Australian Government
Department of Industry, Innovation and Science

Hydrogen from brown coal with CCS an Australia / Japan collaboration HESC

Sarah Chapman
Australian Government

Yasushi Yoshino
Kawasaki Heavy Industries

Presentation Overview

- Australian Government Context
- Overview HESC Project
- HESC Drivers
- De-risking Future Investment
- Japan's Hydrogen Society
- HESC Progress
- Pathway to Commercialisation

Australian Government Context
Overview

- 2008 World first **CCS legislation**
- 2010 **CarbonNet CCS Flagship** with Victorian Government
- 2011 Brown Coal Innovation Australia **HESC** pre-feasibility study with KHI
- 2015 Energy White paper
- 2016/17 **HESC FEED** financed by all government & industry partners
- 2017 CSIRO Low Emission Technology Roadmap
- 2018 Launch of $500M **HESC Pilot** by Prime Minister
- 2018 CSIRO **National Hydrogen Roadmap**
- 2018 **Hydrogen for Australia's Future** – Chief Scientist

Hydrogen Energy Supply Chain Pilot Project

Project Partners

Australian Funded Portion: Hydrogen Engineering Australia (HEA)

HEA Hydrogen Engineering Australia

Kawasaki · POWER · Iwatani · Marubeni · agl

VICTORIA State Government · Australian Government

Japanese Funded Portion: Hydrogen Energy Supply Chain Technology Research Association (HySTRA)

HySTRA

Kawasaki · POWER · Iwatani · Shell · Marubeni

NEDO · METI

HESC Pilot Project – Supply Chain

Overview

AGL Loy Yang, Latrobe Valley
Victoria, Australia

SC1-A – Brown coal gasification
(Japanese funded)

SC2 – Gas Refining

SC3 – Transport
(pressurised gaseous hydrogen

BlueScope Western Port
Port of Hastings
Victoria, Australia

SC4 – Hydrogen liquefaction

SC5 – Hydrogen loading base

Brown Coal exported to Japan

SC6 – Liquefied hydrogen carrier
(Japanese funded portion)

Kitakyushu, Japan

SC1-B – Brown coal gasification (20t/d EAGLE II facility)
(Japanese funded portion)

Kobe, Japan

SC7 – Liquefied hydrogen unloading terminal
(Japanese funded portion)

- Play HESC video at

https://www.youtube.com/watch?v=YNpLXOPGIPQ

Or

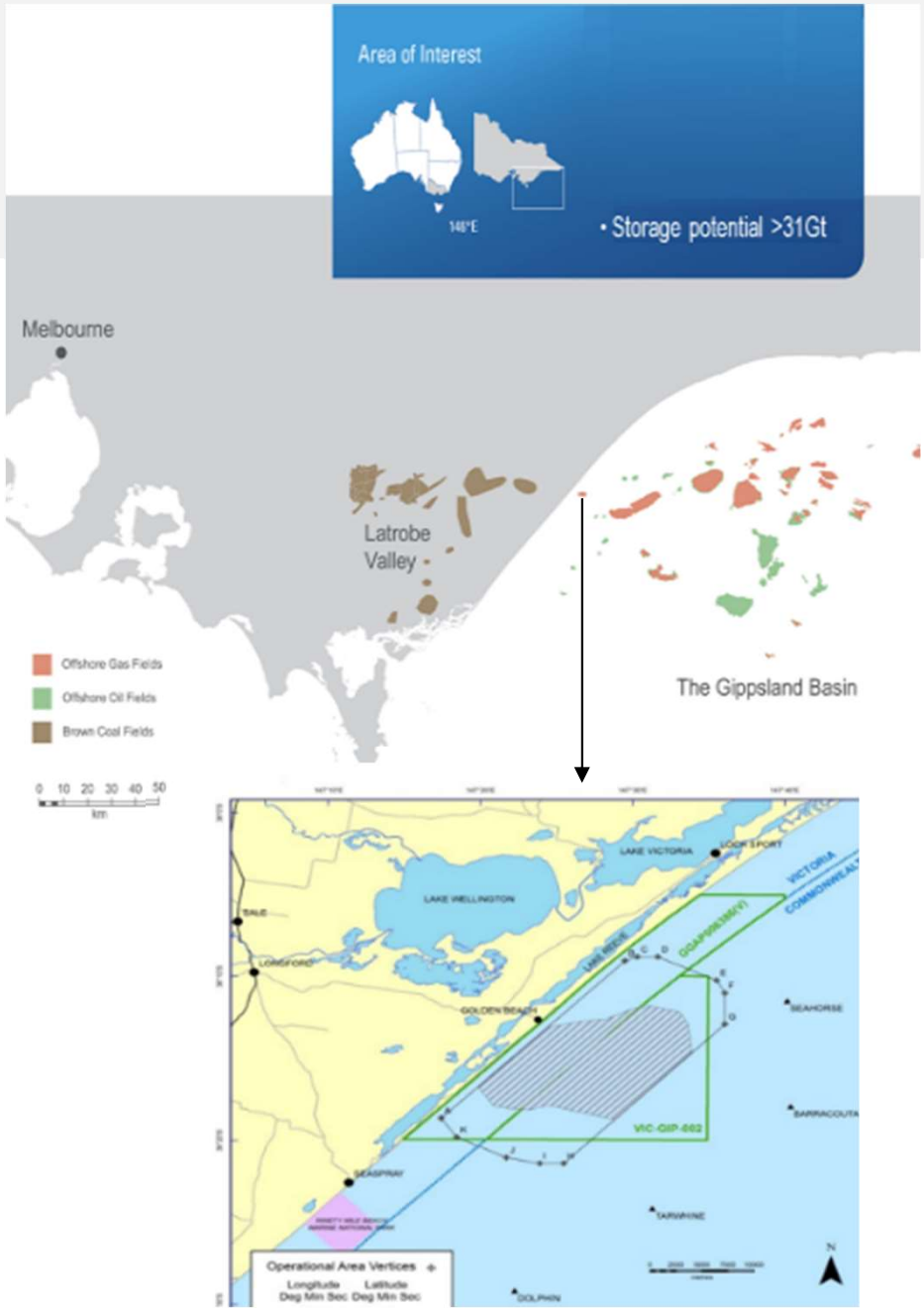
http://hydrogenenergysupplychain.com

Hydrogen Energy Supply Chain Pilot Project
Drivers

- **Australia a global energy powerhouse / natural advantage**
  - H2 exports are economic opportunity for Australia
- **Why the HESC?**
  - abundant recoverable brown coal
  - enables new local industries from use of brown coal
  - excellent existing trade relationship LNG, coal etc
  - proximity to future CCS Network – CarbonNet project
  - access to infrastructure & skilled workforce
  - paving the way for other Australian H2 projects (renewables and FF/CCS)
- **CCS development timing aligns with HESC commercial project needs**
- **Japan energy security & diversity of supply chains**
- **Bilateral research collaboration**

CarbonNet Project
Drivers ctd

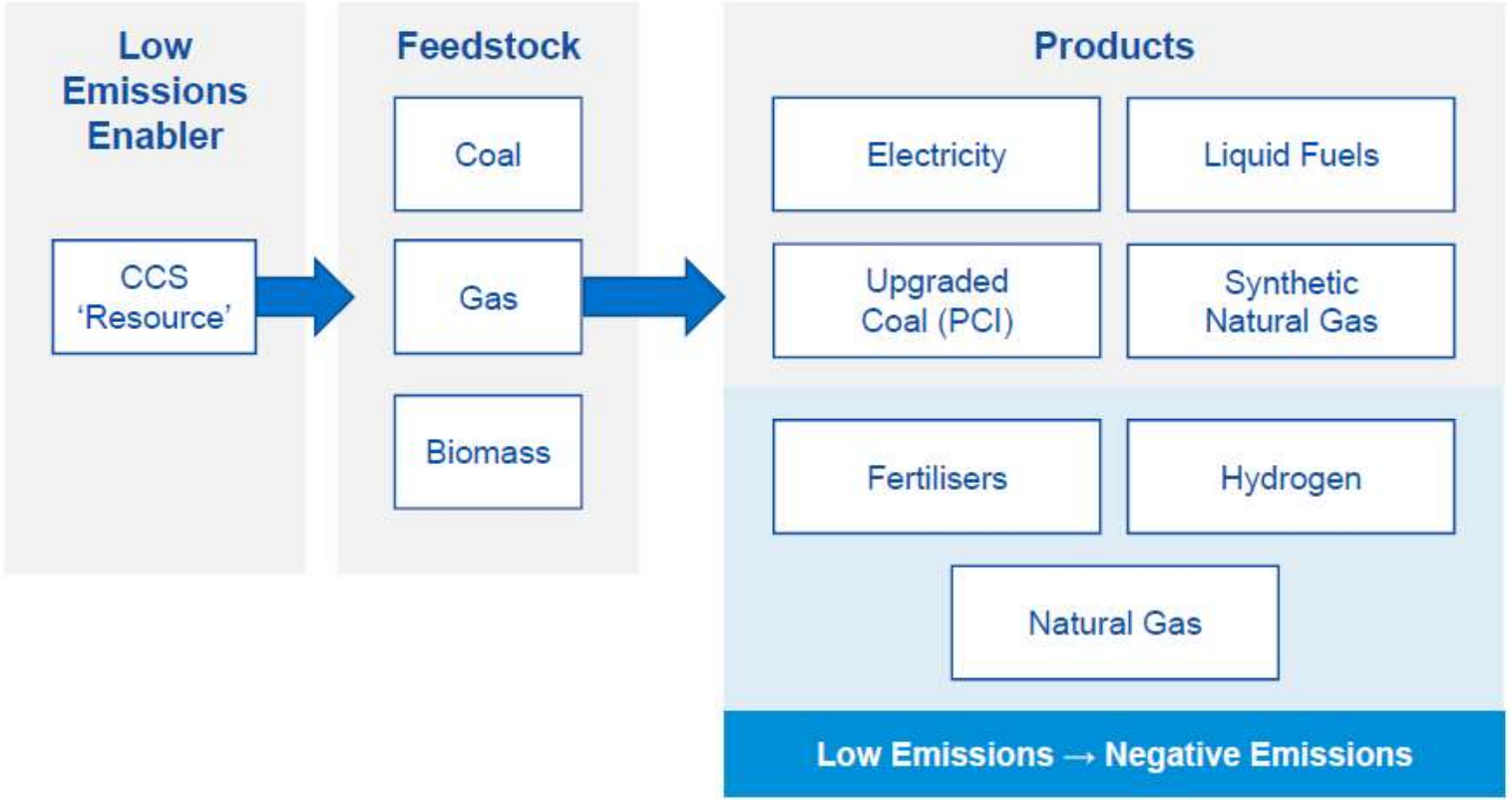
- Investigating feasibility for a commercial-scale, multi-user CCS network in Gippsland, Victoria
- Jointly funded by Australian & Victorian Governments to 2020 ~ $150 million
- Plus significant research investment to support project



CarbonNet Project

Drivers – Enables new industries

CCS: ENABLES LOW EMISSION USES OF BROWN COAL



Government and Industry Partnership
De-risking Future Investment

Financial support

- CarbonNet's *storage site appraisal* is government funded
- HESC all partners/governments invested ~ AUD $500M - no immediate financial return - in expectation of future hydrogen market

Regulatory

- Commonwealth CCS legislation includes long term liability provisions
- CarbonNet undertaking storage site injection license permitting process
- HESC and CarbonNet are 'first testing'

Building social licence - all

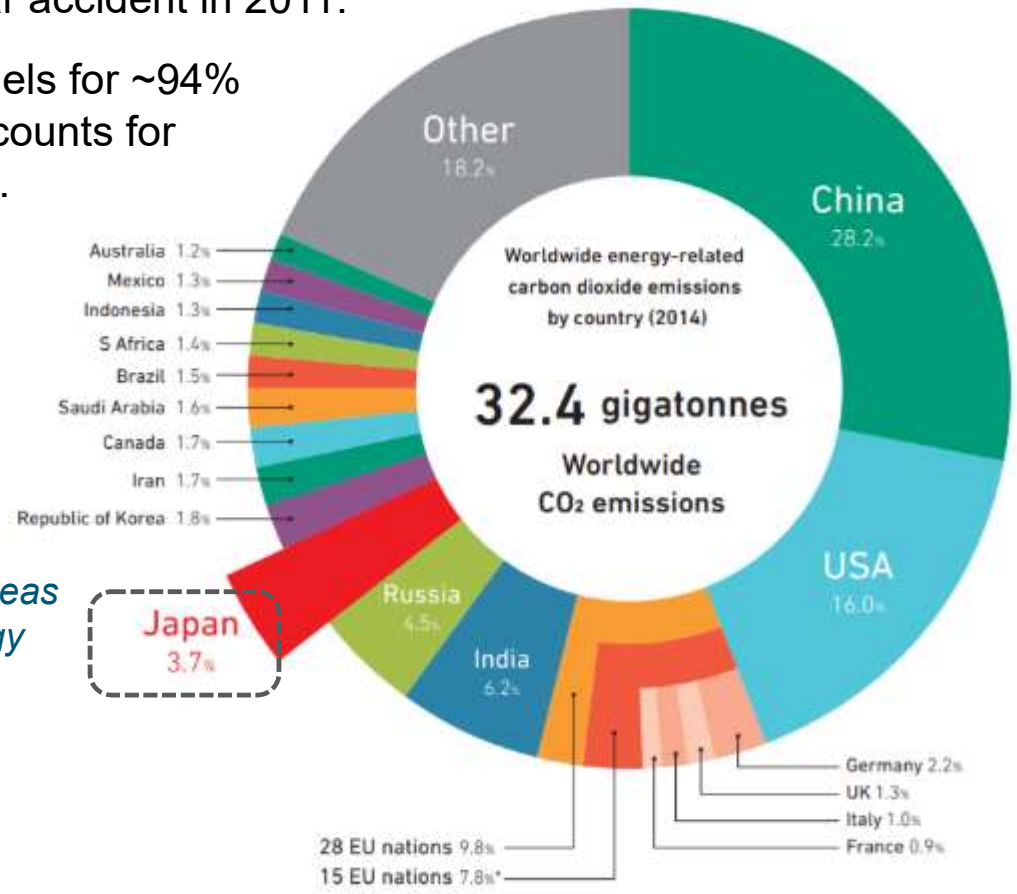
Hydrogen Policy – Australia emerging, Japan strong

Rationale for a Japanese hydrogen strategy

- Japan is facing real challenges regarding energy security and emissions reductions, subsequent to the Fukushima nuclear accident in 2011.
- Japan depends on overseas fossil fuels for ~94% of its primary energy supply[1] and accounts for ~3.7% of worldwide CO2 emissions[2].

6-7% *"Japan's energy self-sufficiency rate (2nd lowest among OECD countries)" [1]*

94% *"Japan's dependence on overseas fossil fuels for its primary energy supply"1*

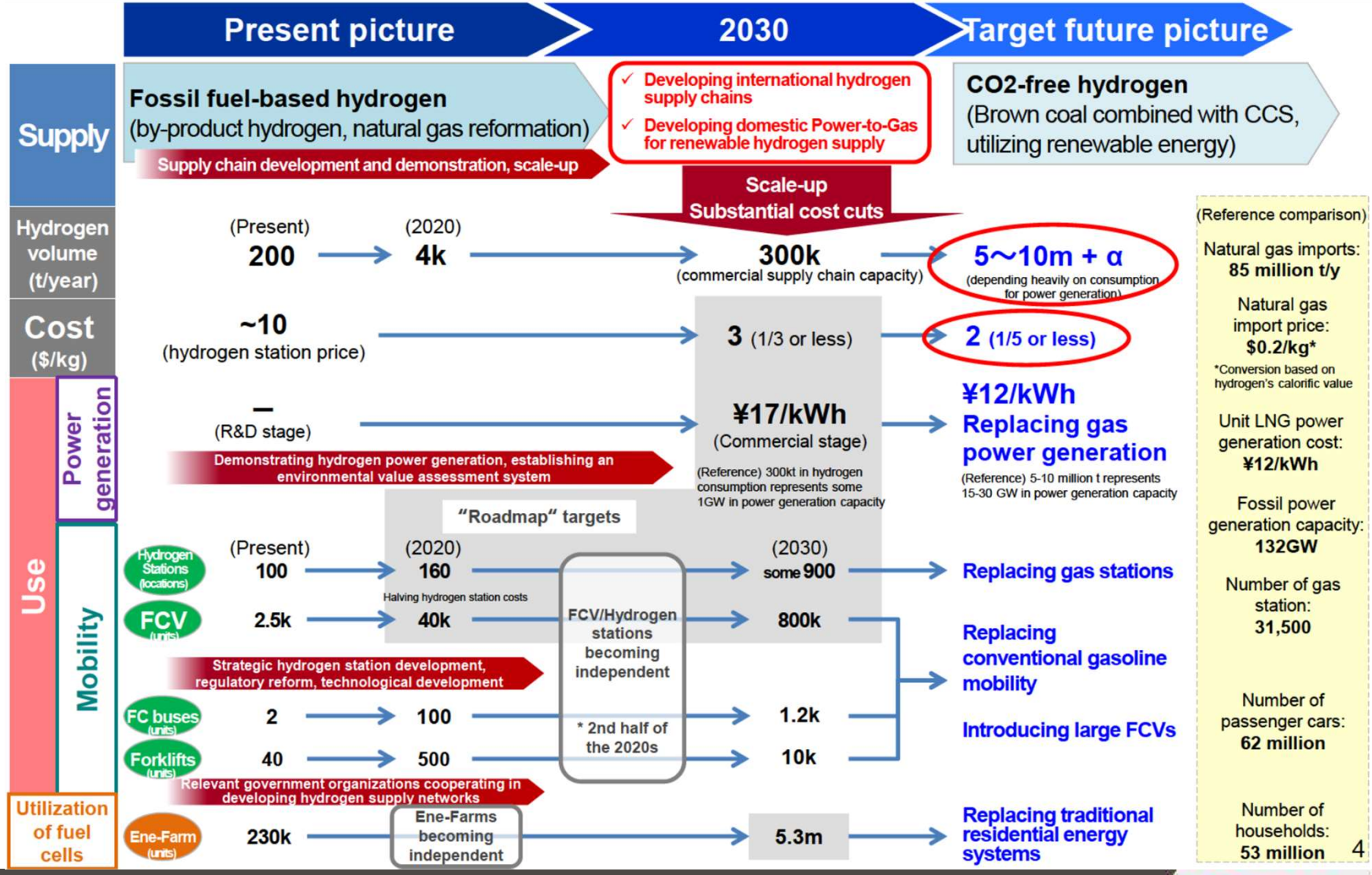


[1] *Basic Hydrogen Strategy (2017), Ministry of Economy, Trade and Industry (METI)*
[2] *CO Emissions from Fuel Combustion - 2016 Edition, IEA*

Source: CO Emissions from Fuel Combustion - 2016 Edition, IEA

Basic Hydrogen Strategy 2017

Source: The Basic Hydrogen Strategy Ministry of Economy, Trade and Industry (METI), 2017



HESC Progress - Australia

AGL Loy Yang, Latrobe Valley Victoria, Australia

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(pressurised gaseous hydrogen truck)

BlueScope Port of Hastings Victoria, Australia

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Kitakyushu, Japan

SC1-B – Brown coal gasification (20t/d EAGLE II facility)
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Kobe, Japan

SC7 – Liquefied hydrogen unloading terminal
(Japanese funded portion)

HESC Progress - Australia

- 12 April 2018 public launch
- Commence community consultation Latrobe Valley and Port of Hastings
- Regulatory approvals underway
- Purchase of initial equipment
- Construction to begin in 2019

HESC Progress - Japan

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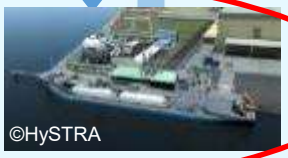
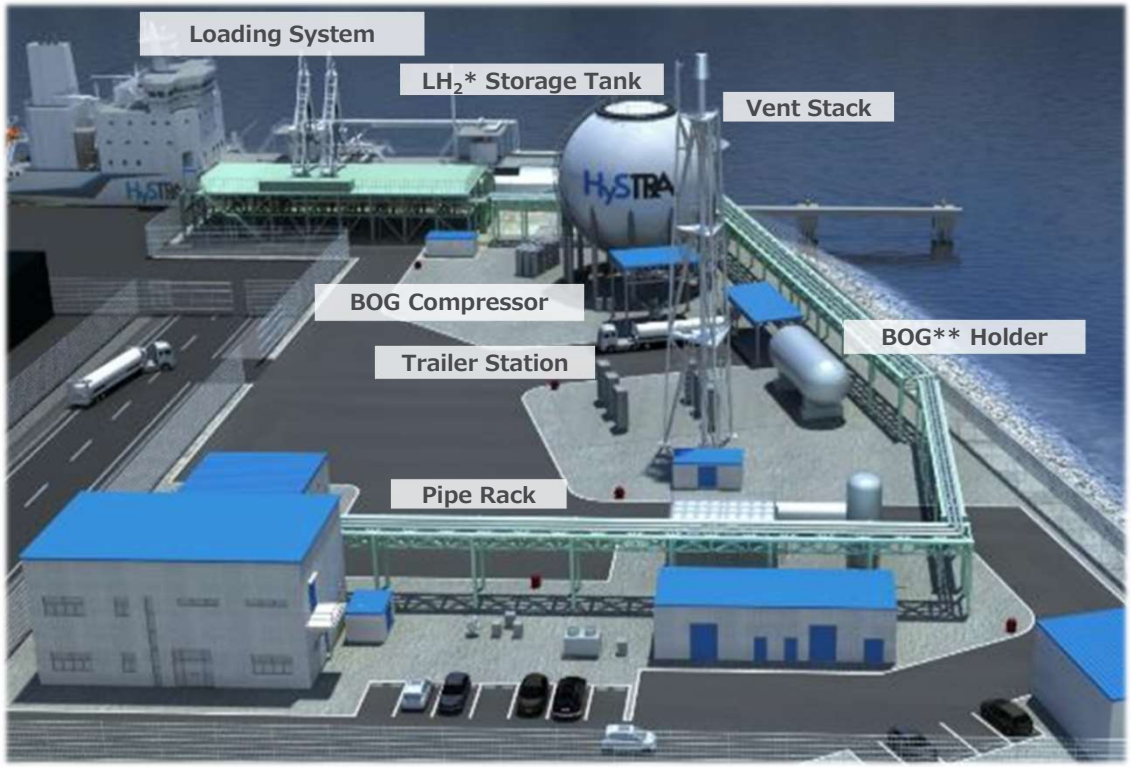


HESC Progress - Japan

Supply Chain 6 - Liquefied Hydrogen Carrier

HESC Progress - Japan

Supply Chain 7 - Liquefied Hydrogen Unloading Terminal



Computer Graphic of Liquefied Hydrogen Unloading Terminal in Kobe Air Port Island

*LH_2 : Liquefied Hydrogen

**BOG : Boil Off Gas

HESC Progress - Japan

Supply Chains 6 and 7

- Manufacture of LH2 tank inner / outer shell for SC6 (Liquefied Hydrogen Carrier) is on-going at KHI Harima works.

Hemisphere end plate for Inner Shell

Body Plate for Outer Shell

Body Plate for Inner Shell

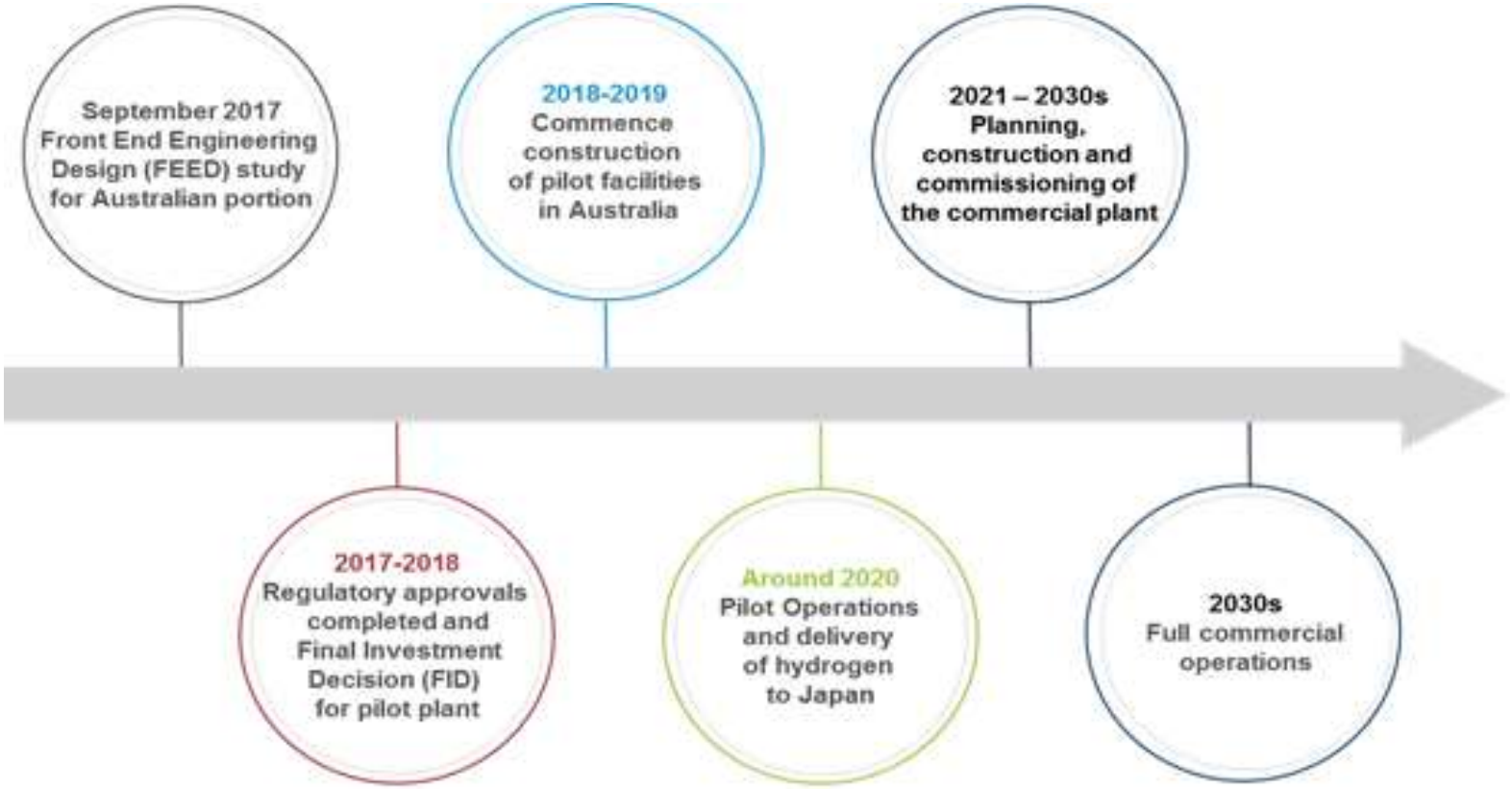
- Soil improvement work & mooring facilities construction for SC7 (Liquefied Hydrogen Unloading Terminal) were completed by Kobe-city, foundation work has been on-going since June 2018 by Kobe-city & HySTRA.

Aug 2017

Oct 2018

HESC Project

Pathway to commercialisation



Indicative timeline and milestones

CarbonNet Project: Storage Site Appraisal, Injection Licence, commercialisation

CarbonNet transfers to private sector, FEED, finance, construction, operation

Thank you

Australian Government
Department of Industry, Innovation and Science

Sarah Chapman
Low Emission Technologies
Department of Industry, Innovation and Science
Australian Government

Tel: +61-2-6213 7711

Sarah.Chapman@industry.gov.au

Kawasaki
Powering your potential

Yasushi Yoshino
Kawasaki Heavy Industries, Ltd.
Corporate Technology Division
1-14-5, Kaigan, Minato-ku, Tokyo 105-8315
Tel: +81-3-3435-2259 Fax: +81-3-3435-2081

Hydrogen Engineering Australia Pty Ltd
Suite 6.09 2 Queen Street, Melbourne,
Victoria, 3000
Tel: +61-404-633-882

yoshino_y@khi.co.jp

hydrogenenergysupplychain.com