SHELL IN THE ENERGY TRANSITION

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SEARCHING FOR
NEW ENERGY

Energy challenge
Increasing population and energy demand

2015 👤👤👤👤👤👤👤

2100 👤👤👤👤👤👤👤👤👤👤

7+bn **WORLD POPULATION**

10bn **WORLD POPULATION**

~500 **EXAJOULES** ENERGY CONSUMPTION PER YEAR

~1.000 **EXAJOULES** ENERGY CONSUMPTION PER YEAR

Double world energy usage

Elements of the Paris Agreement

Δ**T is a function of** { **Area** - **Area** }

Peaking of emissions

Positive emissions
Atmospheric CO_2 rises

Net zero emissions

Net negative emissions
Atmospheric CO_2 falls

Emissions, Gt of CO_2

Anthropogenic sources

2020 onwards

Removing carbon
dioxide from the
atmosphere

A balance is reached when removal of CO_2 (and other GHGs)
from the atmosphere is equivalent to remaining emissions.
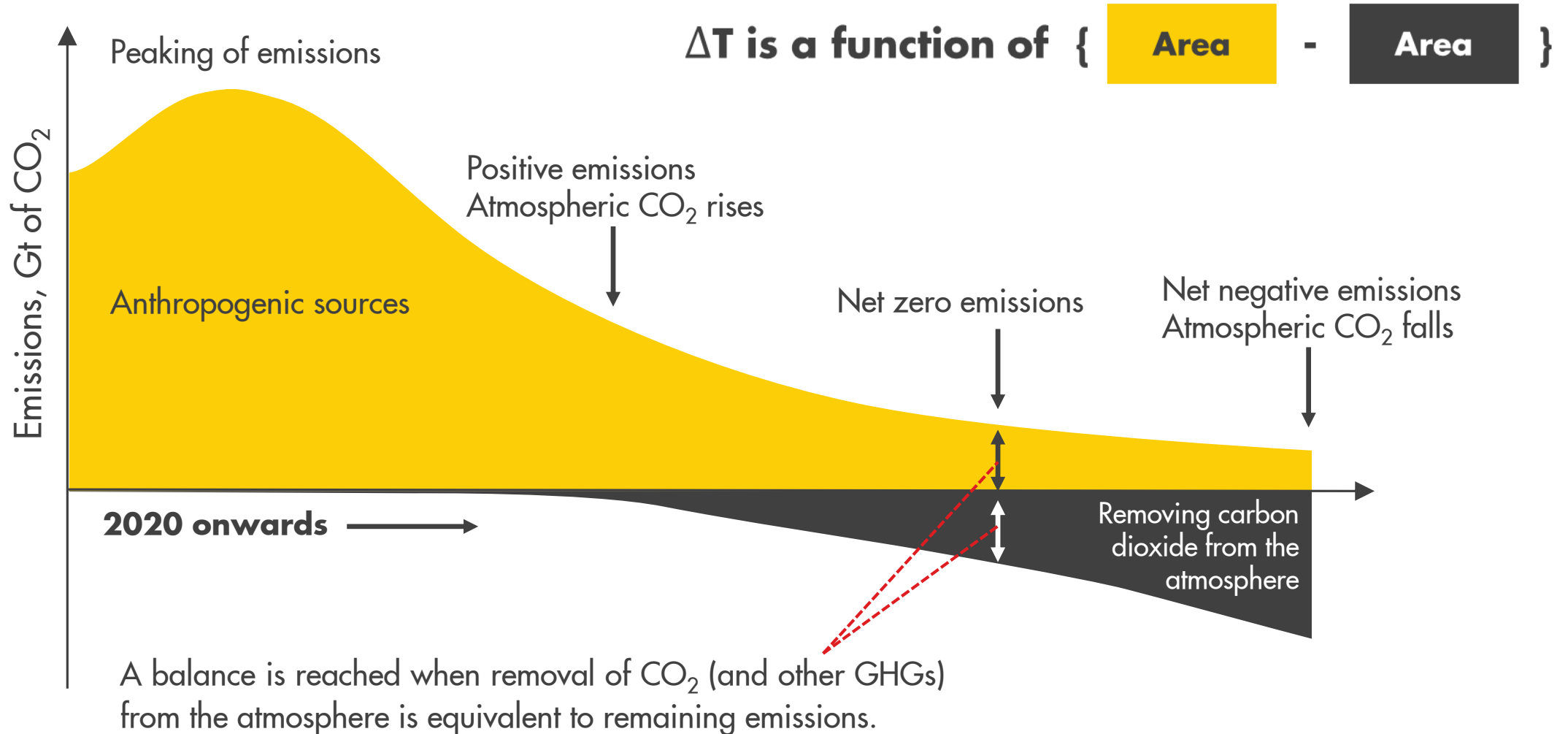
June 2019   4

SKY - A plausible energymix in a Net Zero Emission world in 2070
Meeting the Goals of the Paris Agreement

2015
- 27%
- 9%
- 5%
- 0.5%
- 0.5%
- 3%
- 22%
- 32%

SKY SCENARIO 2070
- 11%
- 32%
- 14%
- 13%
- 6%
- 8%
- 6%
- 10%

Energy Source
- Natural Gas
- Oil
- Coal
- Bioenergy
- Nuclear
- Solar
- Wind
- Other

▲ With CO_2- Capture and Storage

● Fossiel
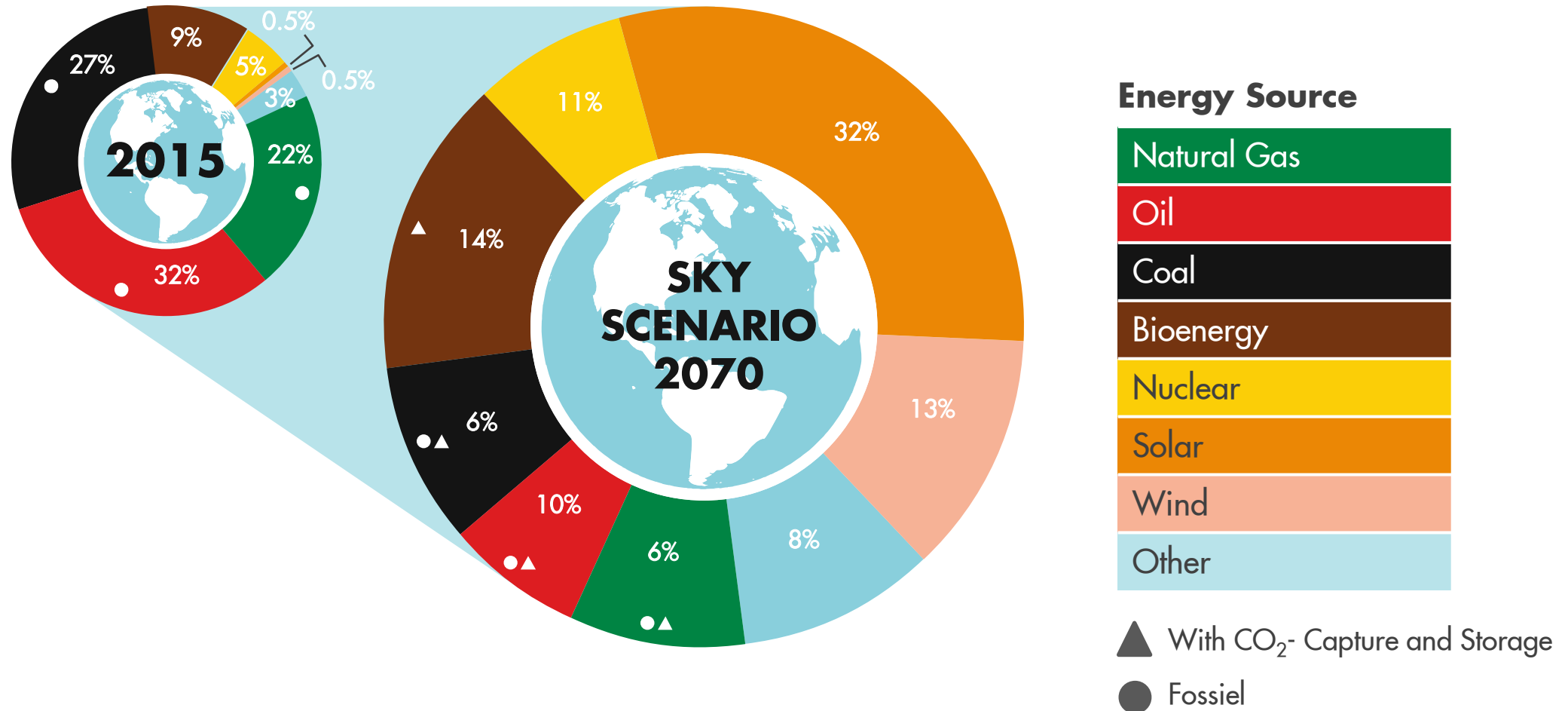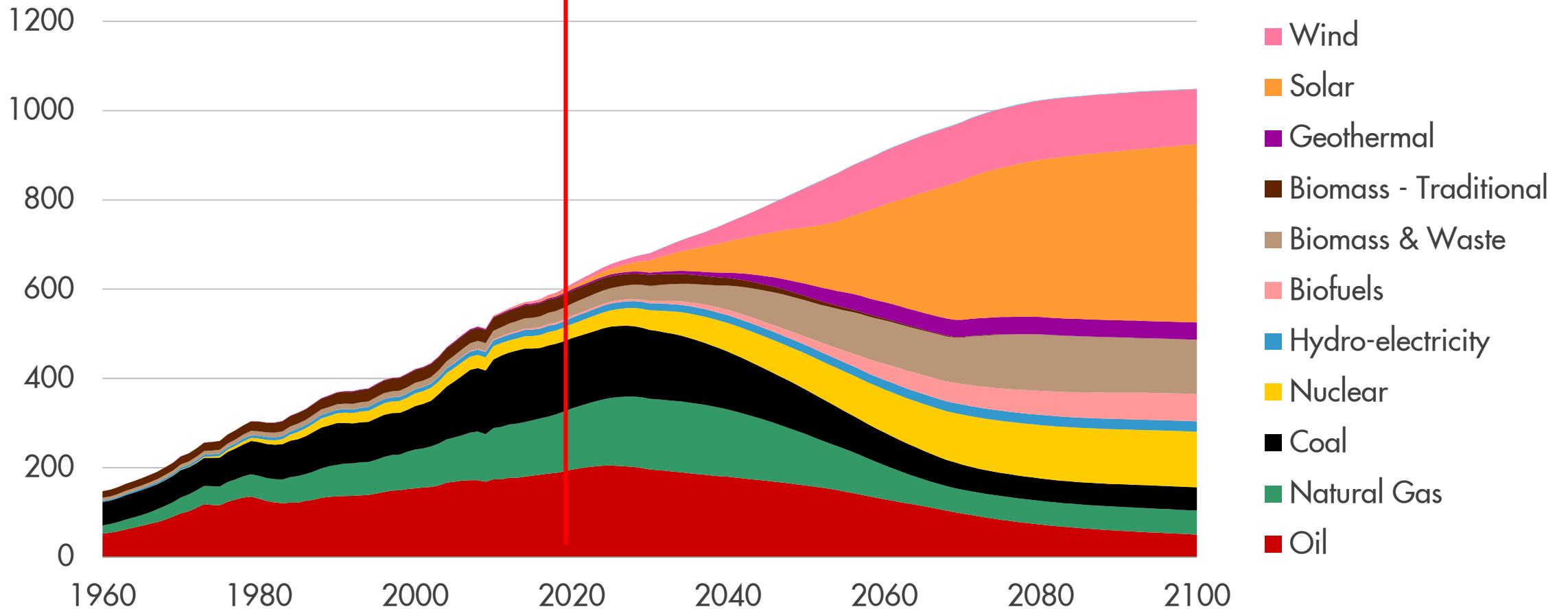
New energy systems emerge
The major sources of primary energy shift in Sky

World total primary energy by source, EJ/year

Legend:
- Wind
- Solar
- Geothermal
- Biomass - Traditional
- Biomass & Waste
- Biofuels
- Hydro-electricity
- Nuclear
- Coal
- Natural Gas
- Oil

In Sky, six big steps forward from now to 2070 . . .

Carbon pricing	Energy efficiency	Electrification of final energy	Growing new energy systems	Carbon capture and storage	Ending deforestation
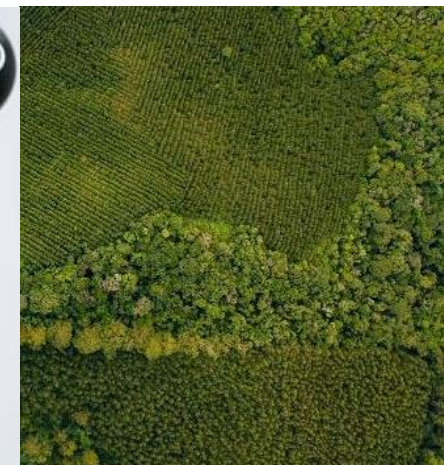
. . . underpinned by a changing consumer mind-set and societal license for change.
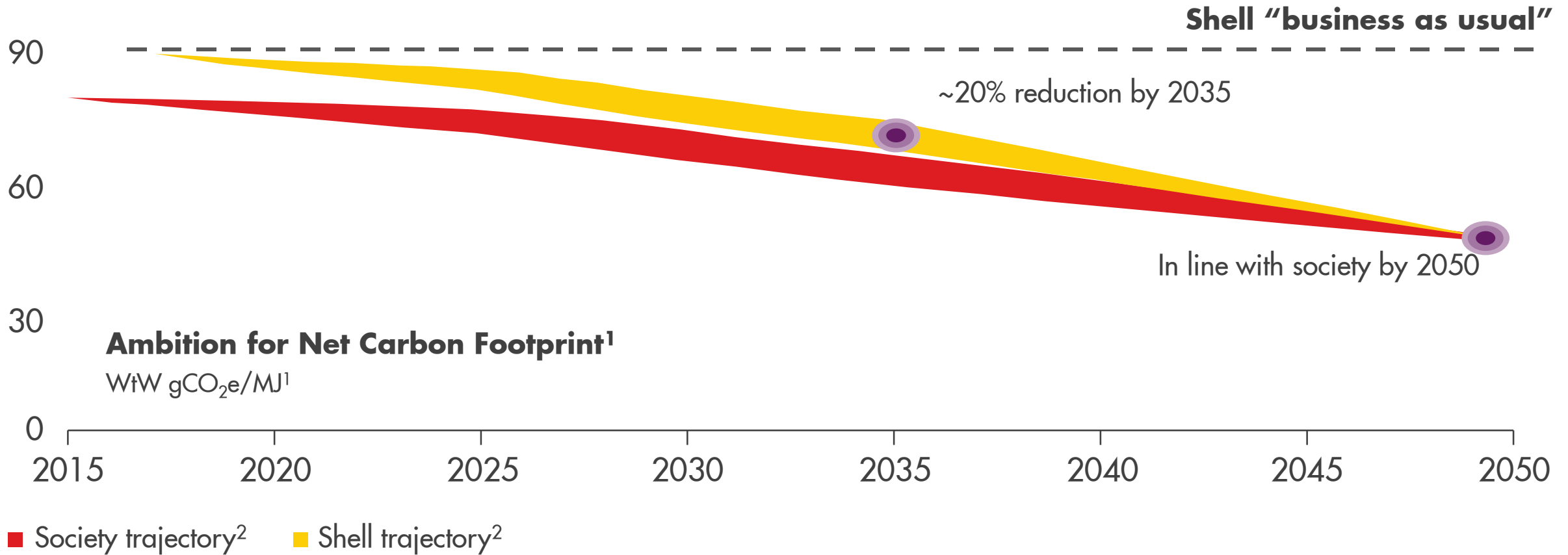
Shell's role in the the energy transition

- Grow our natural gas business
- Build a profitable new energies business
- Research and develop innovative low-carbon energy solutions
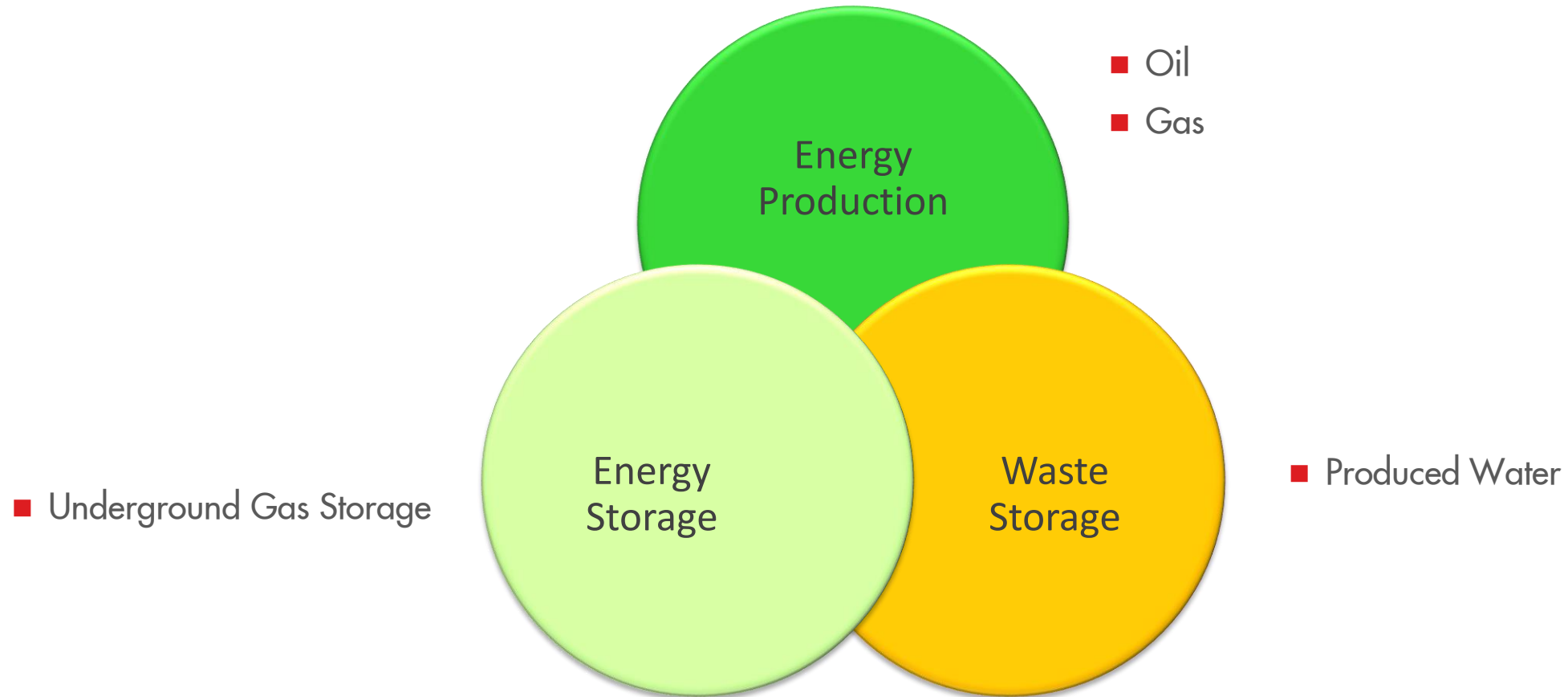- Improve the CO_2-efficiency of our own operations

Energie-challenge
Reduction CO_2-emissions is essential

Shell "business as usual"

~20% reduction by 2035

In line with society by 2050

90

60

30

0

Ambition for Net Carbon Footprint[1]

WtW gCO_2e/MJ[1]

2015   2020   2025   2030   2035   2040   2045   2050

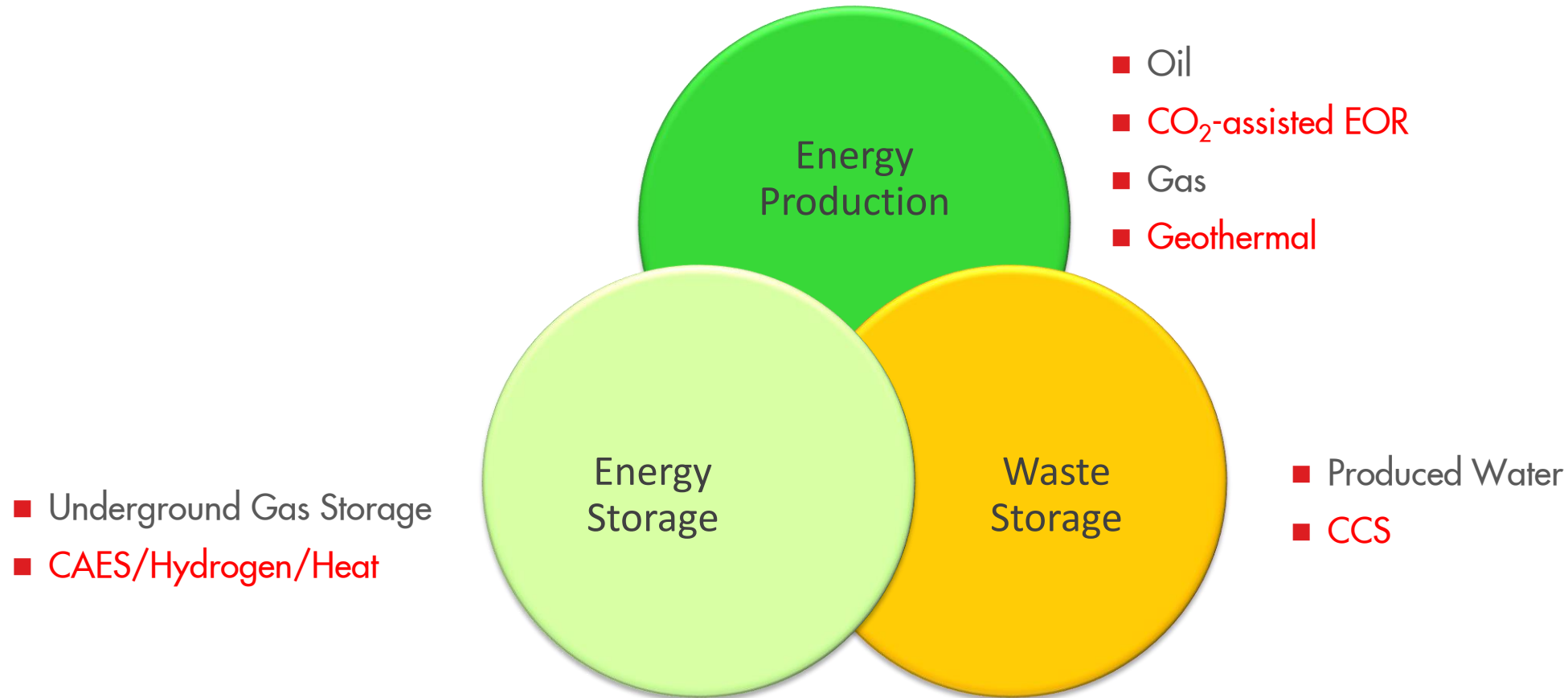■ Society trajectory[2]   ■ Shell trajectory[2]

1 Net Carbon Footprint measured on an aggregate "well to wheel" or "well to wire" basis, from production through to consumption, on grams of CO_2 equivalent per megajoule of energy products consumed; chemicals + lubricants products are excluded. Carbon Footprint of the energy system is modelled using Shell methodology aggregating lifecycle emissions of energy products on a fossil-equivalence basis. The methodology will be further reviewed and validated in collaboration with external experts.

2 Potential society trajectory includes analysis from Shell scenarios estimate of Net Zero Emissions by 2070 and IEA Energy Technology Perspectives 2017; Potential illustrative Shell trajectory.
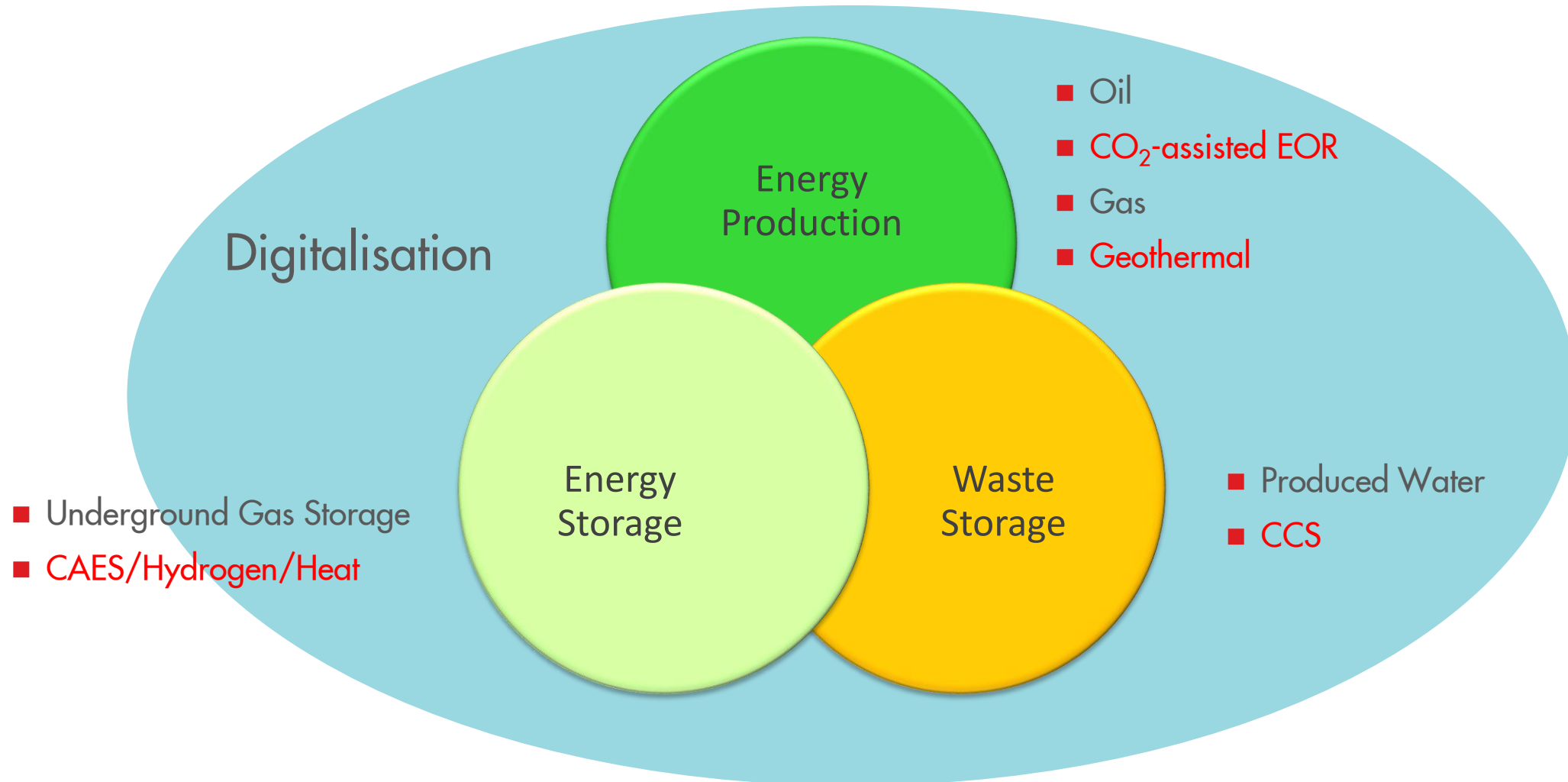
Geosciences in the Energy Industry - now

Energy
Production

- Oil
- Gas

Energy
Storage

- Underground Gas Storage

Waste
Storage

- Produced Water

Geosciences in the Energy Industry - future

- Oil
- CO$_2$-assisted EOR
- Gas
- Geothermal

Energy Production

Energy Storage

Waste Storage

- Underground Gas Storage
- CAES/Hydrogen/Heat

- Produced Water
- CCS

Geosciences in the Energy Industry - future

Digitalisation

Energy Production

Energy Storage

Waste Storage

- Oil
- CO$_2$-assisted EOR
- Gas
- Geothermal

- Produced Water
- CCS

- Underground Gas Storage
- CAES/Hydrogen/Heat

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