KIVI Engineering Society

Afdeling Elektrotechniek

UTRECHT SUSTAINABILITY INSTITUTE

Energievraag in 2050 nader beschouwd

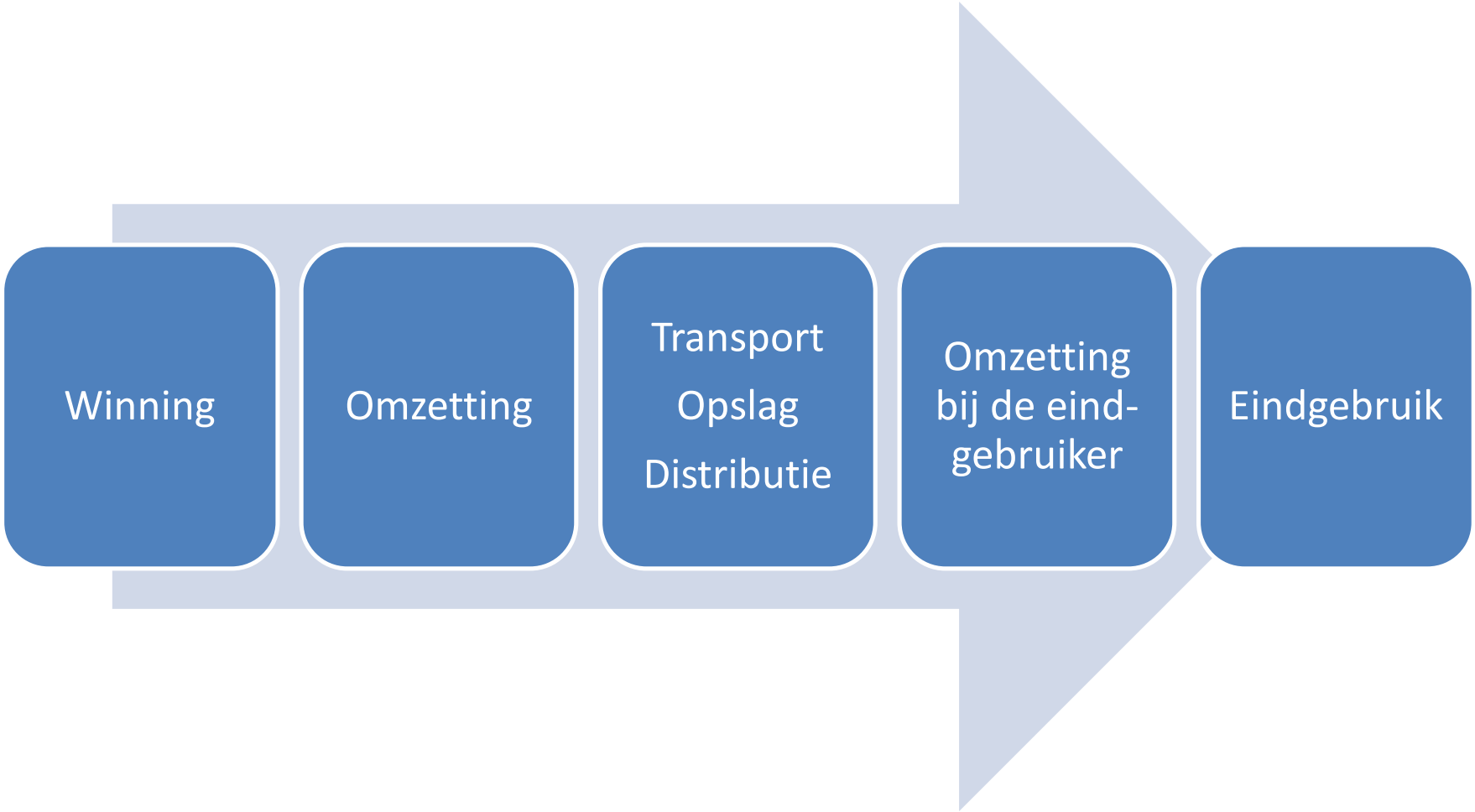
EnergieNL2050 – 3

Prof. dr Kornelis Blok
TU-Delft / Ecofys
@kornelisblok

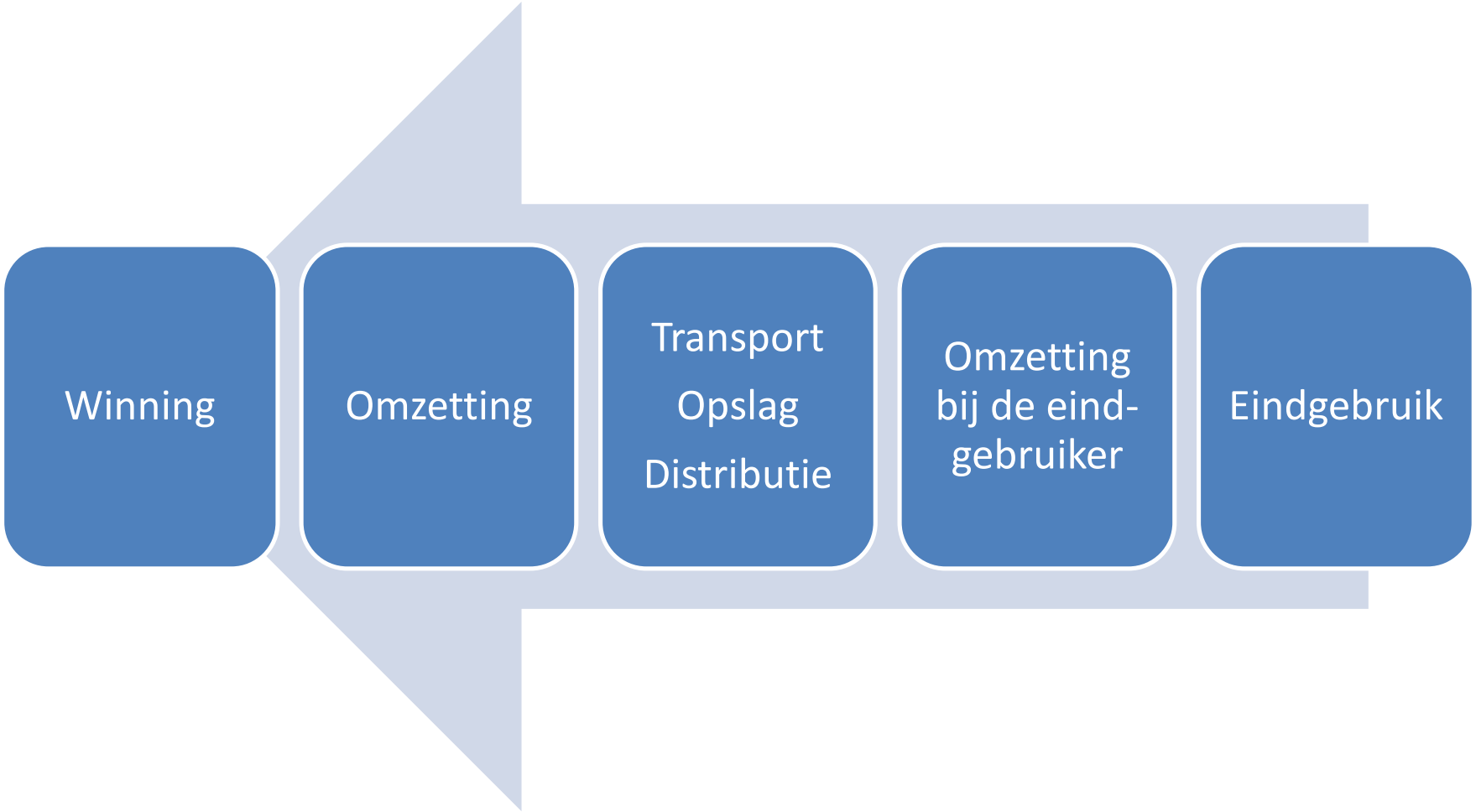
Utrecht, 9 februari 2017

TU Delft

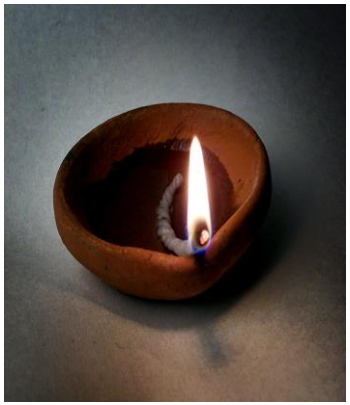
Het energiesysteem



Het energiesysteem



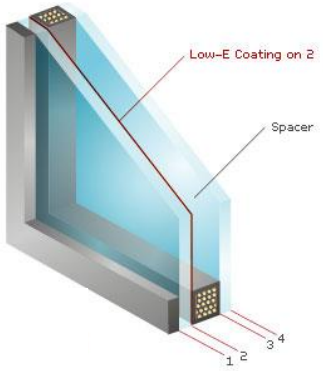
Lichtopbrengst
(in lumen per Watt)



0.1	0.5	10 – 18	50 – 80	70 – 200

Bronnen: Tsao en Waide, 2010, The World's Appetite for Light
Fabrikanteninformatie.

Warmtetransmissie van beglazing
(Watt/m^2,K)

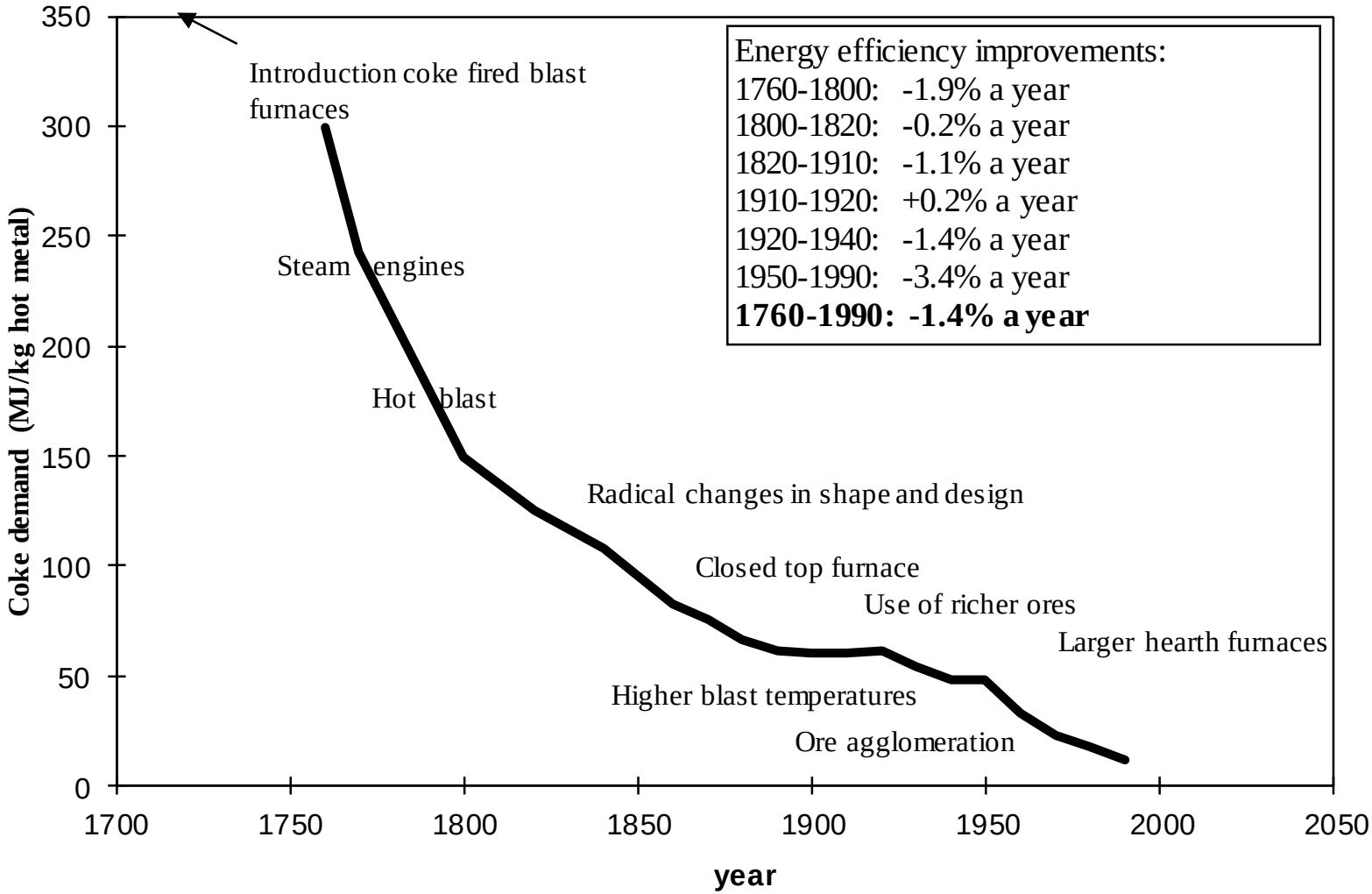


6	3	1

Bron: Ecofys, 2015

Ontwikkeling energiegebruik ijzerproductie

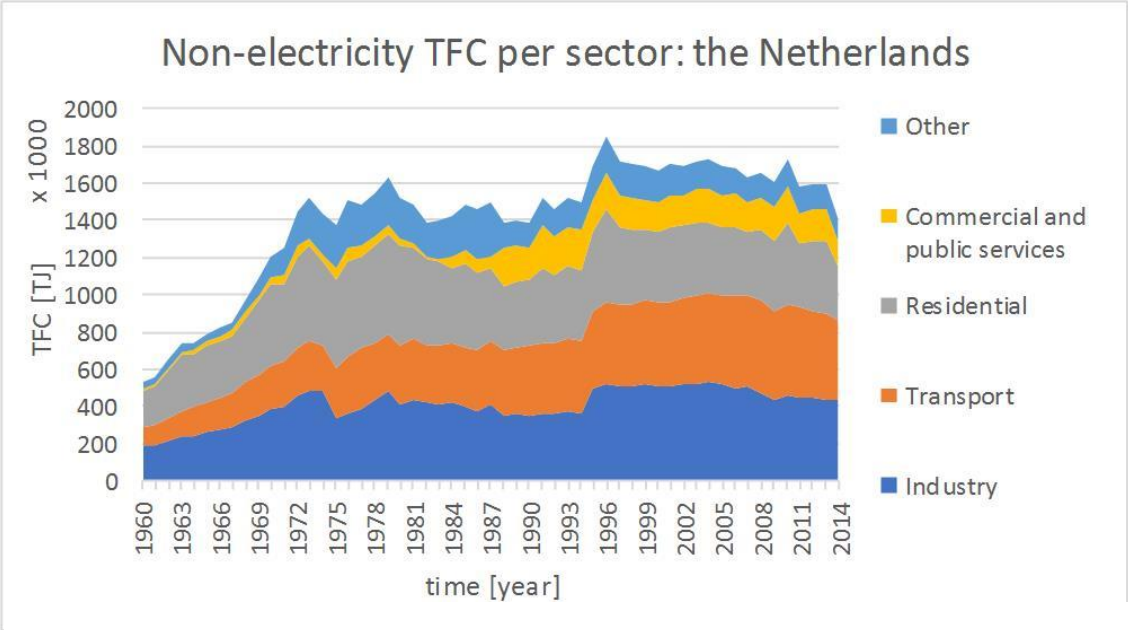
(MJ cokes per kg ijzer)

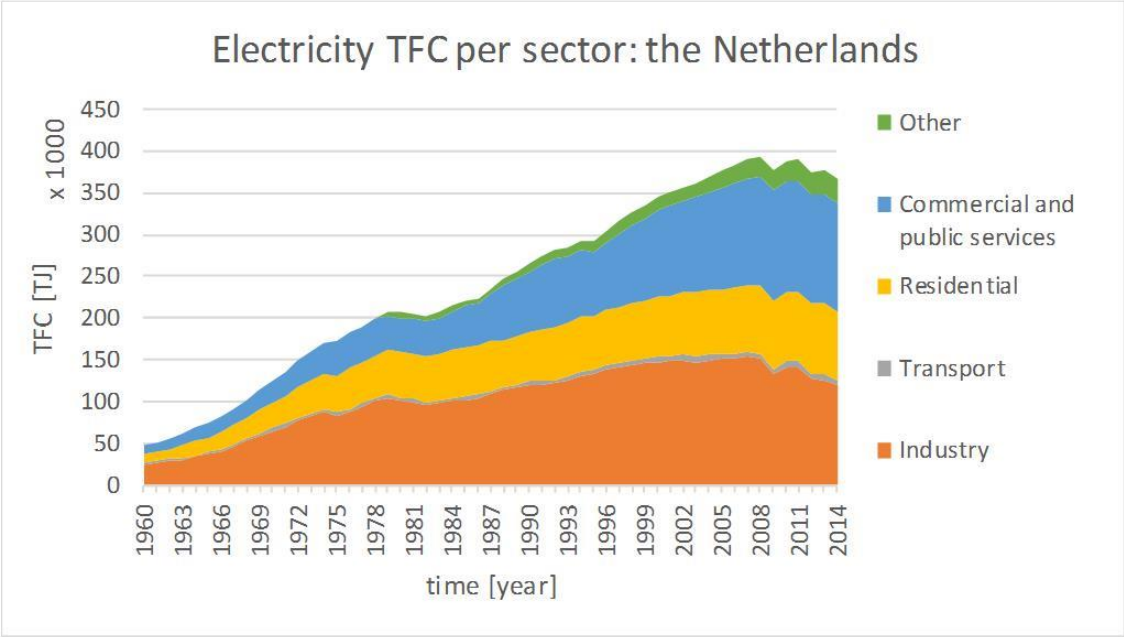


Bron: J. de Beer, Proefschrift, Universiteit Utrecht, 1998

Ontwikkeling energiegebruik

Nederland, 1960 - 2014



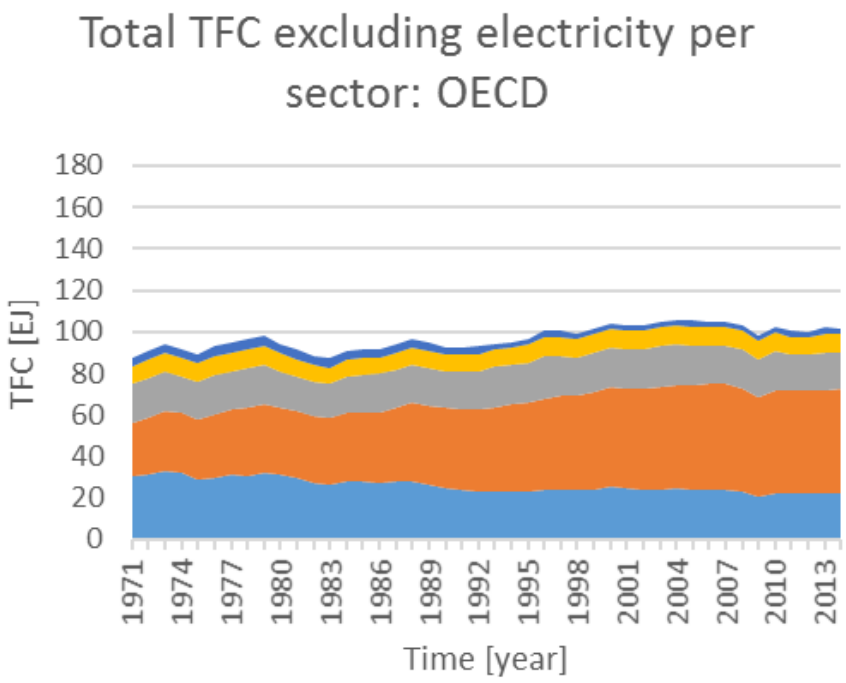


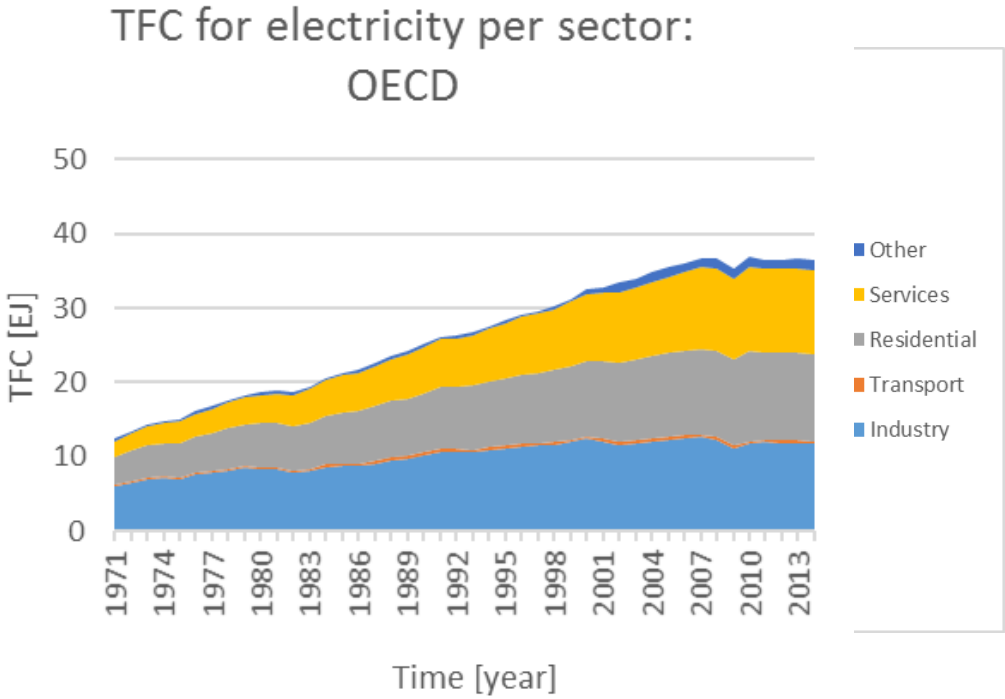
Bron: IEA, World Energy Balances, 2015

TU Delft

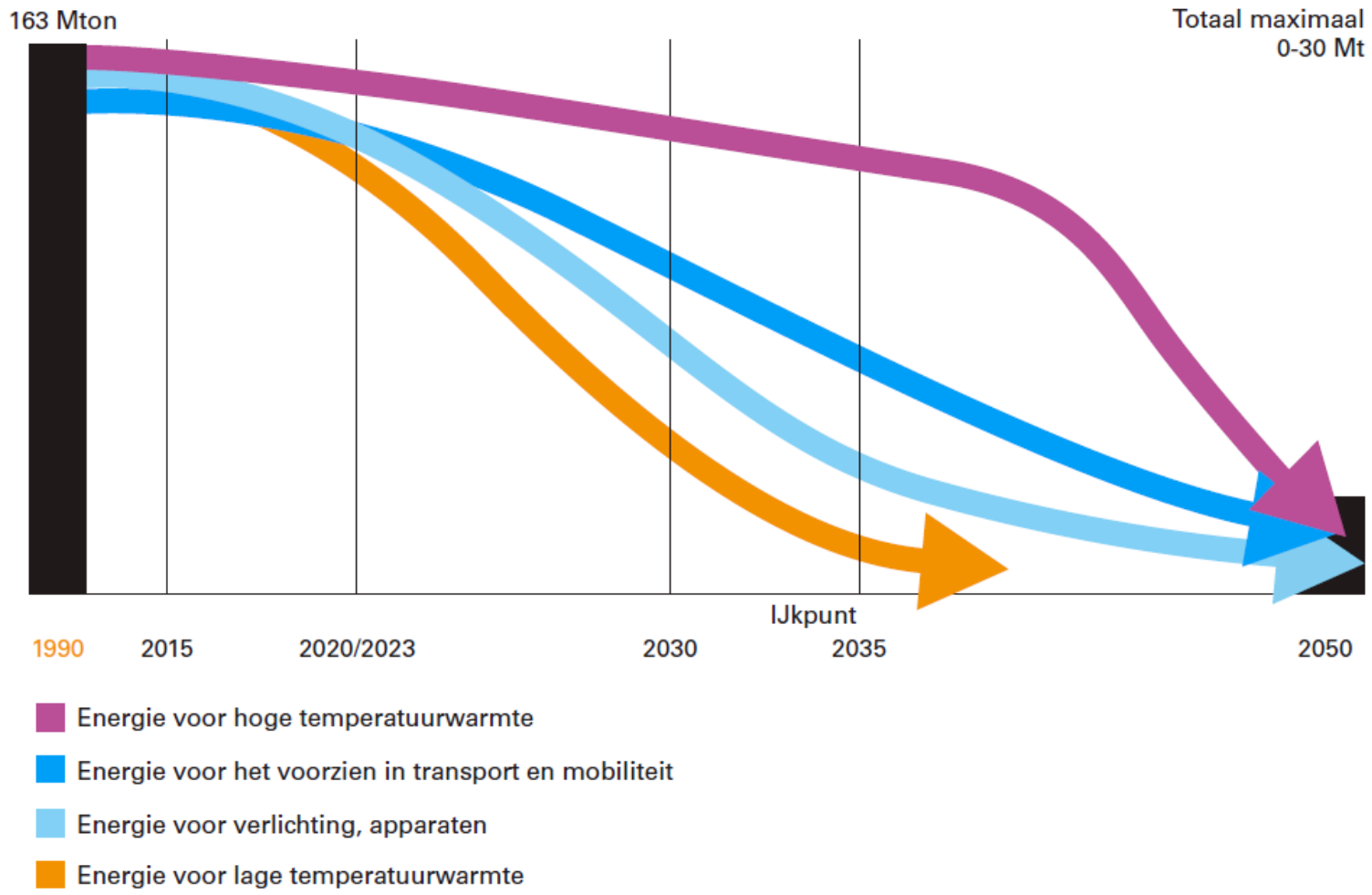
Ontwikkeling energiegebruik

OECD, 1971 - 2014



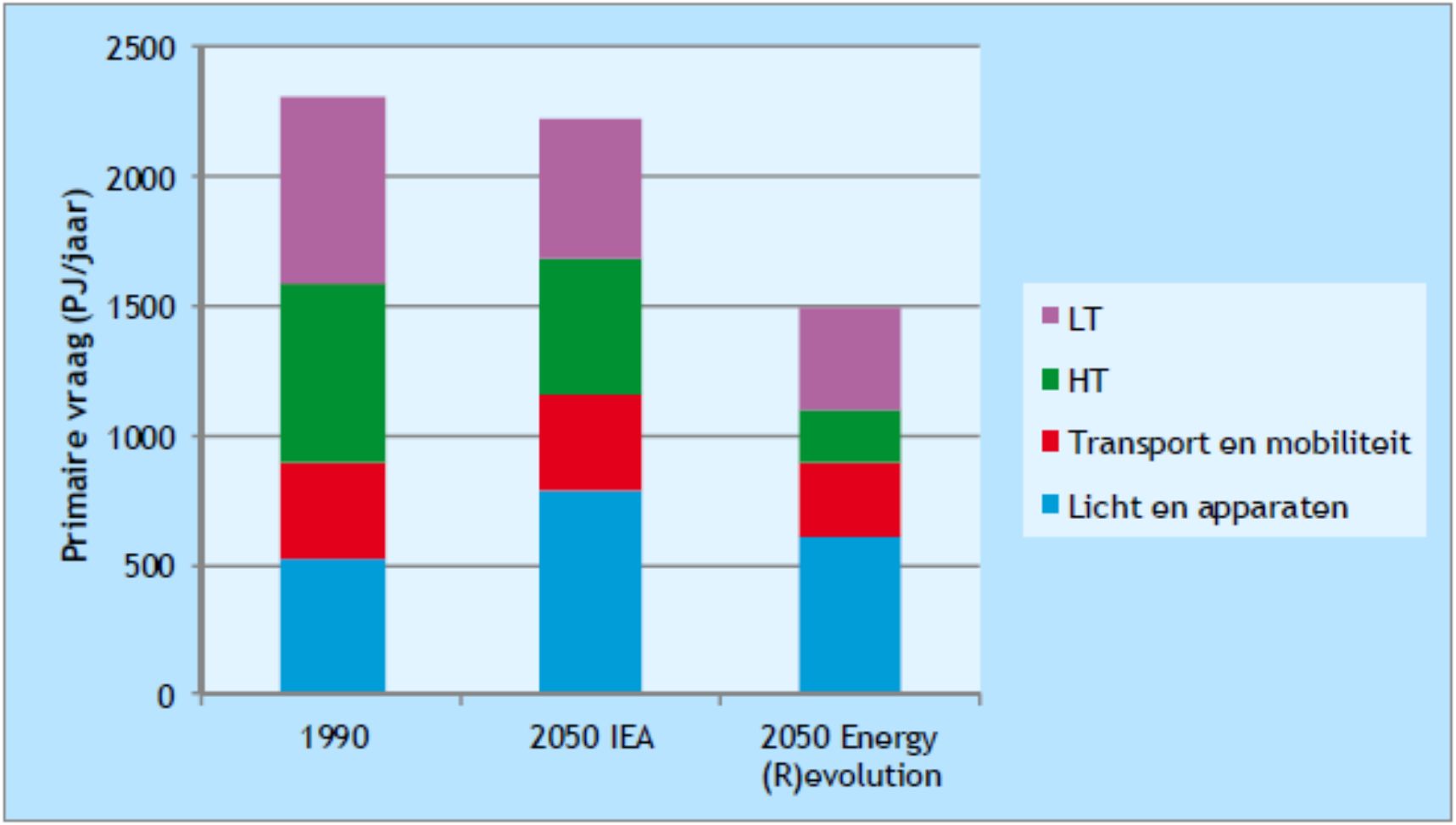


Bron: IEA, World Energy Balances, 2016



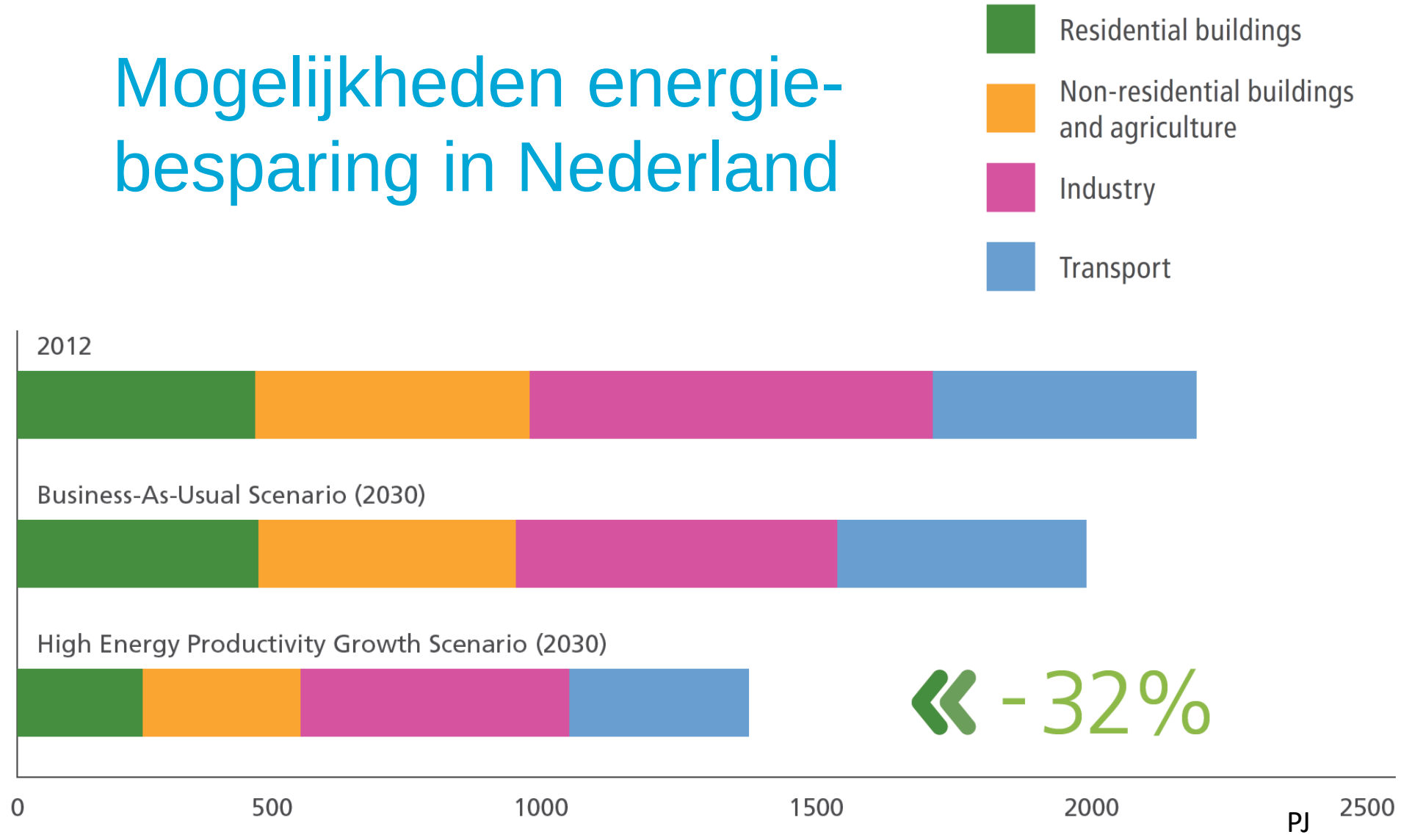
Bron: **Rijk zonder CO_2**,
Raad voor de Leefomgeving, 2015

Scenarios voor het energiegebruik
(achtergrondrapport RLI)



Geert Warringa en Frans Rooijers: Verkenning functionele energievraag en CO2-emissies tot 2050, CE, Delft, 2015.

Mogelijkheden energie-besparing in Nederland

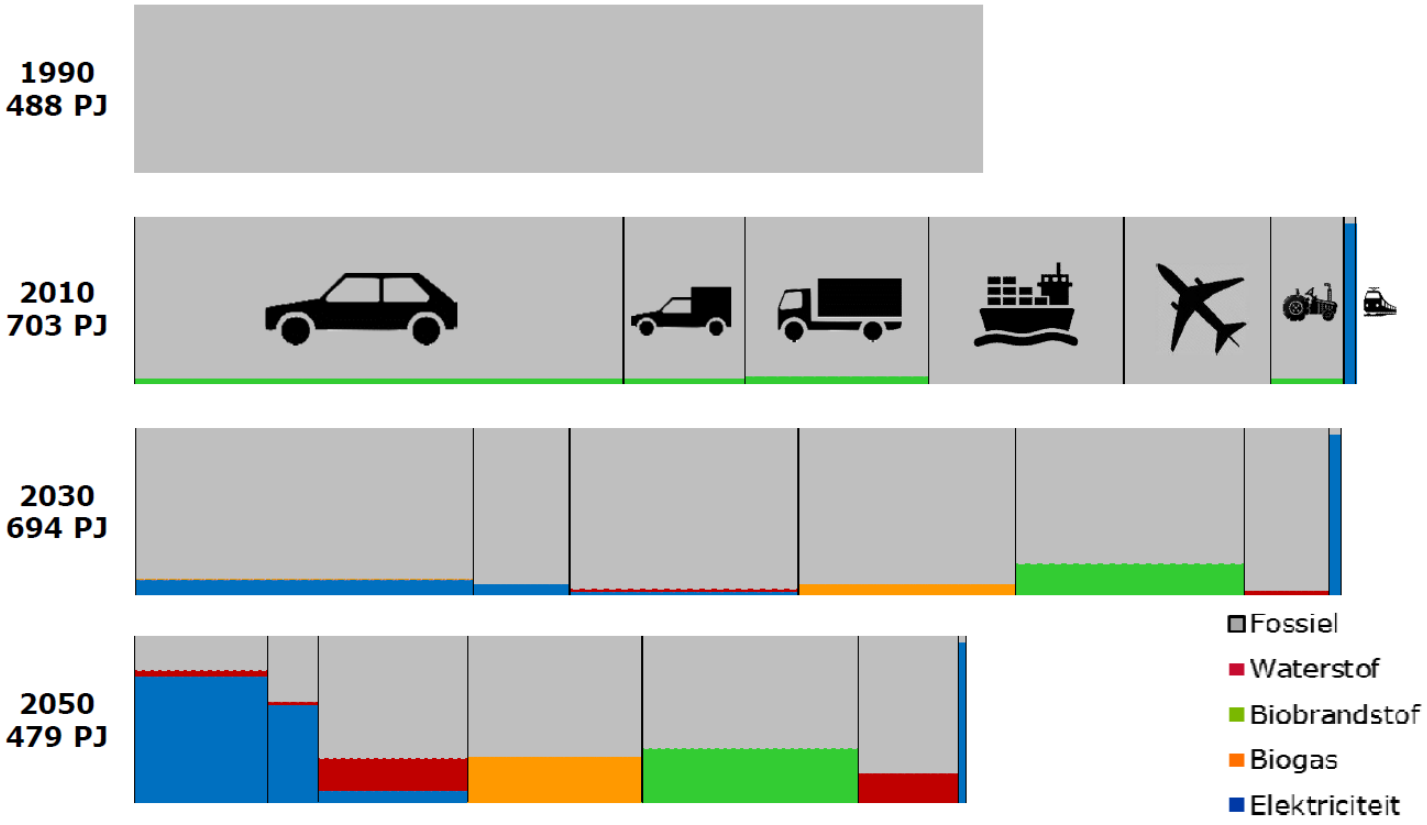


Bron: K. Blok et al. The 2015 Energy Productivity and Economic Prosperity Index

Hamelink (Ecofys):

Sustainable transport scenario (NGOs)

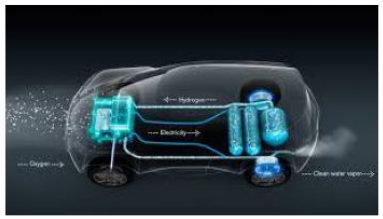
Development of final energy use and types (broad scope)



Van Wee (TU Delft):

Grootste bijdrage moet van technologie komen. Toch ook niet-technologische maatregelen gewenst.

- Zonder zwaar inzetten op technologie kunnen we doel vergeten
- Niet-technologische maatregelen: overgangsperiode, verzachten pijn bij prijsstijgingen, andere redenen dan CO2 / energie (Raad V&W, VROM, Energie, 2009)

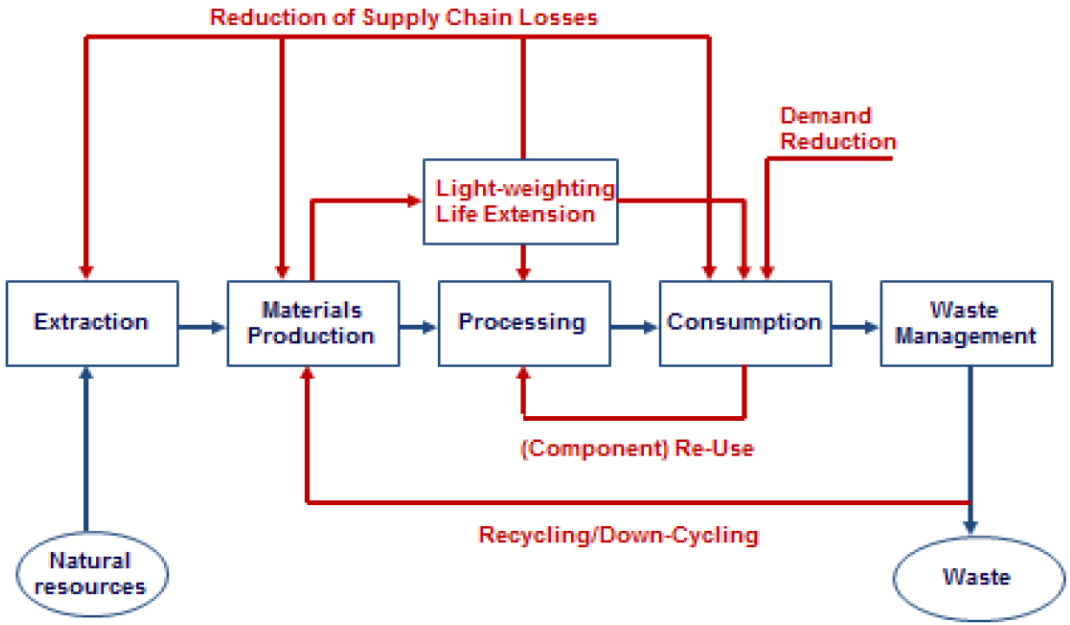


TU Delft

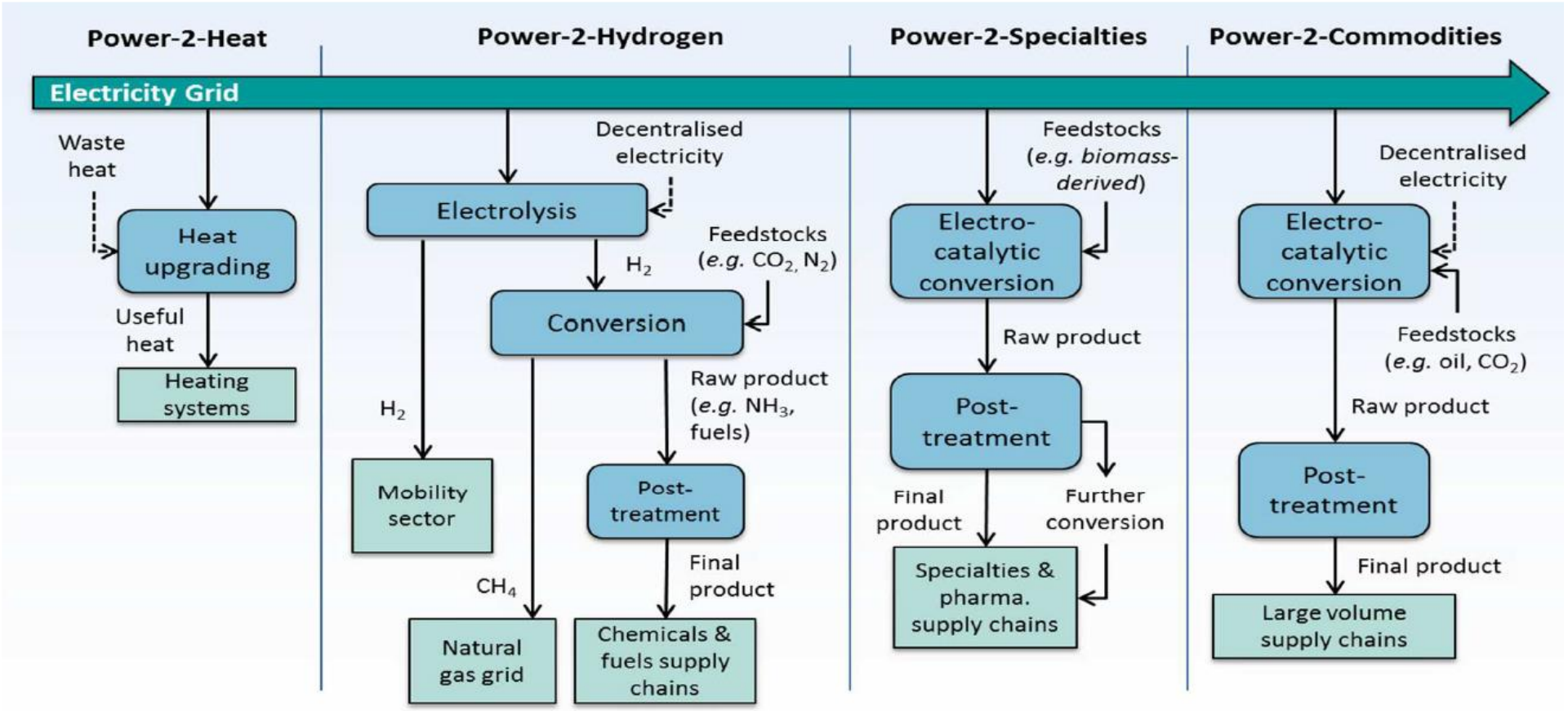
Worrell (UU):

Universiteit Utrecht

Reducing Material Use



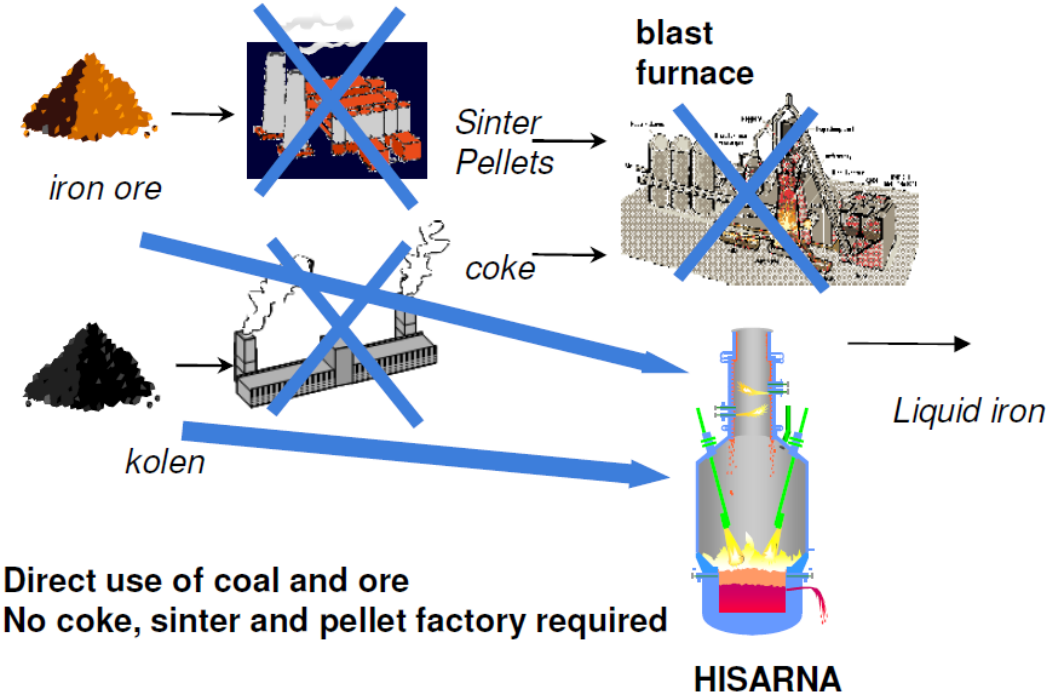
De Graaff (TNO/Voltachem):



Kiesewetter (Tata Steel):

HISARNA – Process innovation

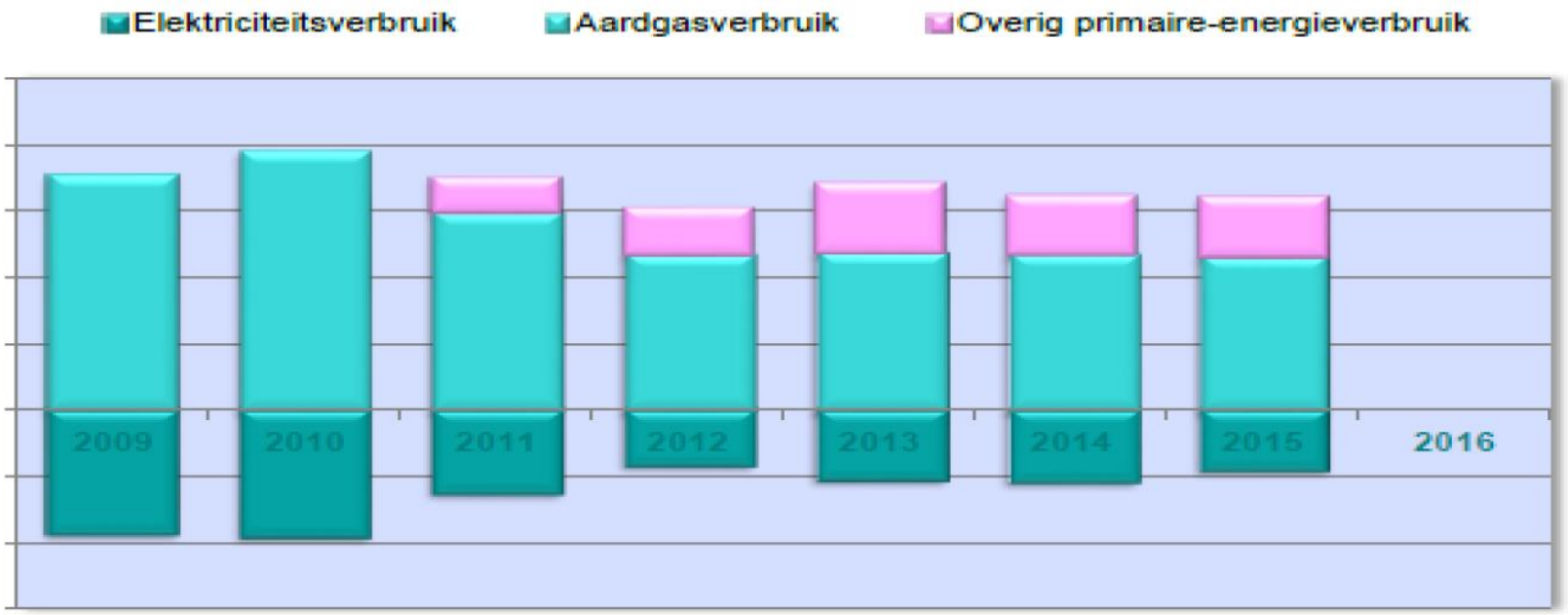
- A **new process** that allows the direct use of **powdered raw material**. No more coke oven or ore processing required
- **Iron ore** is melted in the cyclone reactor
- **Fine coal** is injected directly into the smelter
- By using pure oxygen, we get gases **without nitrogen**
- This makes the combination with **CO_2 recovery & storage (CCS)** easier to realise



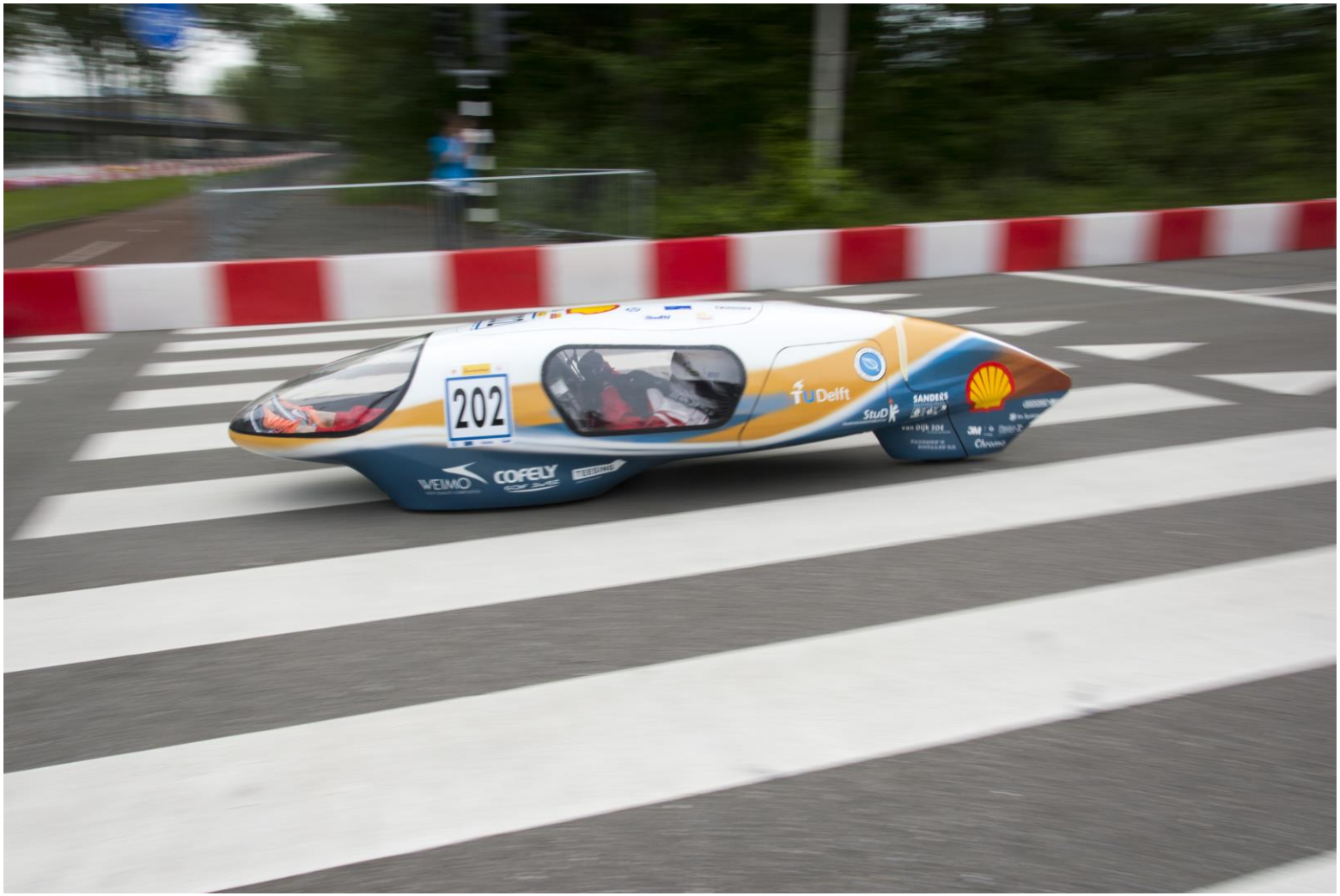
Ybema (AkzoNobel):

Annual energy use AkzoNobel Hengelo

AkzoNobel



Ecorunner




TECHNISCHE UNIVERSITEIT DELFT
MDCCCXLII

Contact

Prof. dr. Kornelis Blok
Chair of Energy Systems Analysis
Faculty Technology, Policy and Management
Jaffalaan 5, Room B3.060
2628 BX Delft
The Netherlands
E-mail: k.blok@tudelft.nl
phone: +31-15-27 85751
mobile: +31-6-558 667 36

Twitter: @kornelisblok