The Sustainable Industry Lab

Universiteit Utrecht

EFFICIENCY AND BEYOND

de weg naar een klimaatneutrale industrie

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ABB, Alfa Laval, NVDE Energy Efficiency Symposium

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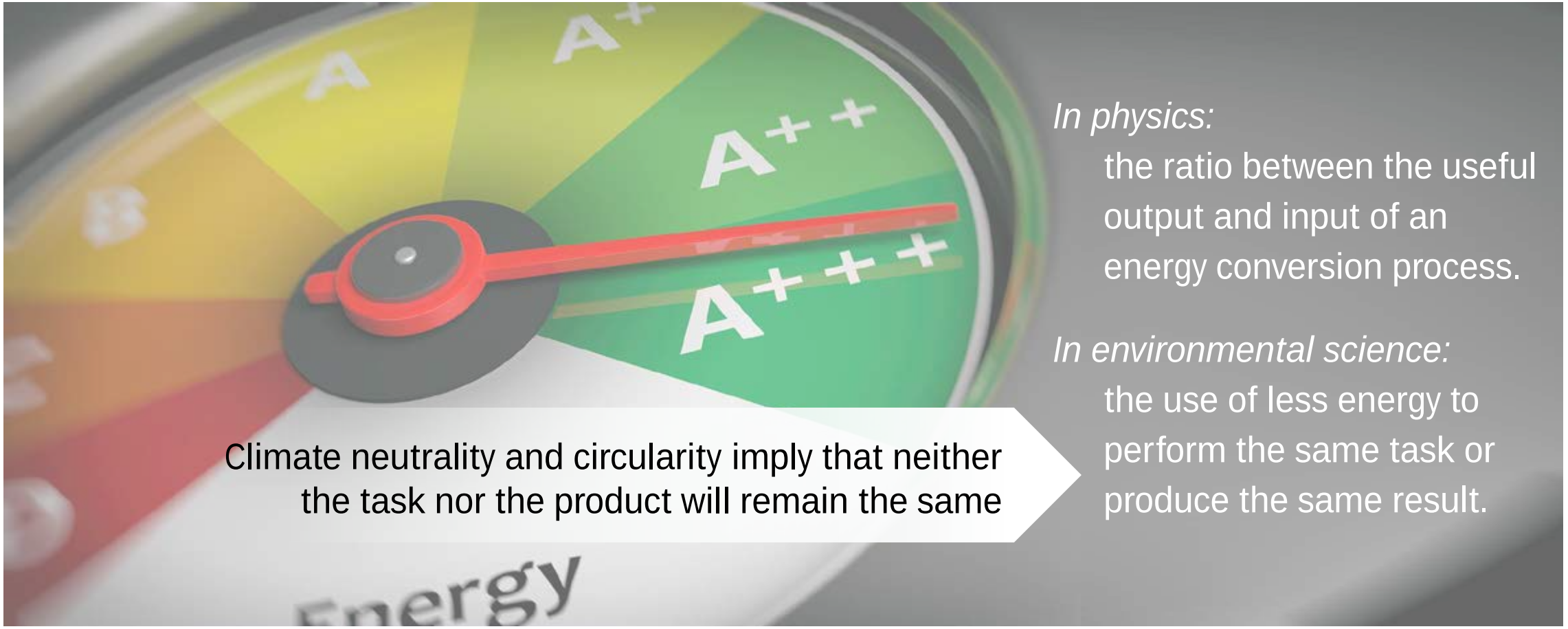
Energy efficiency



In physics:

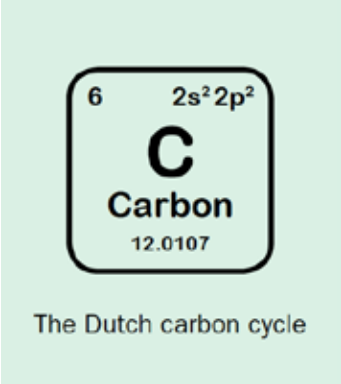
the ratio between the useful output and input of an energy conversion process.

In environmental science:

the use of less energy to perform the same task or produce the same result.

Climate neutrality and circularity imply that neither the task nor the product will remain the same

Background to this work: the Sustainable Industry Lab



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

Basic Industry in the Netherlands in 2050 – the same, but green

* That means: Is it desired by ‘us’ (*i.e.* the Dutch)?

Basic Industry in the Netherlands in 2050 – the same, but green

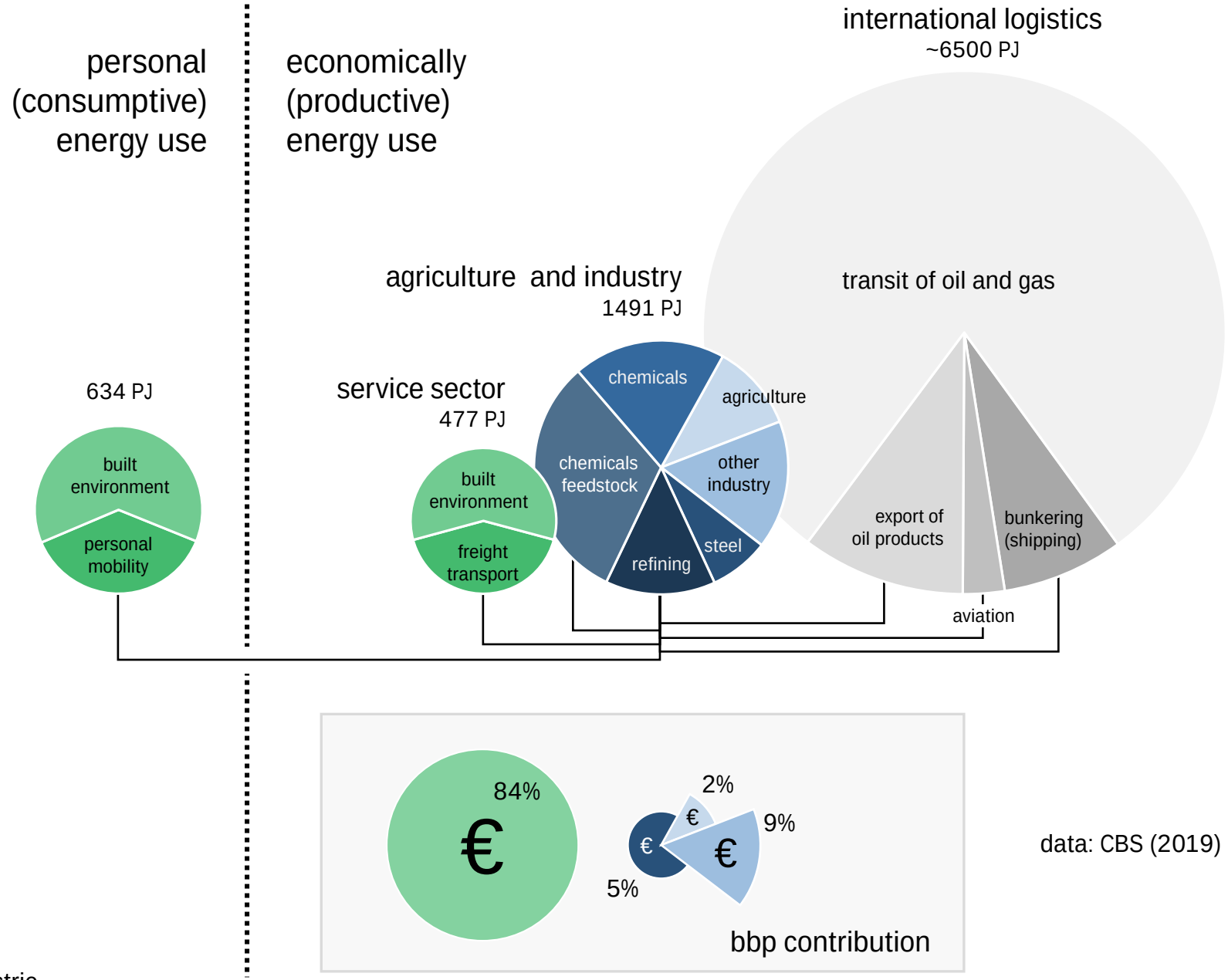
Yes, it is possible !

- **The Netherlands is energy-rich, but carbon-poor**
- Offshore wind >70 GW
- No green energy import (i.e. no hydrogen import)
- Import of carbon (bioresidue and waste)
- Import of high-energy feedstock molecules (e.g. ammonia)
- Possibly import of aviation and marine fuels

* That means: Is it desired by 'us' (*i.e.* the Dutch)?

The Netherlands

industry, energy and economy in 2019

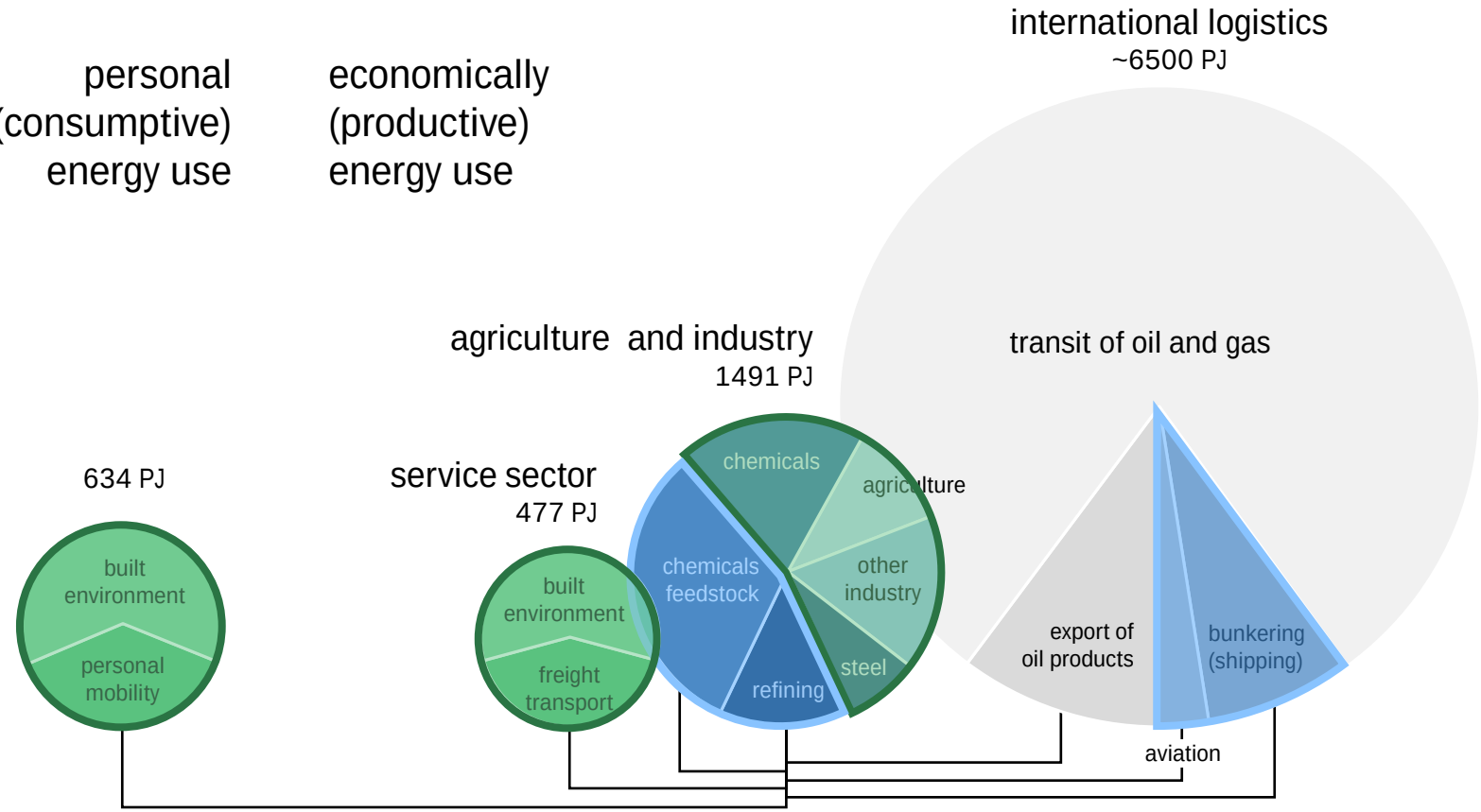


data: CBS (2019)

Source: Groene keuzes voor de Nederlandse basisindustrie

The Netherlands

Two challenges for 2050

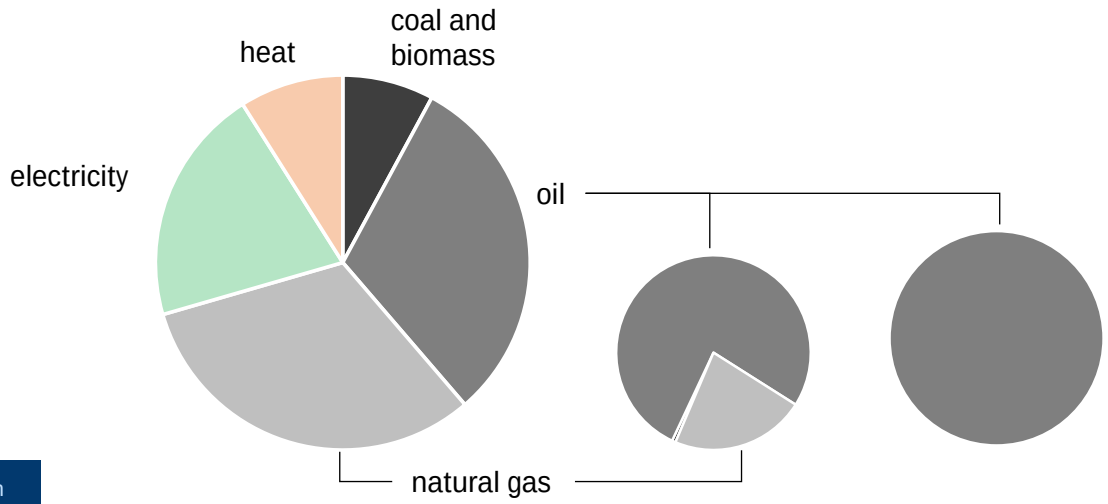


- Elektrificering en (groene) waterstof
- Duurzaam koolstof en circulariteit

Source: Groene keuzes voor de Nederlandse basisindustrie

Energy in 2050
carbon neutral & circular

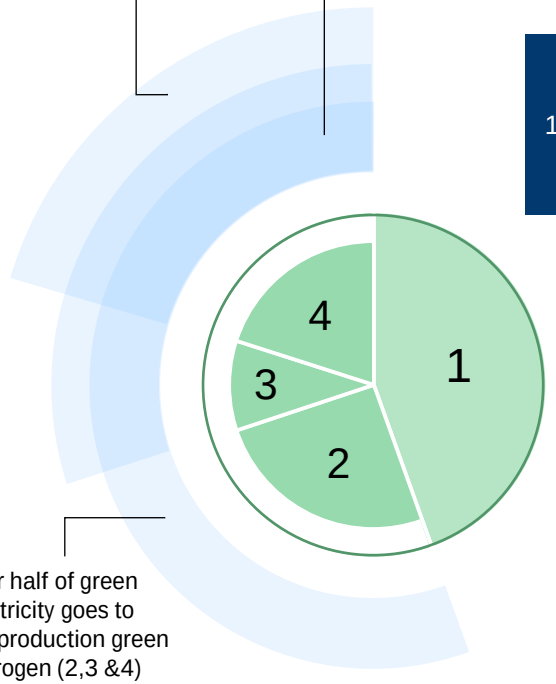
2019



domestic energy end use | feedstock | irreplaceable fuels*

Almost a quarter of the primary green electricity is used for circularity of carbon-based chemicals (4)

A third of the primary green electricity serves the carbon and circularity agenda (3&4)

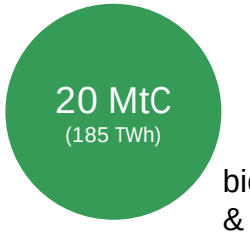


Over half of green electricity goes to the production green hydrogen (2,3 &4)

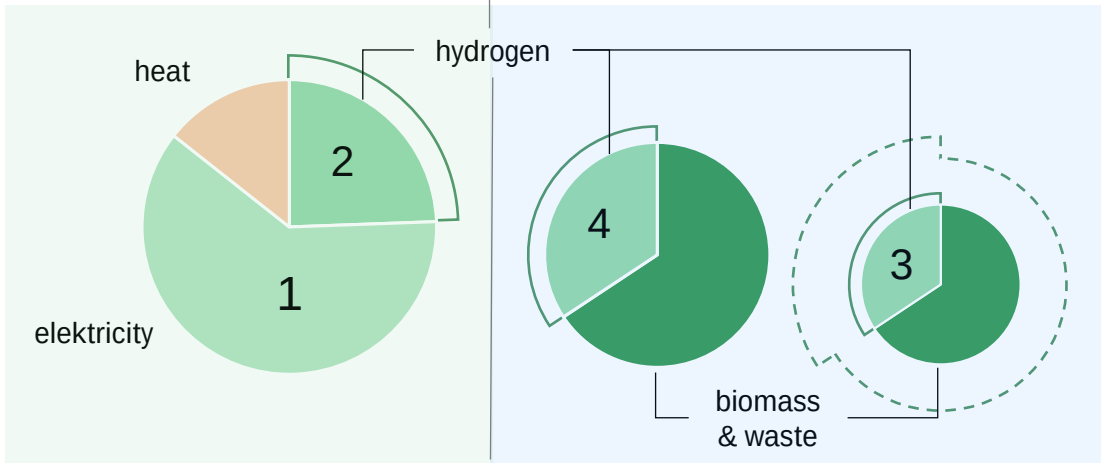
75	GW	offshore wind	(c.f. 50%)	330 TWh
10	GW	onshore wind	(c.f. 25%)	20 TWh
125	GW	PV solar	(c.f. 10%)	110 TWh
60	GW	electrolyser	(c.f. 50%)	5 MtH_2

460 TWh
green electricity

2050



bioresidue & waste

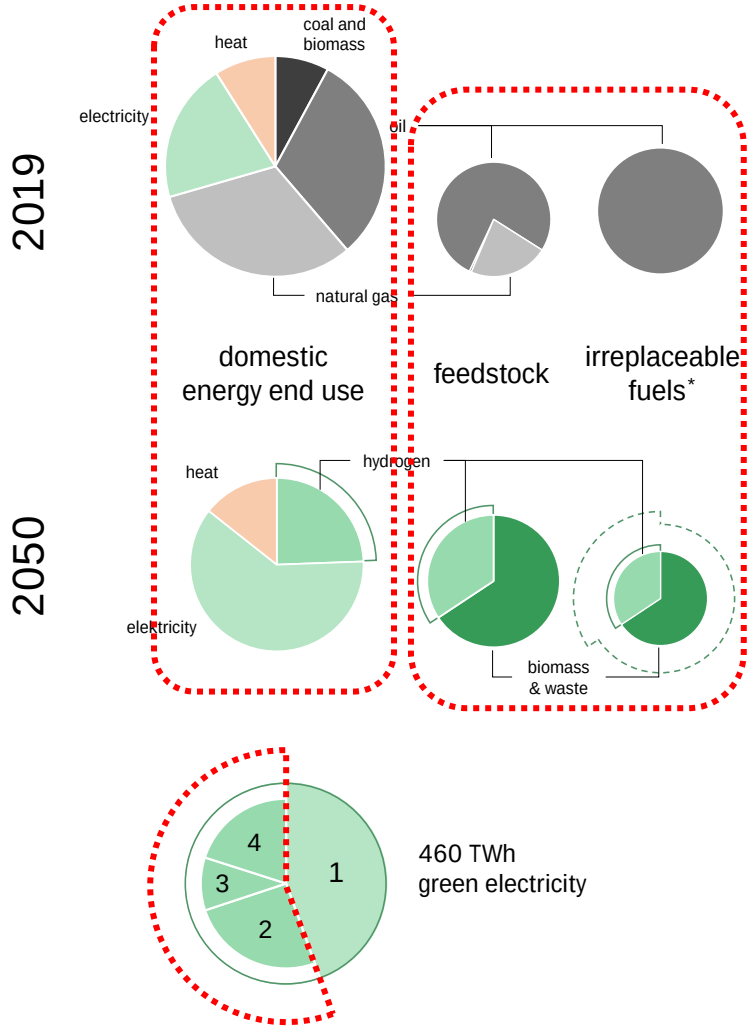


green energy challenge | circular carbon challenge

Source: Groene keuzes voor de Nederlandse basisindustrie

The Efficiency Story in the Background

- Electrification is the major driver of efficiency improvement at the energy system level
  - Vehicle electrification – factor 3
  - Insulation and heat pumps in the built environment – factor 5-6
  - Electrification in industry has more modest gains (because industry is already pretty efficient)
- Circularity comes with an ‘efficiency’ penalty
  - Converting biomass and waste to products requires more energy than converting oil
  - Hence efficiency in the process industry only gains in importance
- Hydrogen is both boon and bane
  - Hydrogen is an enabler of full penetration of intermittent renewables, allowing us to maximize utilization of these
  - Hydrogen use is always less efficient than direct electricity use



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www.sustainableindustrylab.nl