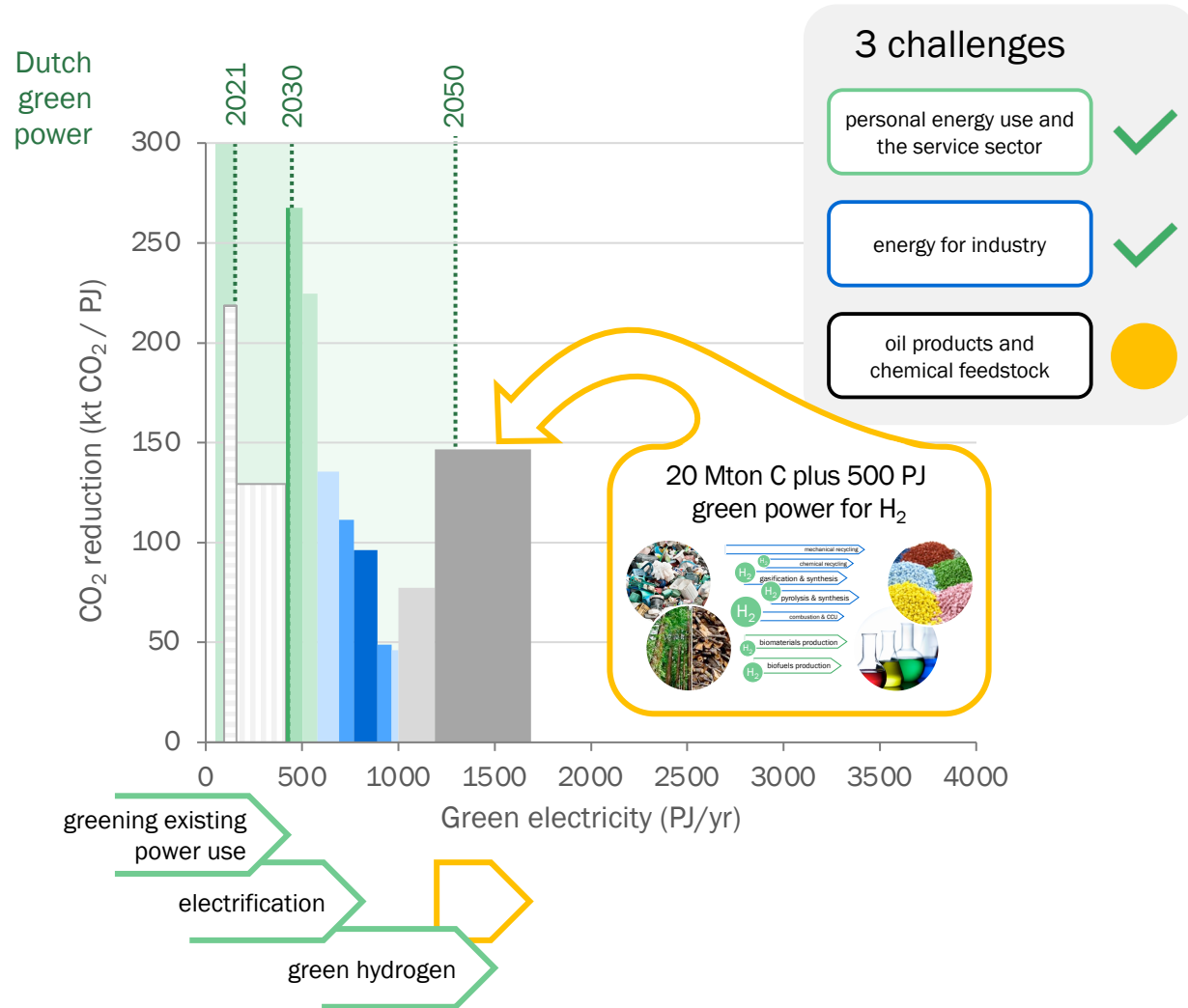
# Carbon recycling requires green energy and green hydrogen



The higher the fraction of carbon kept in the loop, the higher the demand for green hydrogen.  
A first, rough estimate is 500 PJ green power for 20 MtC.

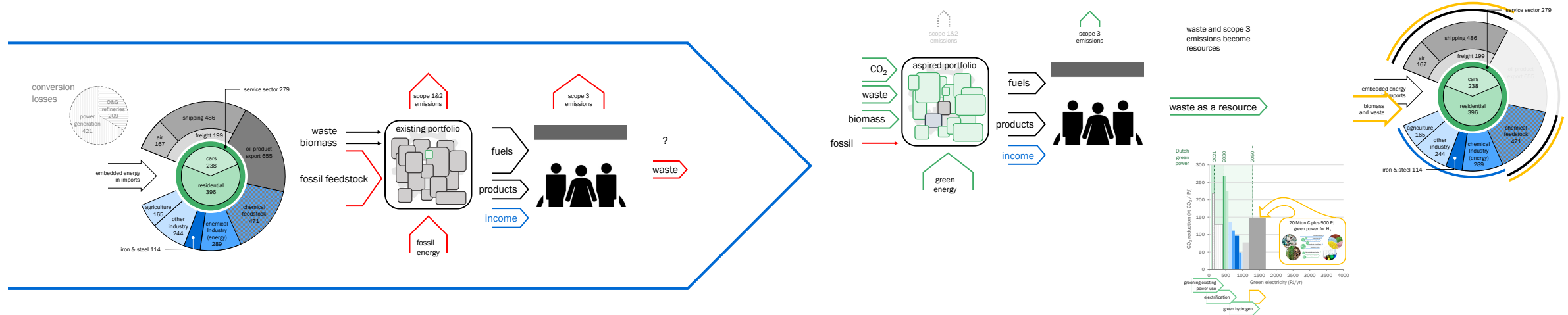


# Green power, green hydrogen & 'circular' carbon



\* e-fuels and e-chemical are synthesized from CO<sub>2</sub> and green hydrogen

# An aspired Dutch industry portfolio: contours and preconditions



**massive electrification**  
(built environment, road transport)

**full use of our offshore wind resource**  
(>1200 PJ green electricity; >72 GW offshore wind)

**green hydrogen to allow solar and wind build-out**  
(post 2030, ultimately 30 GW electrolyzers)

**build a supply position for waste and biomass**  
(treasure the current position, even if use changes)

**a 10-20 MtC green industry is feasible**  
(chemicals and fuels based from waste and biomass)

**Netherlands can be energy-self-sufficient for industry; Germany most likely not**

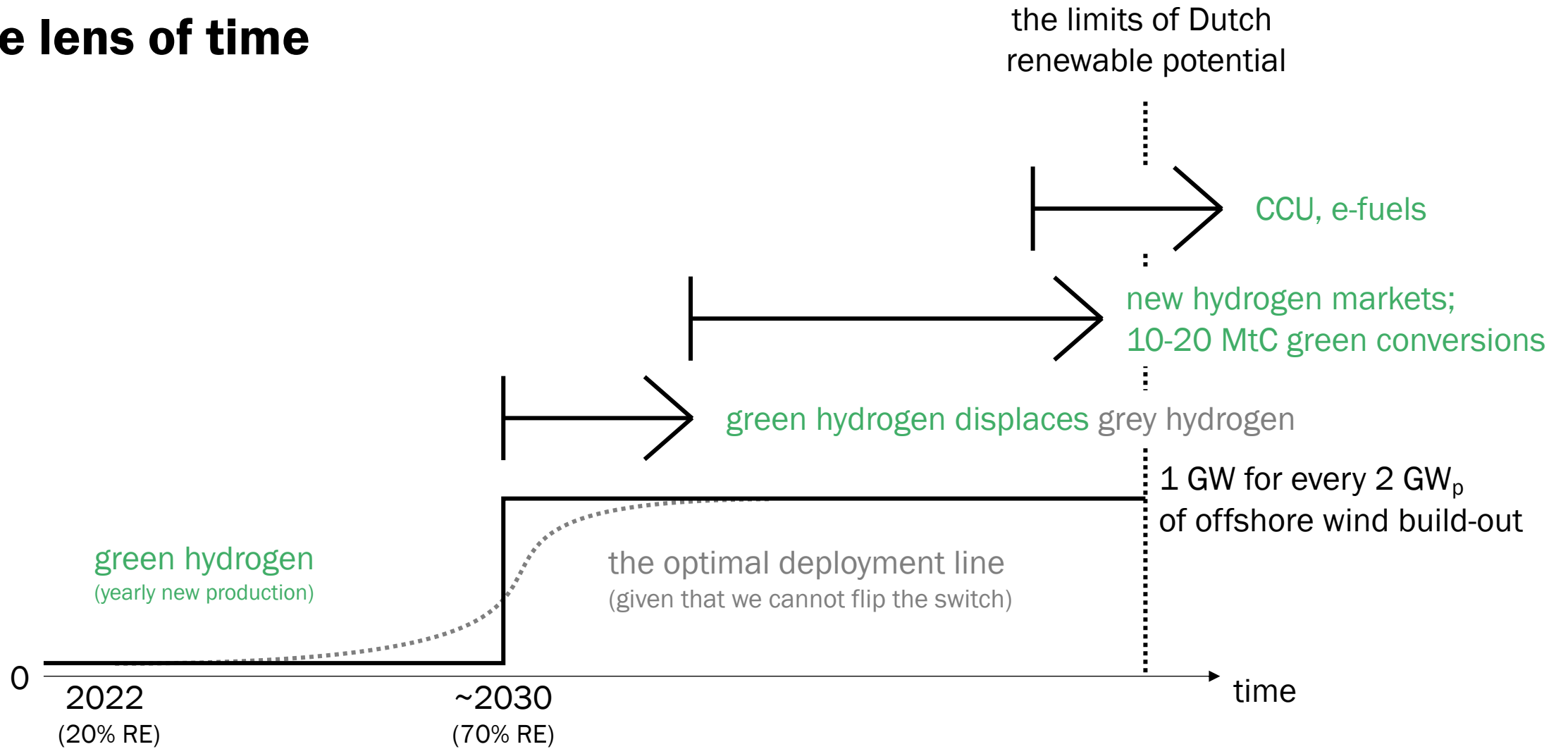
**Netherlands is short on energy for CO<sub>2</sub> utilization (CCU) for e-fuels**

# The Sustainable Industry Lab

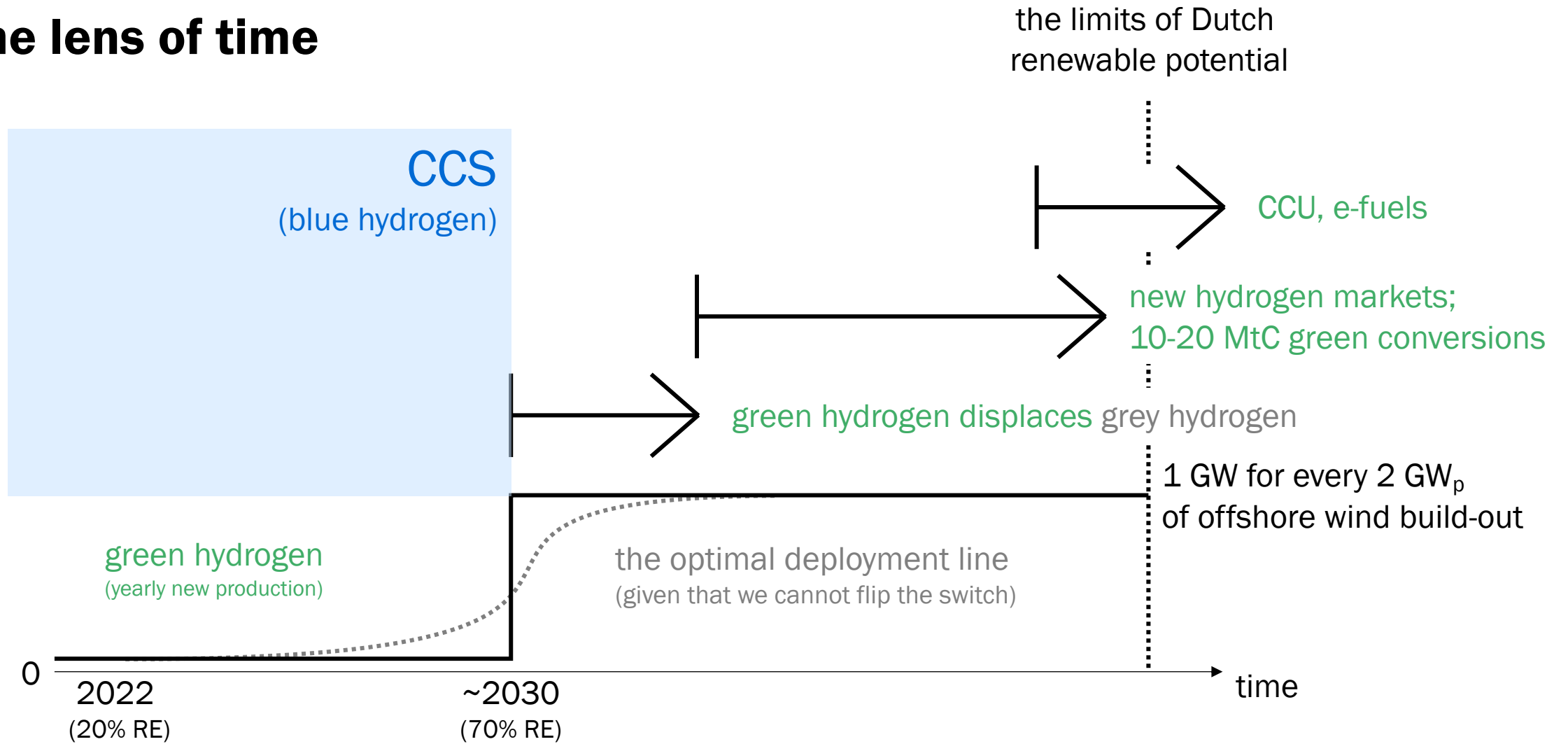


[www.sustainableindustrylab.nl](http://www.sustainableindustrylab.nl)

# The lens of time



# The lens of time



# An aspired Dutch industry portfolio: contours and preconditions

## Aspired Portfolio

- The Netherlands has a good position to retain a large *sustainable* basic industry, conditional on:
  - Massive offshore wind deployment (>70 GW)
  - Building a supply position for biomass and waste
- Focus on circular carbon imports, less on green energy (hydrogen) imports.
- Resource scarcity implies portfolio-level guidance.
  - A key component of green industrial policy (?)
  - Meta's datacenter Zeewolde might serve as an example

## The journey to the Aspired Portfolio

- The (green) hydrogen deployment timeline is a major uncertainty, with great impact on Dutch industry.
  - Be mindful that the Netherlands is very different from rest of the EU: more basic industry; more bunker fuels
  - EU hydrogen agenda deserves more (critical) government attention
- CCS is necessary but inherently difficult