Meeting the Goals of the Paris Agreement

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WARNING: Uncertainties ahead

This presentation contains data from Shell’s new Sky Scenario. Unlike Shell’s previously published Mountains and Oceans exploratory scenarios, the Sky Scenario is targeted through the assumption that society reaches the Paris Agreement’s goal of holding global average temperatures to well below 2°C. Unlike Shell’s Mountains and Oceans scenarios which unfolded in an open-ended way based upon plausible assumptions and quantifications, the Sky Scenario was specifically designed to reach the Paris Agreement’s goal in a technically possible manner. These scenarios are a part of an ongoing process used in Shell for over 40 years to challenge executives’ perspectives on the future business environment. They are designed to stretch management to consider even events that may only be remotely possible. Scenarios, therefore, are not intended to be predictions of likely future events or outcomes and investors should not rely on them when making an investment decision with regard to Royal Dutch Shell plc securities.

Additionally, it is important to note that Shell’s existing portfolio has been decades in development. While we believe our portfolio is resilient under a wide range of outlooks, including the IEA’s 450 scenario (World Energy Outlook 2016), it includes assets across a spectrum of energy intensities including some with above-average intensity. While we seek to enhance our operations’ average energy intensity through both the development of new projects and divestments, we have no immediate plans to move to a net-zero emissions portfolio over our investment horizon of 10-20 years. Although we have no immediate plans to move to a net-zero emissions portfolio, in November of 2017, we announced our ambition to reduce our net carbon footprint in accordance with society’s implementation of the Paris Agreement’s goal of holding global average temperature to well below 2°C above pre-industrial levels. Accordingly, assuming society aligns itself with the Paris Agreement’s goals, we aim to reduce our net carbon footprint, which includes not only our direct and indirect carbon emissions, associated with producing the energy products which we sell, but also our customers’ emissions from their use of the energy products that we sell, by 20% in 2035 and by 50% in 2050.

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The goals of the Paris Agreement

...aim to reach global peaking of greenhouse gas emissions as soon as possible;

...achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.

Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.
The New Lens
Scenarios
Family
Looking beyond Mounatins and Oceans

Mountains
>2°C

Sky
<2°C

Oceans

Mechanisms to share common interests

Less effective

More effective

Strength of leadership

Stronger

Weak
In Sky, six big steps forward from now to 2070 . . . illustrating the interplay of technology innovation, public policy, market forces, and human behaviour

. . . underpinned by a changing consumer mind-set and societal license for change.
A major ramp-up in electrification

Electricity as a % of final energy use

The transition in Sky is at least triple the historic rate

Historic electrification trend is ~2% points per decade

Source: Shell analysis, Sky scenario
New energy systems emerge
The major sources of primary energy shift in Sky

World total primary energy by source, EJ/year

Source: Shell analysis, Sky scenario
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Hydrogen becomes significant in the second half of the century

A hydrogen based energy delivery system

Source: Shell schematic

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Sky imagines a new business model for passenger vehicle manufacture with bespoke local fabrication of bodies 3D printed on to flat-pack electric chassis.
Aviation fuel trends to 2100 in Sky

Energy use by fuel type, EJ

- Fossil fuels
- Fossil fuels and biofuels
- Hydrogen

Source: Shell analysis, Sky scenario
Sky Heavy Industry Decarbonisation Pathway
A man-made sink: Carbon capture and storage (CCS)

1. Capture
2. Transport
3. Storage
4. Measuring

2000m
Bioenergy with CCS (BECCS) has an important role to play

Energy crops
- High biomass yield
- Extensive availability

Biomass residues

Capture compression transport

Geological storage
- Saline aquifers
- Depleted oil and gas fields

Non-energy by-products

Combustion
Fermentation
Aerobic Digestion
Gasification

Fuel upgrading
- gas cleaning
- liquidation

CO₂

Heat
Biohydrogen
Biomethane
Synthetic biofuels
Electricity

Energy products

Source: Shell schematic
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Fossil fuels

Net emissions
35.2 Gt
(all emissions are Gt of CO₂)

37.8 Gt
Fossil fuels

Bioenergy production and use
6.7 Gt
Photosynthesis
6.7 Gt

2.6 Gt

Source: Shell analysis, Sky scenario
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Sky: Achieving the balance in 2070
Net-zero emissions for energy

Emissions from biofuel use
15.1 Gt

21.6 Gt
0.4 Gt

6.5 Gt
6.5 Gt
3.4 Gt
6.1 Gt

16.5 Gt

Fossil fuels
Geological storage of CO₂

Source: Shell analysis, Sky scenario

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In addition, increasing global forest coverage by an area the size of Brazil offers potential to deliver the stretched 1.5°C ambition of the Paris Agreement.

### Sky meets the Paris goal

**MIT assessment of climate impact**

**Average global surface temperature rise (°C)**

- History
- Mountains
- Oceans
- Sky

[Extra nature-based solutions]

Source: Massachusetts Institute of Technology, Shell Sky data

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Read more about Sky and download the data-set

www.shell.com/skyscenario