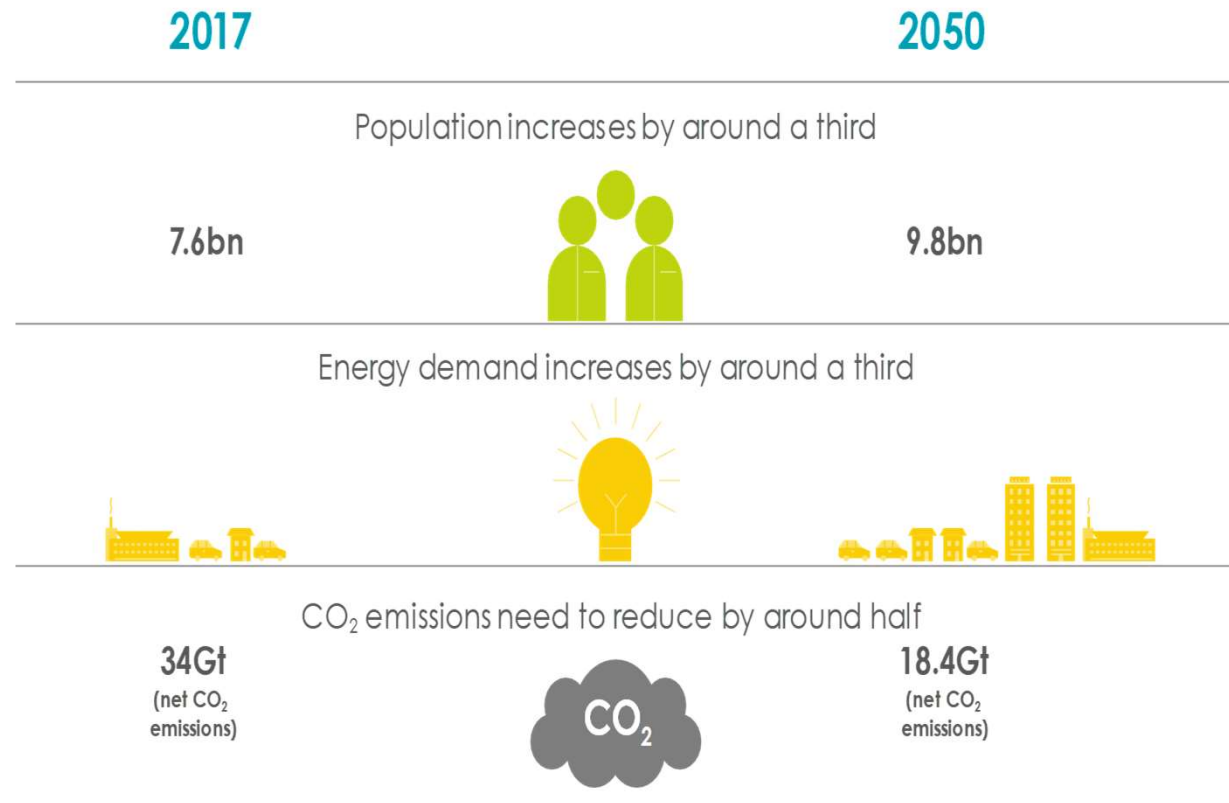# HYDROGEN SUPPLY CHAIN
- Shell Global Activities -

Yasuko YOSHIDA

Japan Country Chair, President – Shell Japan

THE IMPERATIVE TO ACT…

The world needs to take urgent action to tackle climate change.

The Paris Agreement set a goal of keeping the rise in average global temperature to well below 2°C compared to pre-industrial levels.

2017   2050

Population increases by around a third

7.6bn   9.8bn

Energy demand increases by around a third

CO_2 emissions need to reduce by around half

34Gt
(net CO_2 emissions)

CO_2

18.4Gt
(net CO_2 emissions)

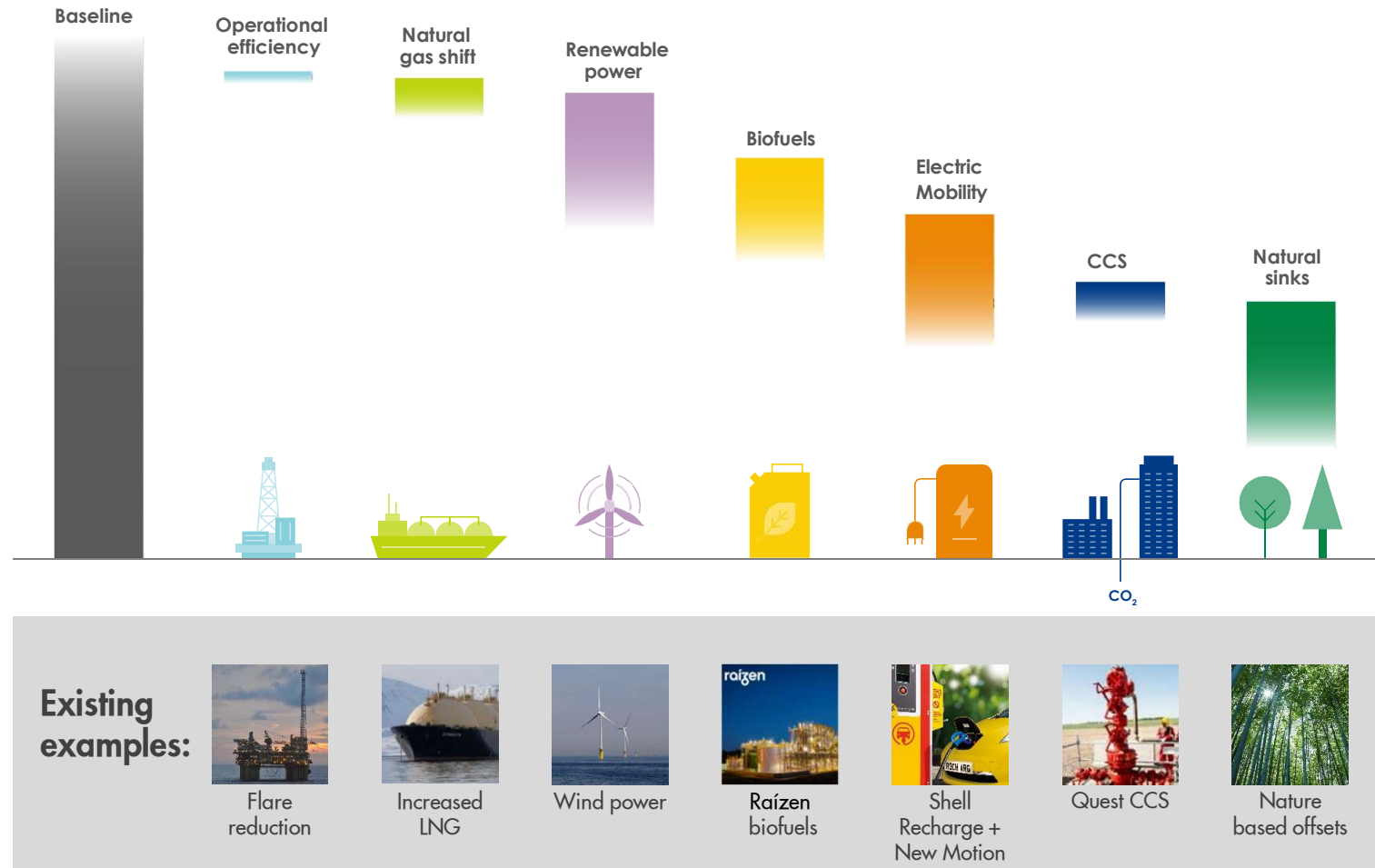# OUR AMBITION IS CONSISTENT WITH THE PARIS AGREEMENT...

- Our ambition has been calibrated using data from scenarios which are consistent with the Paris Agreement.

- We will seek to reduce our Net Carbon Footprint mainly by increasing the proportion of lower-carbon products in the mix we sell to our customers

- Our ambition will keep in step with society's progress towards Paris. Both energy demand and energy supply must evolve together.

- If we observe that society is changing its energy demands more quickly, we intend to aid that acceleration.
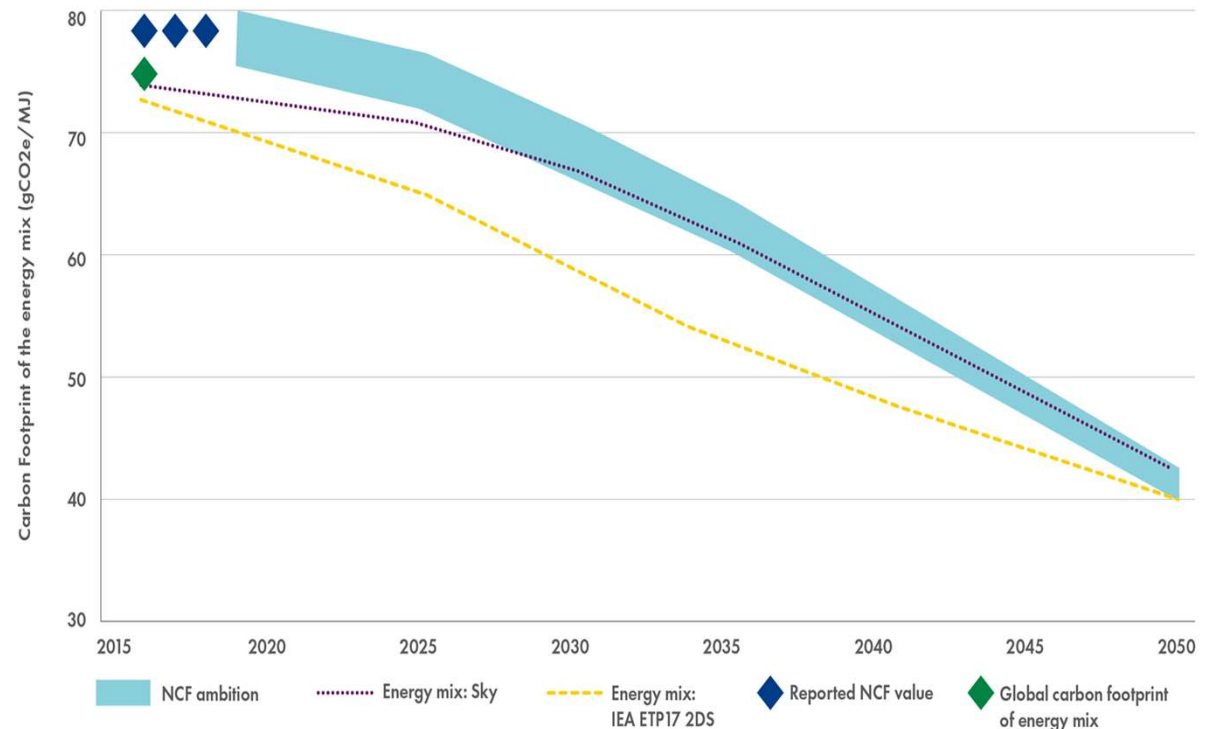
OUR NCF AMBITION WILL TRANSFORM OUR PORTFOLIO...

We will sell fewer products with higher emissions, and more products with lower or no emissions.

...realising our ambition will mean that Shell will be a radically different company in 2050.

Baseline

Operational efficiency

Natural gas shift

Renewable power

Biofuels

Electric Mobility

CCS

Natural sinks

CO$_2$

Existing examples:

| Flare reduction | Increased LNG | Wind power | Raízen biofuels | Shell Recharge + New Motion | Quest CCS | Nature based offsets |

In 2016 the business unit New Energies was founded, dedicated to providing more and cleaner energy solutions

New Fuels

Biofuels
Hydrogen
Gas for transport
Electric mobility
Connected mobility

Power

Integrated energy solutions
Wind
Solar
Natural gas
Energy storage
Energy access
Power trading & marketing
Connected energy
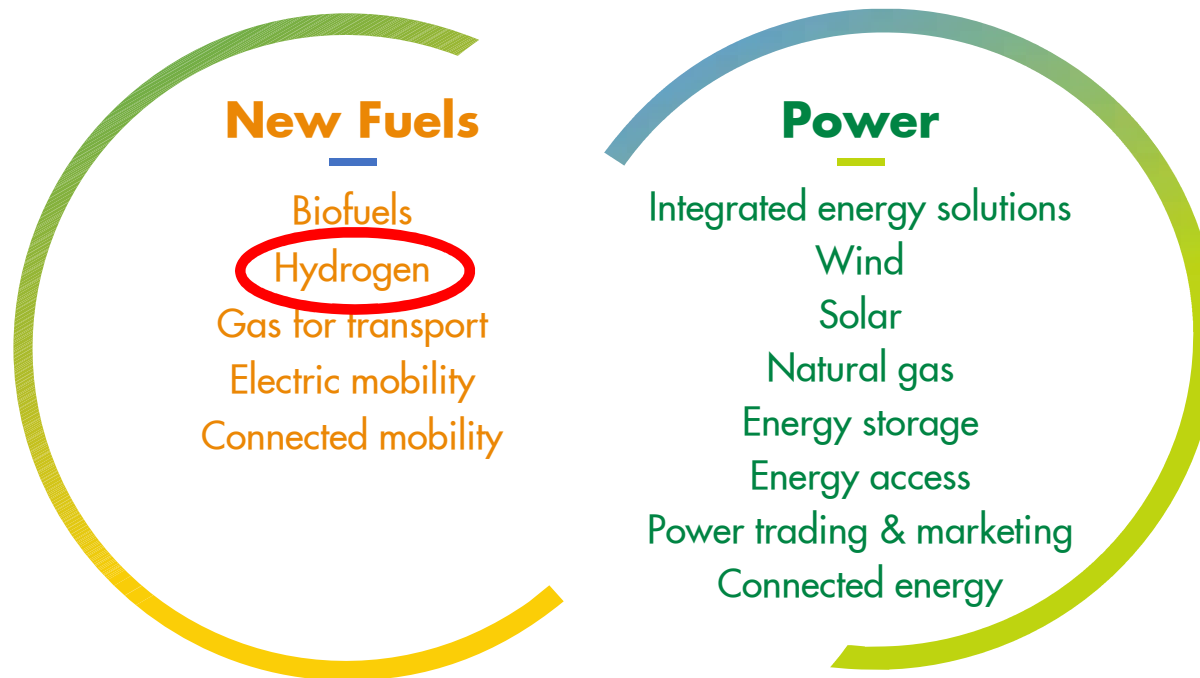
• **Digital ventures** • **Technology ventures** • **City solutions** •

Global Hydrogen activities

Clean / Green

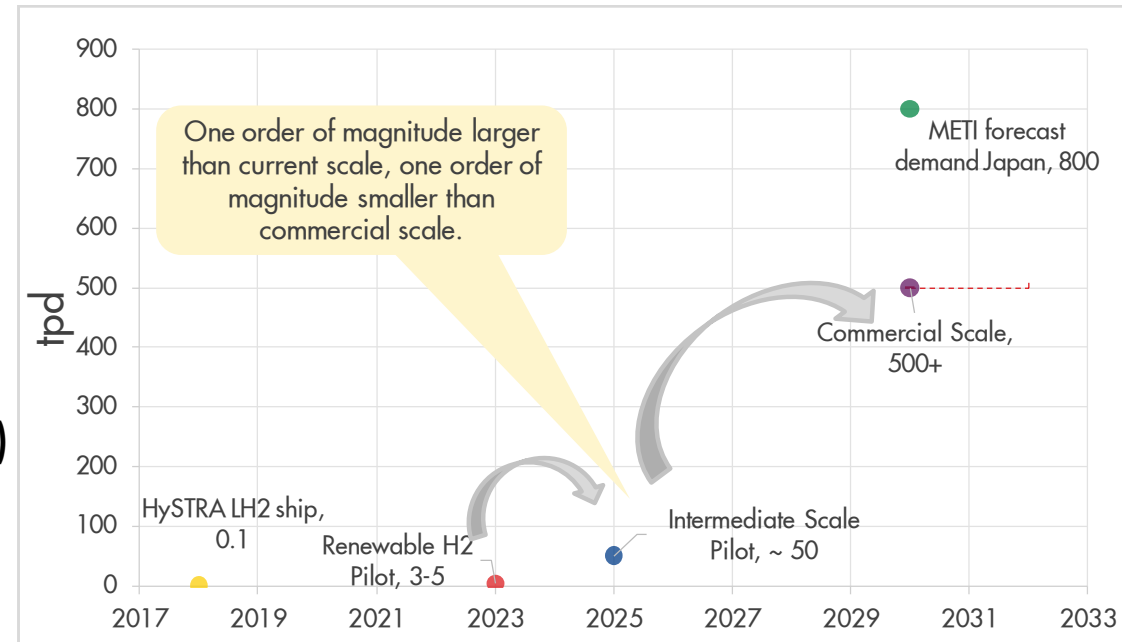|		Transport		Unique CVP	Where we are developing & monitoring
Coal Gasification +CCS			Mobility · Passenger · Freight	· Higher efficiency · Higher range than BeV (500 vs. 250km)	California, Germany China
Gas Reforming +CCS		LH₂/NH₃/LOHC &	Power	· No need for CCS at plant	**Japan**
Bio Reforming (+CCS?)			Industry	· If electrification does not work	**Japan** Australia
Electrolysis			Buildings · Power · Heat	· Distributed power/heat, limiting electricity grid investments	Not yet
			Aviation & Marine	· Clean · Higher efficiency	

LH$_2$/NH$_3$/LOHC

Building a Global Renewable Hydrogen Supply Chain

- Requires multi-billion $ development/de-risking investments
  - Need govt support, strategic partners & customers
  - Needs a coherent & sustainable policy environment

- Needs10+ years to de-risk technology (from today)
  - HySTRA (& other projects) prove the feasibility of Shipping
  - Need to demonstrate Integrated renewable hydrogen carrier (LH2, NH3, etc.) production & affordability
  - Need to demonstrate scale-up feasibility & affordability

One order of magnitude larger than current scale, one order of magnitude smaller than commercial scale.

METI forecast demand Japan, 800

Commercial Scale, 500+

HySTRA LH2 ship, 0.1

Renewable H2 Pilot, 3-5

Intermediate Scale Pilot, ~ 50

...... We think it's possible & presently there is lot of global momentum to make this happen

17 December 2018