McKinsey&Company

Accelerating the energy transition: cost or opportunity?

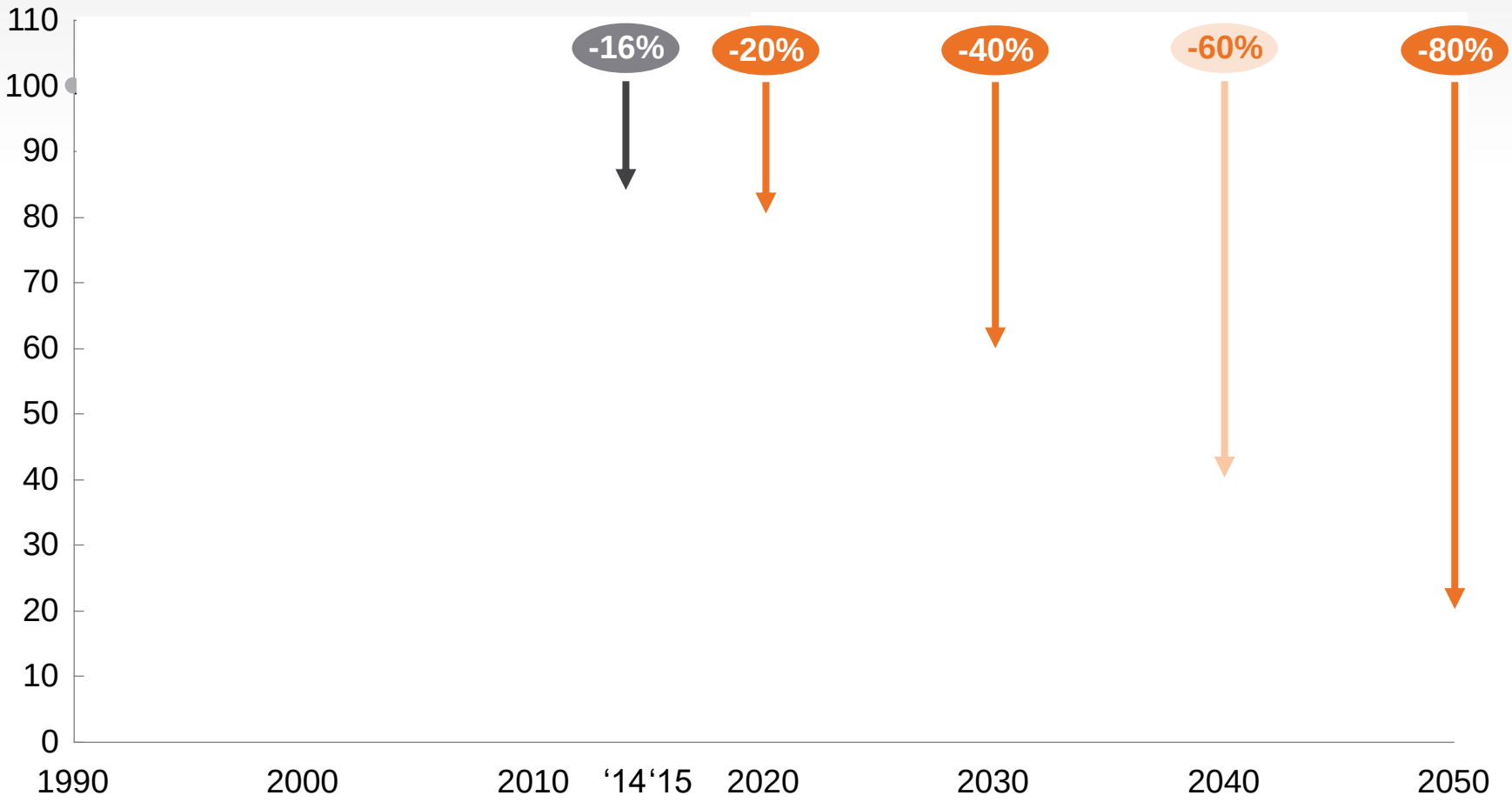
A thought starter for the Netherlands

PRESENTATION VERSION

November 2016

To achieve EU 2050 ambition of GHG emission reduction of 80 percent, the Netherlands would need to accelerate with factor 3

CO_2 equivalent emission, % change as of 1990



SOURCE: CBS

Scenario: Selecting a set of plausible measures amidst uncertainty

NOT EXHAUSTIVE

What is highly likely

Fundamental shifts in the current energy system need to happen in order to achieve the ambition

- Major efforts around increasing efficiency, fuel switches, and renewable supply are all needed
- Wind energy and solar PV are promising scalable replacements of fossil fuels
- Transport and built environment will (at least partially) electrify to decarbonize

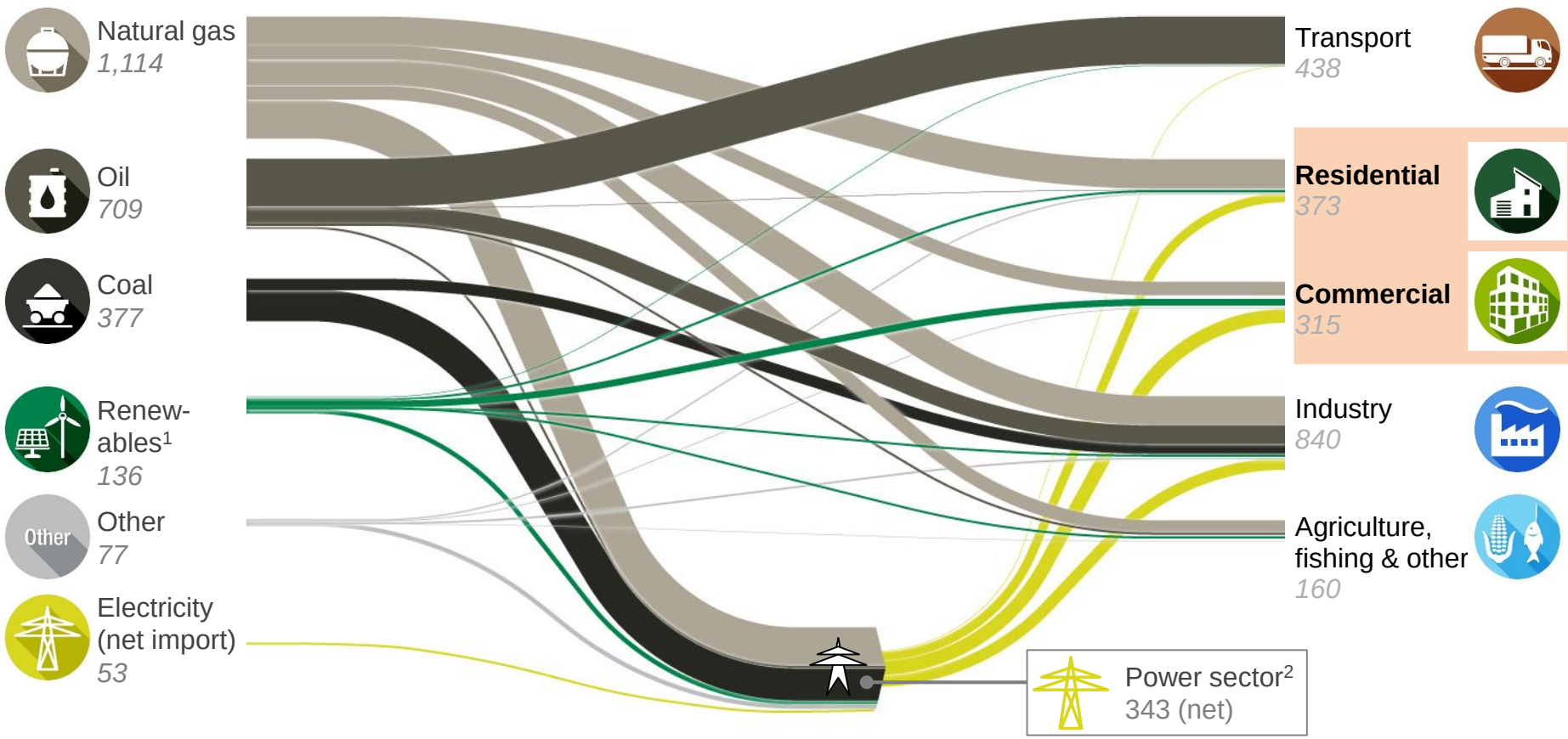
What is uncertain

However, some shifts are not as clear yet

- In several sectors it's too early to predict which specific technologies will enable decarbonization, and to what extent (e.g. adoption of CCS in Industry, hydrogen in heavy transport)
- Landscape of future energy supply depends on myriad of factors - technology and cost developments as well as (political) choices
- (Enforcing) Role of governments, citizens, public sector, as well as investors yet to be defined

In 2014 the energy system is largely dependent on fossil fuels

Netherlands energy demand in 2014; flow between energy sources and sectors, PJ

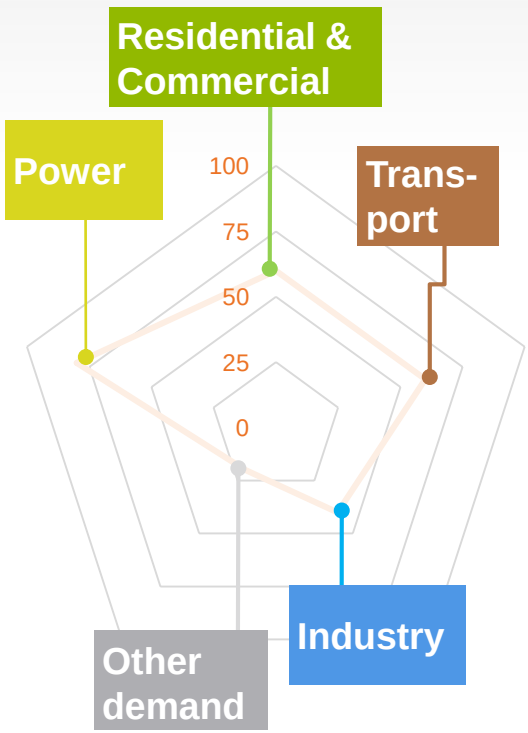


1 Includes: hydro, geothermal, solar, wind, and biomass
2 Only includes net use for central power production (320 PJ) and transmission and distribution losses (23 PJ); energy sector own use (e.g., oil consumption in refining is included in industry)

SOURCE: Centraal Bureau voor de Statistiek (2014), “Energiebalans” and “Energieverbruik” databases

Scenario: With selected measures all sectors improve emissions, with biggest impact in the power and residential & commercial sectors

CO_2 reduction achieved



Assumptions used

Transport

- Shift to electricity for domestic shipping, buses, light duty vehicles, and motor cycles
- Shift to hydrogen for trucks

Residential & Commercial

- Improved insulation
- Shift to electric (54%), district (and geothermal) (28%), and biogas space heating (18%)
- Shift to biogas (18%) and electric (82%) water heating and cooking

Industry

- Shift from oil and gas furnaces and steam boilers to electric versions
- Example shift from coal blast to biogas and electric furnaces
- Efficiency improvements

Other demand

- Energy efficiency improvements of 1% per annum

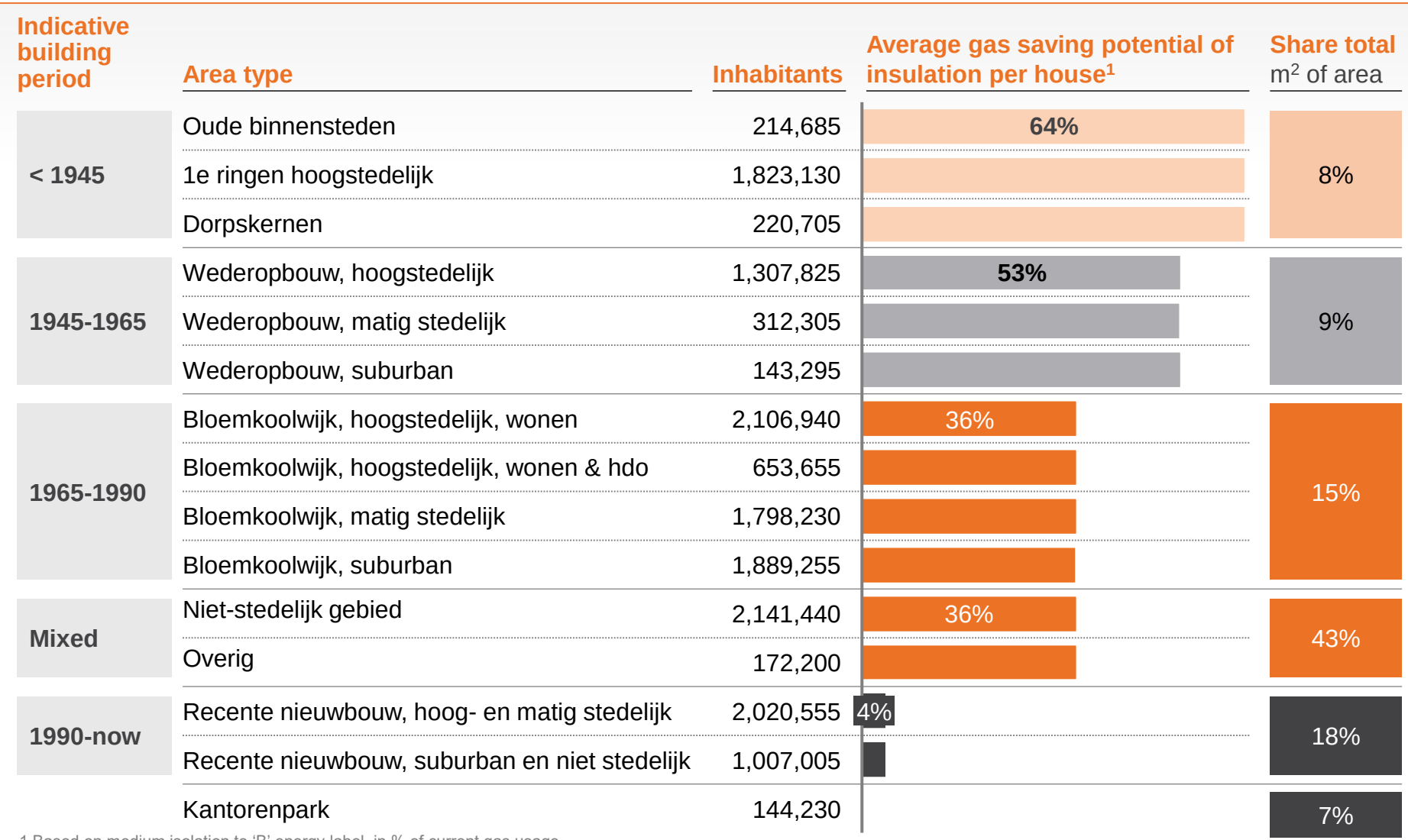
Power

- Gas, coal, and oil are replaced by wind, solar, biomass and gas as backup
- Introduction of flexibility measures

SOURCE: McKinsey MGI, CE Delft, CPB, CBS

Of over 75% of houses, insulation improvement potential is high to very high

Area division for the Netherlands

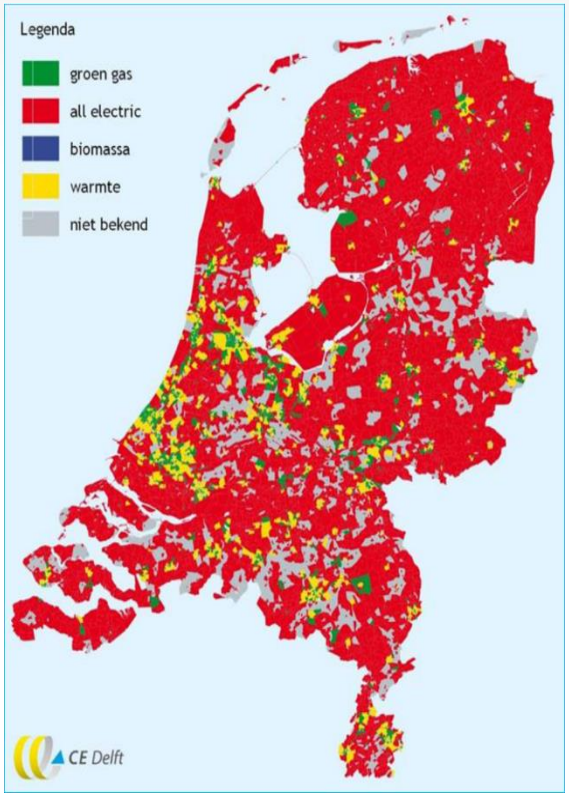


1 Based on medium isolation to 'B' energy label, in % of current gas usage

SOURCE: CE Delft, CBS, McKinsey analysis

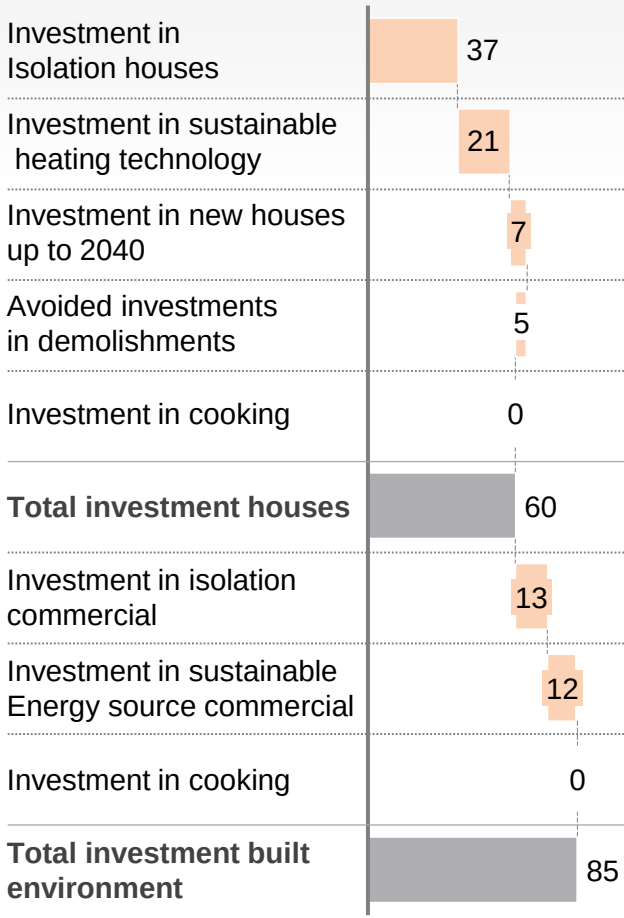
With a total investment of € ~85 billion houses and services will be better insulated and half will have a sustainable heating source

Heating source per area



Investment in insulation and renewable heating sources[1]

EUR billion, cumulative



Impact

- Reduces energy demand for heating houses by 30 %
- Completely eliminates household dependency on gas
- Ensures that all new houses use renewable heating sources
- Investments avoided for part of planned housing demolishment
- Investment in 82% of houses (capex delta induction vs gas stove)
- Investment of ~ €8,500 per household
- Reduces energy demand for heating commercial areas by 27%
- Completely eliminates commercial building heating dependency on gas
- Investment in 82% of houses (capex delta induction vs gas stove)

1 Based on assumptions from CE Delft (2015): Op weg naar een klimaatneutrale gebouwde omgeving 2050. Insulation is assumed here to be done up to energy label 'B' and we partially follow the most efficient heat source per area as designated by CE Delft to calculate investment in sustainable energy sources. New houses and demoslihments are assumed to be pro-rata divided among the 15 different areas

SOURCE: CE Delft, CBS, McKinsey analysis

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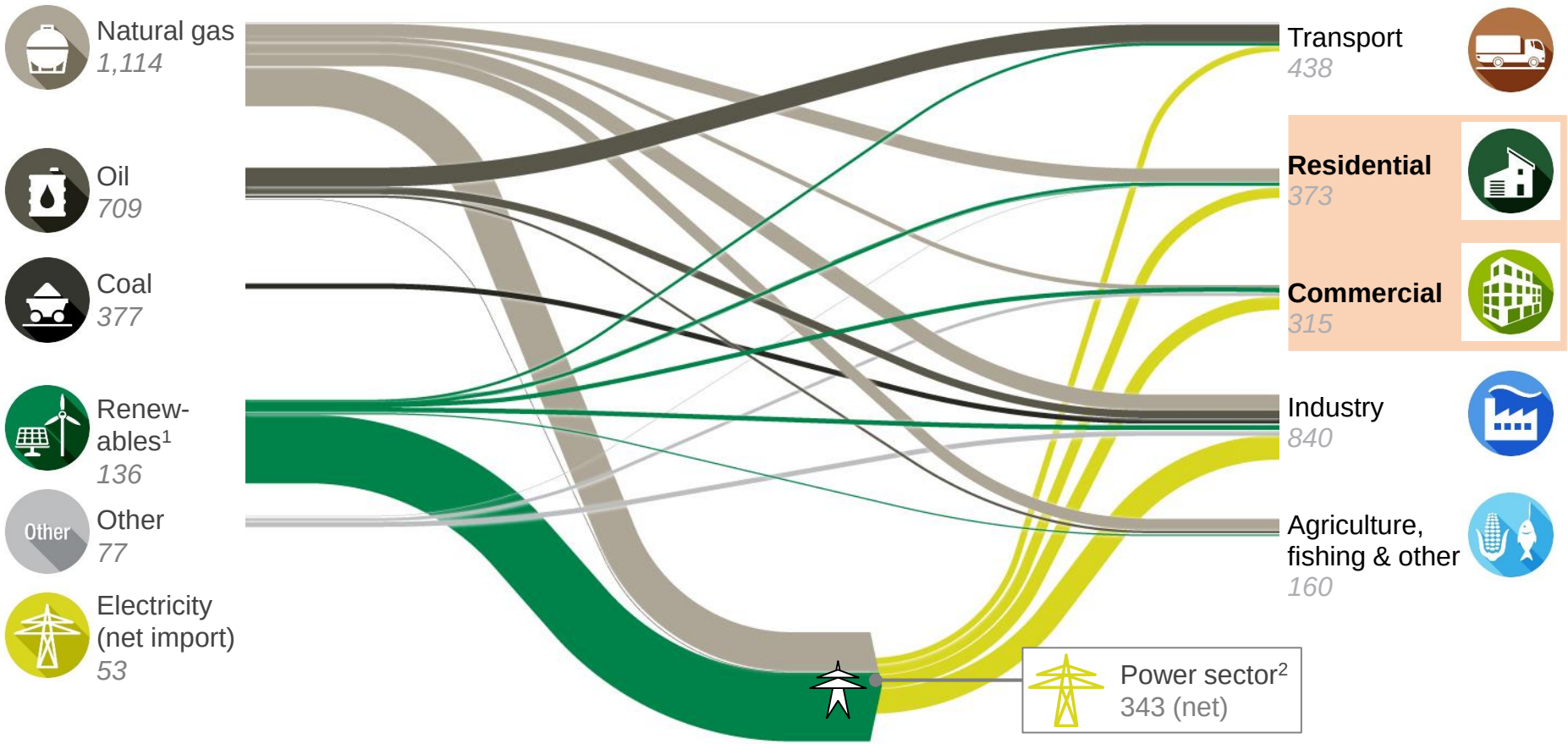

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Source: Centraal Bureau voor de Statistiek (2014), "Energiebalans" and "Energieverbruik" databases

When reaching 80% reduction the role of renewables increases further

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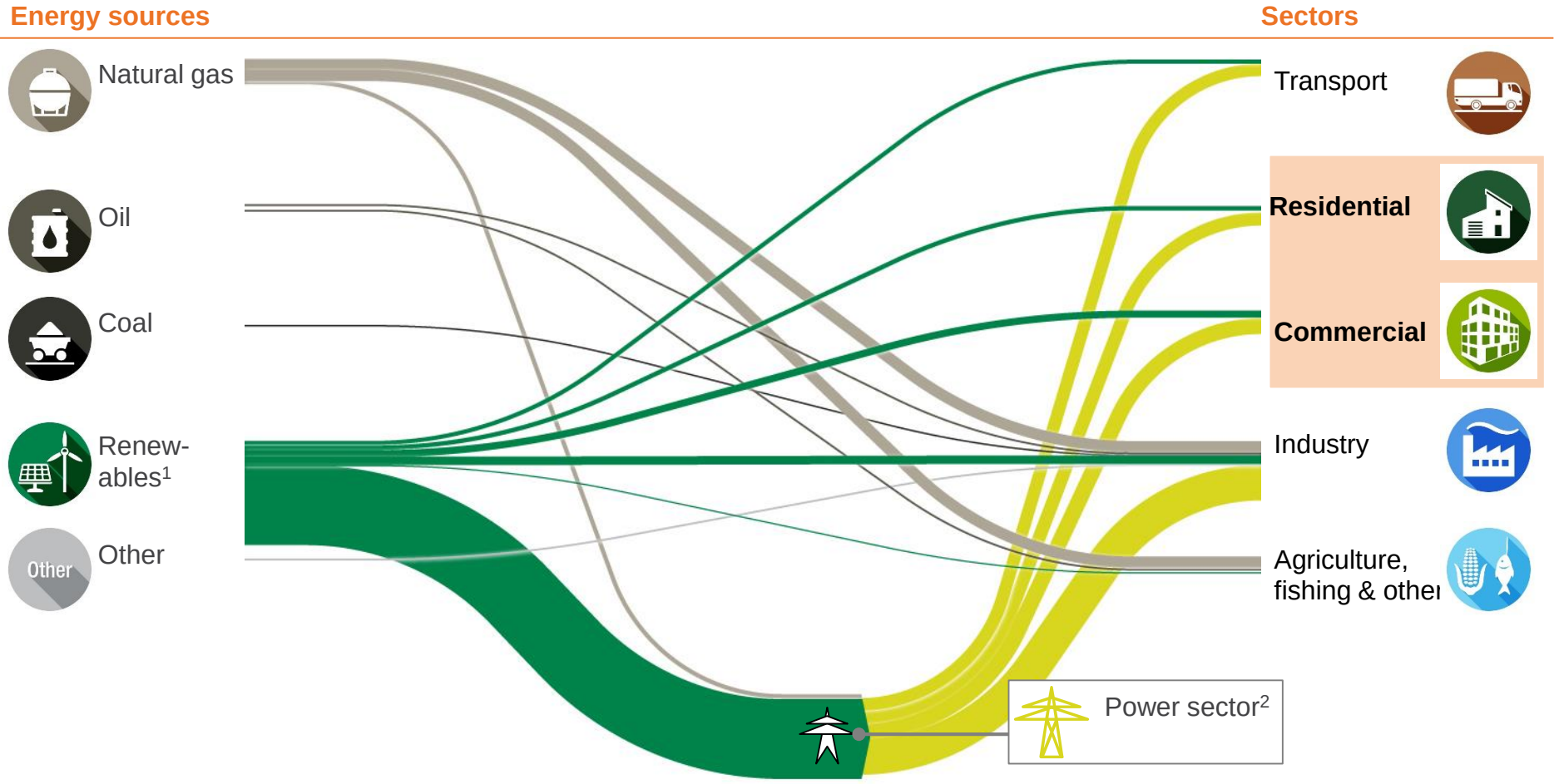
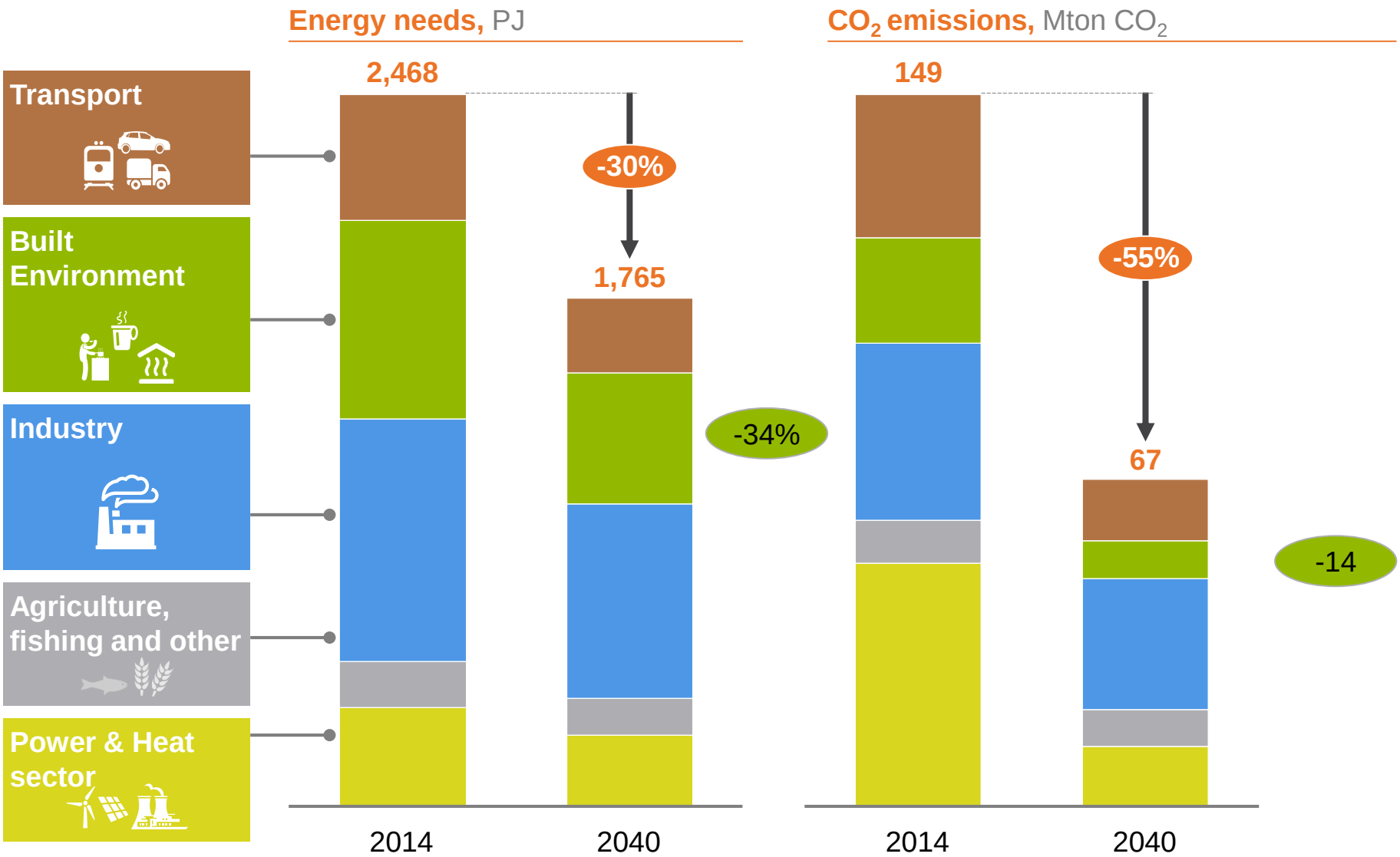


1 Includes: hydro, geothermal, solar, wind, biomass, and hydrogen
2 Includes net biomass use (94 PJ), gas use (37 PJ), and own use and transmission and distribution losses

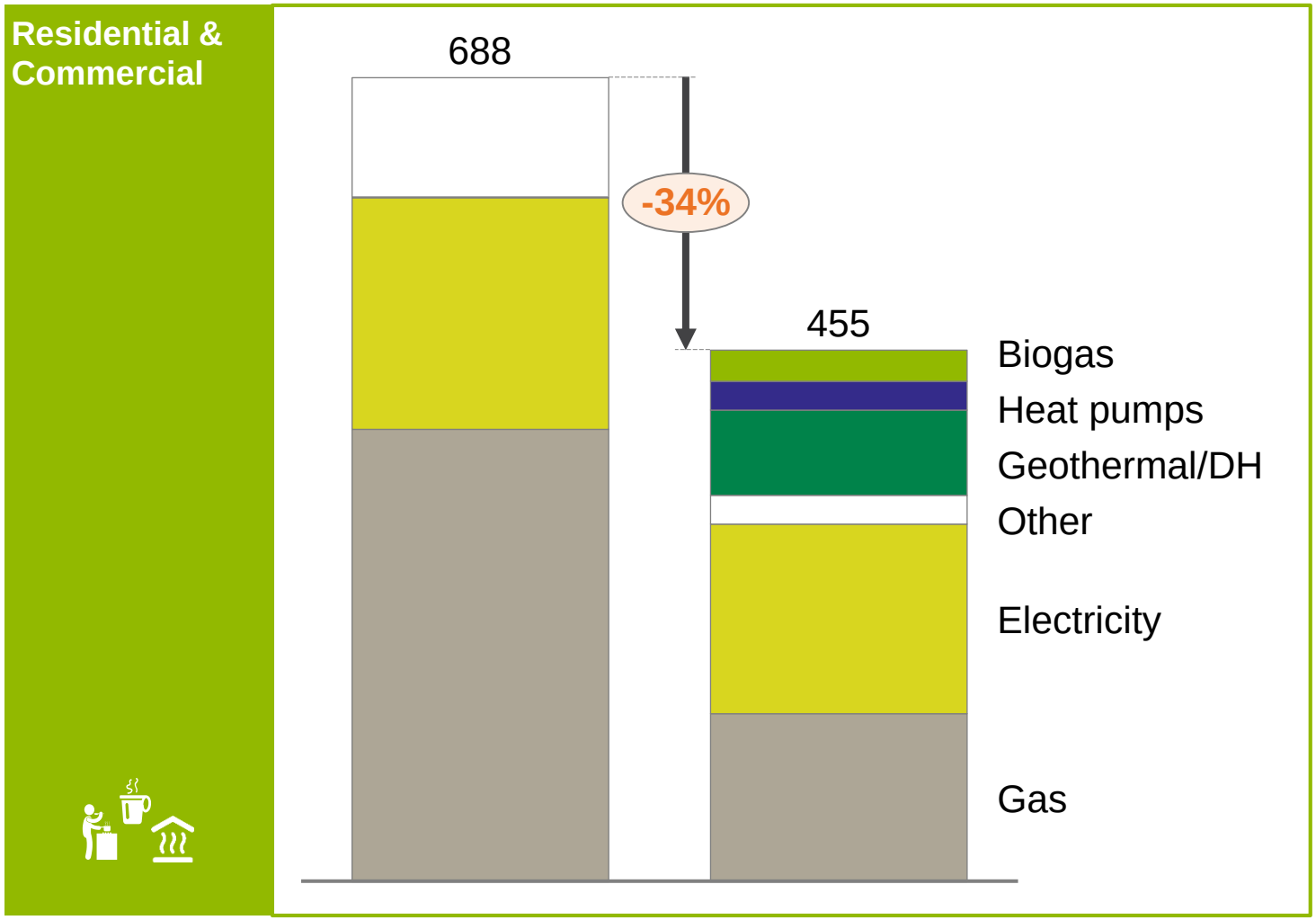
Following these measures, energy demand is reduced by 30% and CO_2 emissions by 55% (>80 Mton)



SOURCE: Centraal Bureau voor de statistiek (2014); McKinsey

More than a quarter of the achieved CO_2 emission reduction is directly contributable to changes in demand from the built environment (14 Mton)

Energy demand by energy carrier, PJ



SOURCE: McKinsey

How to drive this transition in the built environment?

Areas of key challenges

- (Regulatory) **Unclarity about goals** and target setting
- Regulatory policies hampering swift implementation
- **High investment need** (compared to consumer expenditure)
- Investments with **(long) payback time** (e.g. >10 years for insulation improvement)
- **Unfavorable Risk – Return** profile of investments
- Application of relatively **new technology** (e.g. BIPV, Geothermal)
- **Phasing out of the grid** needs to happen area by area
- Very **personal** – when making changes to home environments

Potential set of solutions

- **Creation of a 'masterplan'** for the transition of the built environment: this should help give consumers and businesses more certainty about their investment prospects, thereby unlocking investments – And it will help with phasing out the gas grid where and when needed
- **Put public incentives, including tax policies, in perspective** of the longer-term challenge ahead and redesign them in such a way that citizens and major energy consumers are encouraged to participate in the overhaul of the energy market
- **Set up of a 'national investment bank':** to help de-risk investments, making them attractive for investors with a long return horizon (e.g. pensionfunds)
- **Make it attractive for consumers:** through offering of a superior solution

SOURCE: McKinsey

Summary

- **Greenhouse gas emission reduction has to accelerate by more than a factor 3**

- For this transition an **investment level of ~200 bn EUR or ~10 bn EUR/year** is needed

- Such investments could result in **GDP growth, creation of well over 45,000 jobs**

- **400.000 new EV's need to come on the road per year** as of 2032 (6000 till now), warranting a 'Giga-size' battery factory in NLs
- **7 mln houses need improved insulation**; materials filling 225 soccer stadiums and providing 27000 jobs for 20 years
- **Process energy of >150 PJ** (high temperature need) in industry needs to be decarbonized

- Following electrification of transport and building heating amongst others, the **demand for power will increase with 37% and it's share will double**

- **21 GW of solar, 33 GW of wind, and 24 GW of back up or storage has to be installed** to reach ~80% renewable power generation by 2040
- For **solar this means 5X more** than currently in plans for 2023 (equal to 0.5% of global production)
- For **offshore wind this means 5X** more than planned for 2020, **47(!) times Borssele**