

A Net-Zero CO₂ Energy System by 2050

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Ajay Mehta, GM New Energies Research & Technology, Houston

WARNING: uncertainties ahead

This presentation contains data and analysis from Shell's Sky scenario. Unlike Shell's previously published Mountains and Oceans exploratory scenarios, the Sky scenario is based on the assumption that society reaches the Paris Agreement's goal of holding the rise in global average temperatures this century to well below two degrees Celsius (2°C) above pre-industrial levels. 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.

Additionally, it is important to note that as of October 30, 2020, Shell's operating plans and budgets do not reflect Shell's net-zero emissions ambition. Shell's aim is that, in the future, its operating plans and budgets will change to reflect this movement towards its new net-zero emissions ambition. However, these plans and budgets need to be in step with the movement towards a net-zero emissions economy within society and among Shell's customers.

Also, in this presentation we may refer to "Shell's Net Carbon Footprint", which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions but, to support society in achieving the Paris Agreement goals, we aim to help and influence such suppliers and consumers to likewise lower their emissions. The use of the terminology "Shell's Net Carbon Footprint" is for convenience only and not intended to suggest these emissions are those of Shell or its subsidiaries.

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SHELL'S CLIMATE AMBITION



A NET-ZERO EMISSIONS ENERGY BUSINESS BY 2050 OR SOONER

Own operations: net-zero emissions

Reduce the emissions from the manufacture of all our products¹ to net-zero by 2050 or sooner

Changing our products and operations in step with society and our customers

Energy products: carbon intensity in line with 1.5°C

Reduce the Net Carbon Footprint² of the energy products we sell by 30% by 2035 and by 65% by 2050. This is consistent with society's ambition to achieve a 1.5°C future

Remaining customer emissions: fully mitigated

Work with customers to reduce the emissions from their use of our energy products³ to net-zero by 2050 or sooner

¹Refers to the Scope 1 and 2 emissions in absolute terms associated with operations under direct Shell control. ²The Net Carbon Footprint (NCF) is a weighted average of the lifecycle CO₂ intensities of different energy products sold by Shell normalising them to the same point relative to their final end-use. The calculation includes all emissions associated with bringing these energy products to the market as well as our customers' emissions from using them. ³Refers to the Scope 3 emissions in absolute terms associated with the use by customers of the energy products Shell sells.

Fundamental change in how energy is produced and consumed

More and early action, supported by infrastructure investment

ACCELERATE CLEAN TECHNOLOGIES

- Increase electrification, with low-carbon electrons
- Commercialise low-carbon fuels: hydrogen, bioenergy

IMPROVE ENERGY EFFICIENCY AND USE LOW-CARBON FUELS

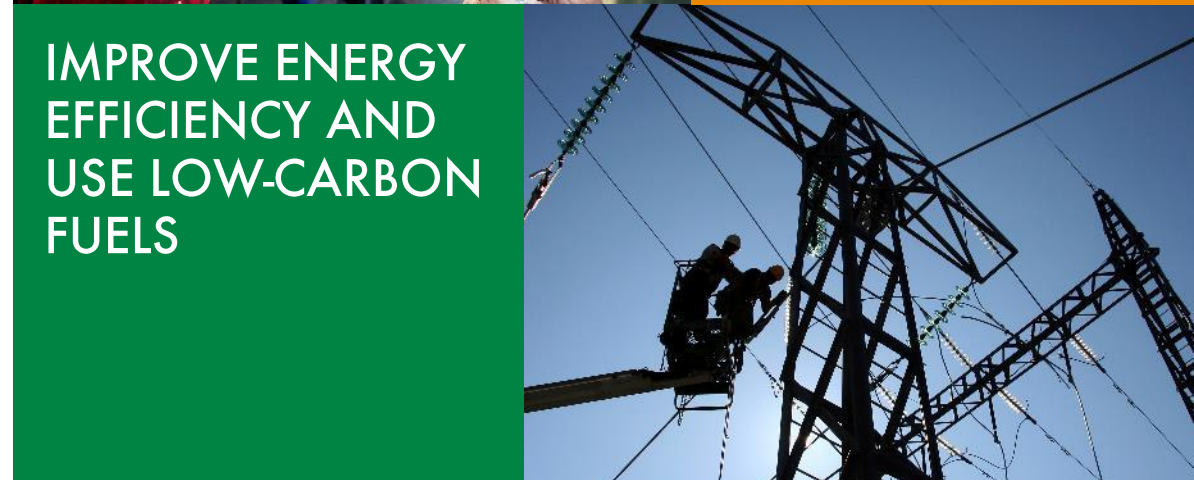
- Invest in infrastructure & technology
- Raise the carbon price using market and regulatory mechanisms

REMOVE CARBON EMISSIONS

- Deploy carbon capture, utilization and storage (CCUS) at scale
- Determine the role of nature-based approaches like afforestation



ACCELERATE
CLEAN
TECHNOLOGIES



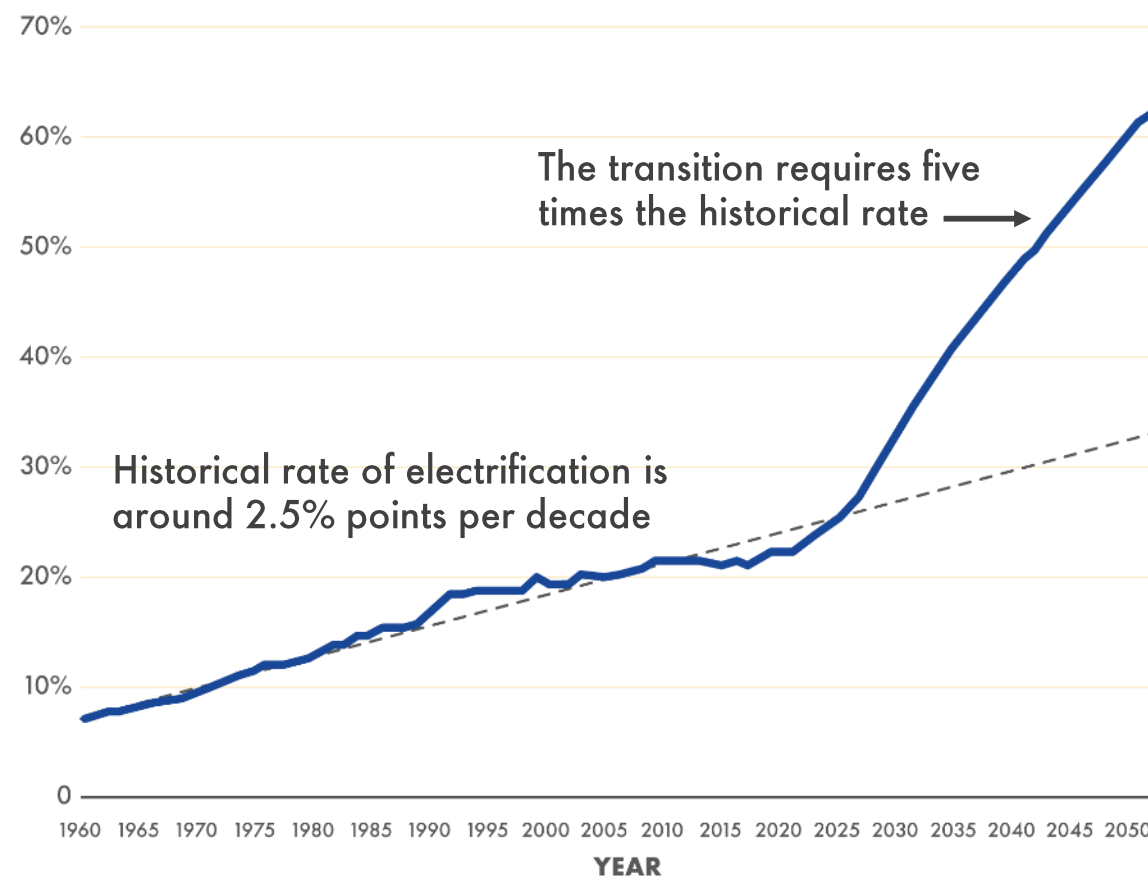
IMPROVE ENERGY
EFFICIENCY AND
USE LOW-CARBON
FUELS



REMOVE
CARBON
EMISSIONS

Rewire the US economy

Electricity as a % of final energy use



Source: Shell analysis

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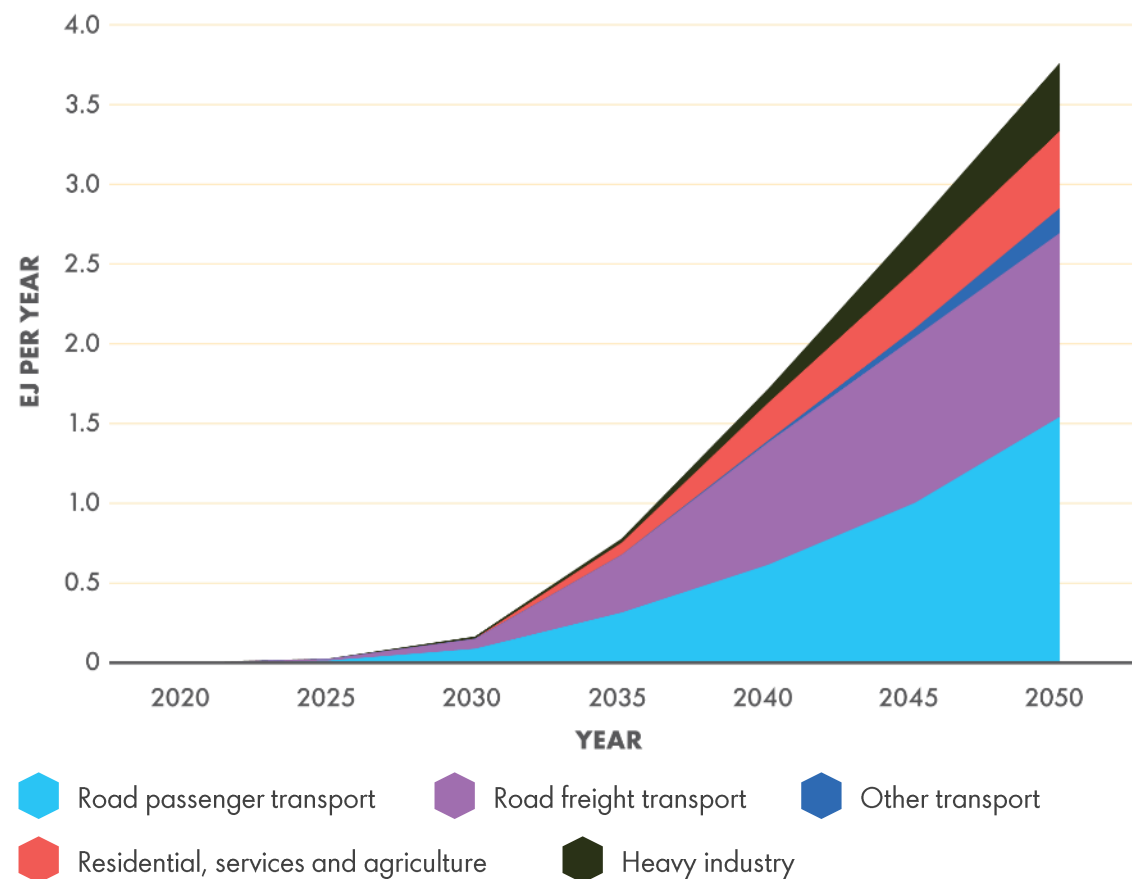
Scenarios Sketch: A US net-zero CO₂ energy system by 2050



- More than double the size of the electricity system today
- Rate of electrification is five times the historical rate
- Significant expansion/upgrade of power transmission and distribution infrastructure
- Connect demand centers to renewables-rich areas

Accelerate commercialization of hydrogen

Hydrogen total final consumption by sector



Source: Shell analysis based on historical IEA data

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Scenarios Sketch: A US net-zero CO₂ energy system by 2050

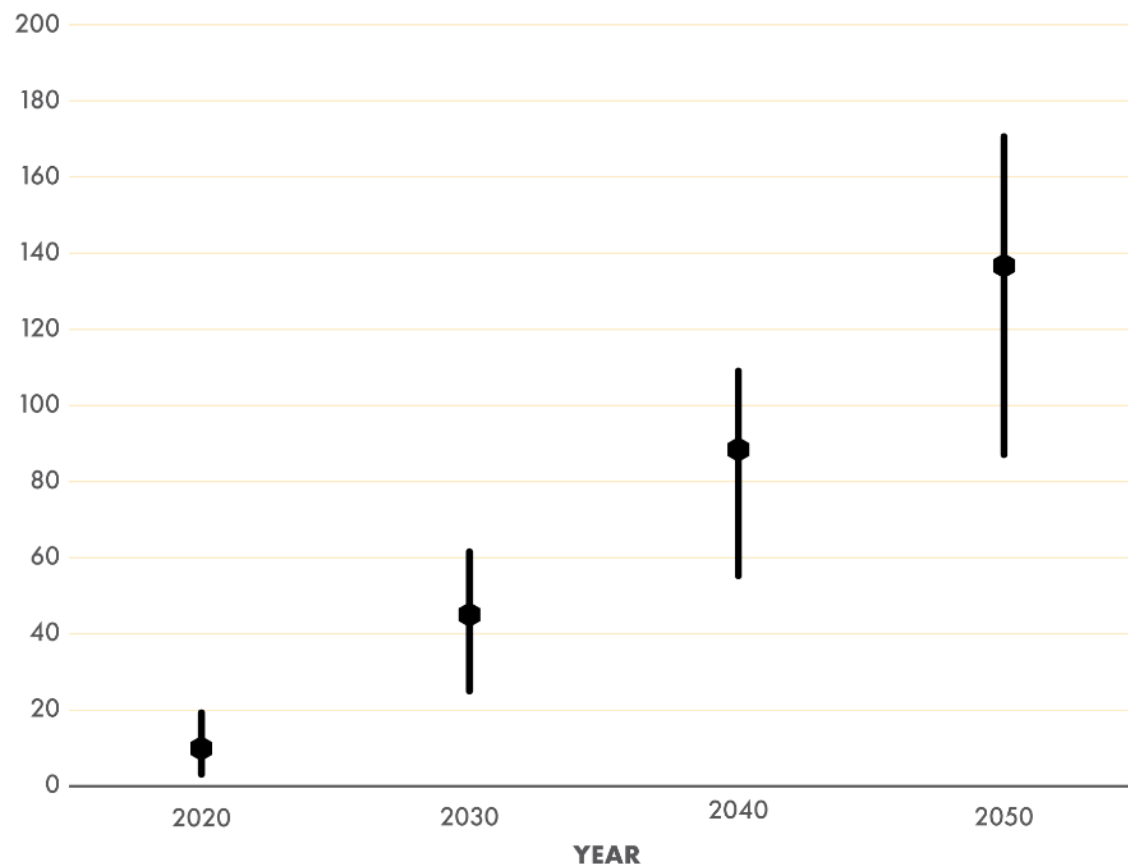
ACCELERATE CLEAN TECHNOLOGIES



- Aim for 7% hydrogen in final energy, including as a fuel for transport and industry
- From 2020, infrastructure investment is required to support the hydrogen transition - from "grey" to "blue/green"
- 25% of the truck fleet (or 1.5 million trucks) are hydrogen trucks by 2050

Carbon price key lever for change

Carbon price in the US for NZE CO₂ energy system



Source: Shell analysis

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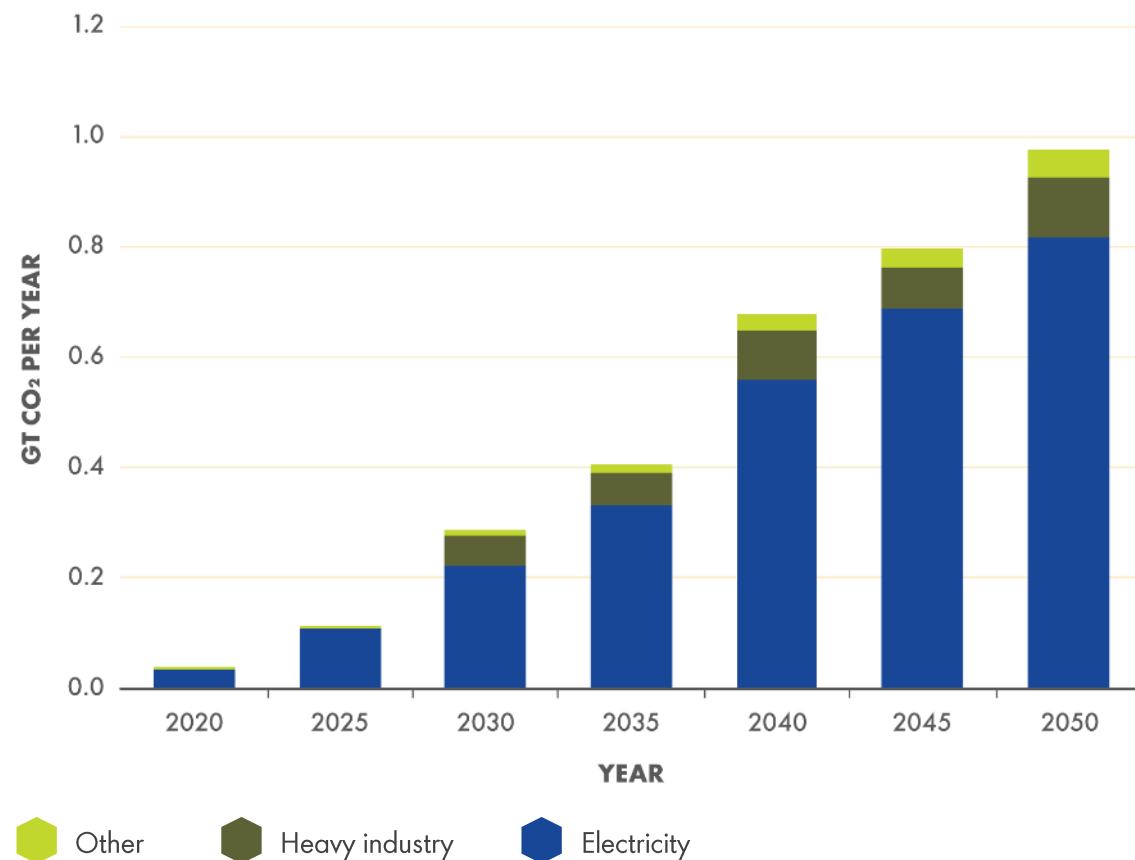
Scenarios Sketch: A US net-zero CO₂ energy system by 2050



- Progressively raise government-led carbon price in the US – slowly in the next decade, then more quickly to reach \$140/tCO₂e in 2050
- Drives reallocation of capital and resources to support new fuels and technologies commercialization
- Complemented by technology and infrastructure policies for sectors in the 2020s

Deploy carbon capture, utilization and storage at scale

CO₂ emissions captured by CCS from all US energy



Source: Shell analysis

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Scenarios Sketch: A US net-zero CO₂ energy system by 2050

REMOVE CARBON EMISSIONS



- CCUS is essential, e.g. industrial processes, bio-energy power generation, gas-fired power generation and direct air capture
- Build one major US CCUS facility every 3 months until 2050 (each capturing more than 8 million metric tons per year)
- Utilization of captured CO₂ is important, but eventually restrict to permanent (or near-permanent) storage

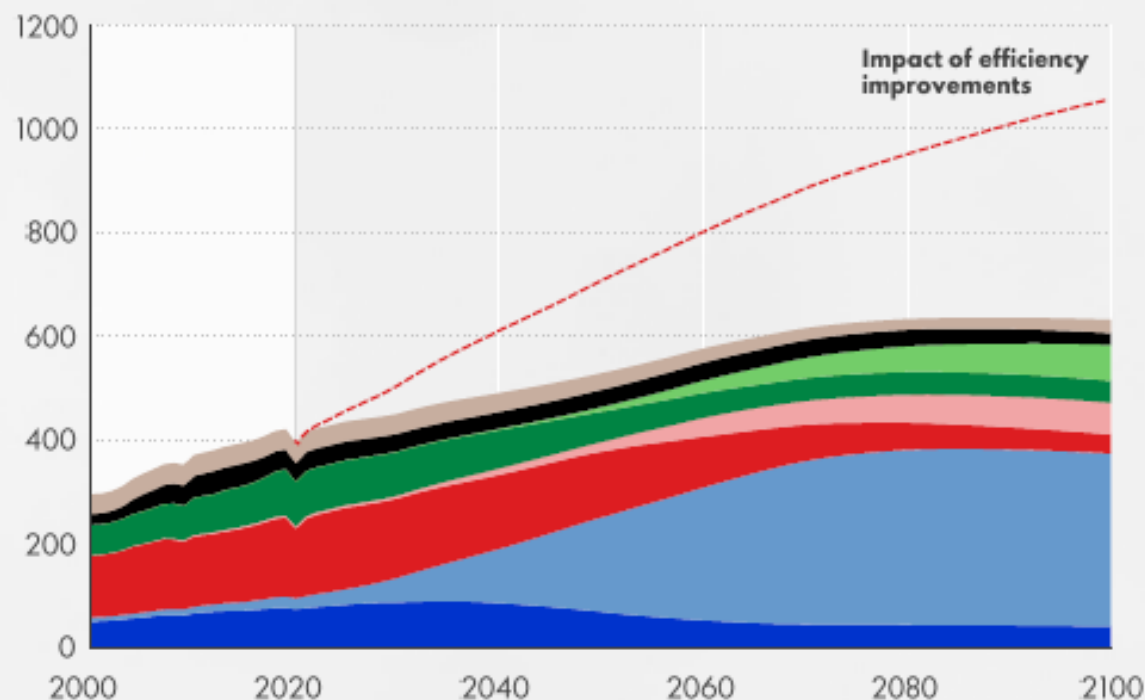
SHELL ENERGY TRANSFORMATION SCENARIOS

ACTION ACCELERATORS

Sky 1.5 Scenario

Total final consumption of energy + carbon removals

EJ/year (final energy)

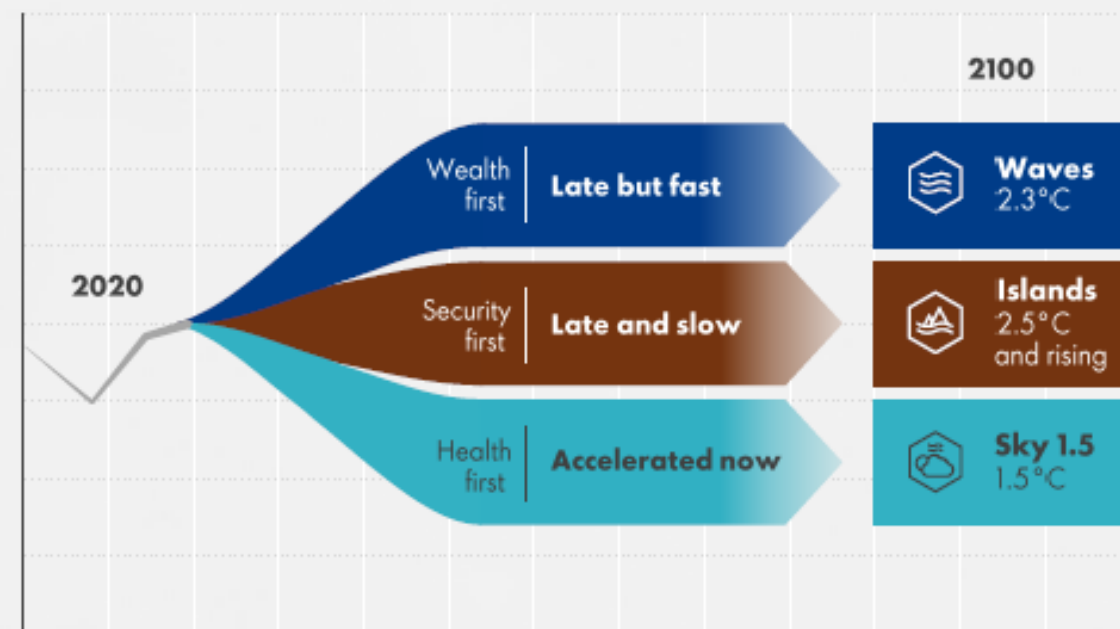


Electricity consumption
predominantly from renewable sources

Liquid fuels
shifting from fossil to non-fossil

Gaseous fuels
shifting from fossil to non-fossil

Pace of decarbonisation



Crisis can galvanise action. To quicken progress towards net-zero emissions requires:

- Alignment – policies, sectors, governments
- Policy frameworks and incentives
- Pioneer leaders



A net-zero CO₂ energy system by 2050

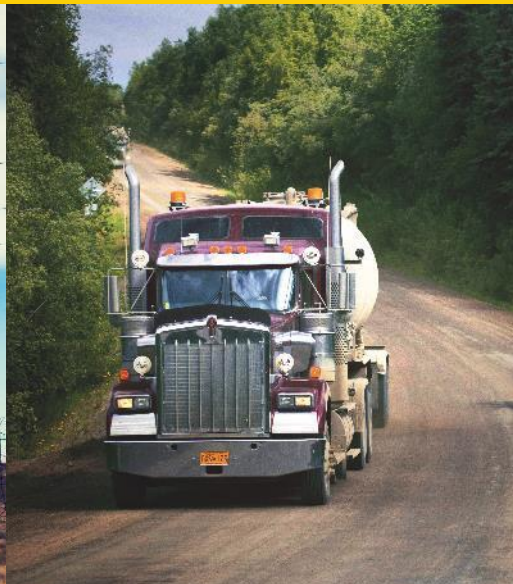
ACTIONS TO GET MOVING TODAY



Invest in
lower carbon
fuels and
technologies



Build
lower carbon
infrastructure



Progress
business coalitions
in harder-to-abate
sectors



Accelerate change
through greater
policy alignment



Enable a fair
and inclusive
transition

Questions

