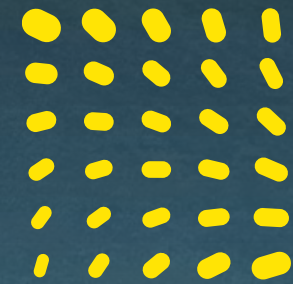




# Renewable Energy Projects At Oil and Gas Scale

("Power to X", PtX)



The Asian  
Renewable  
Energy Hub

Nyangumartamili  
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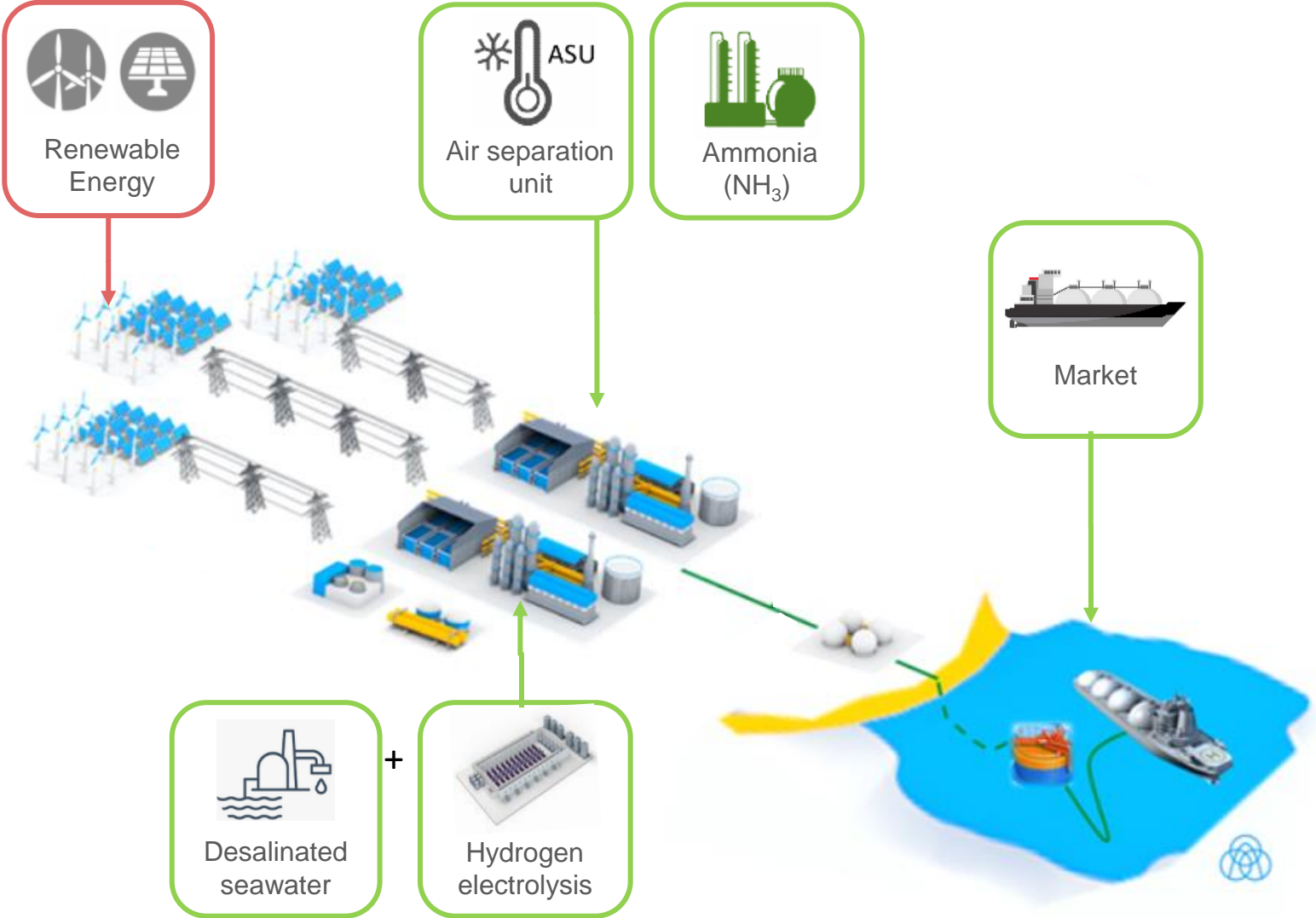


21 July 2021

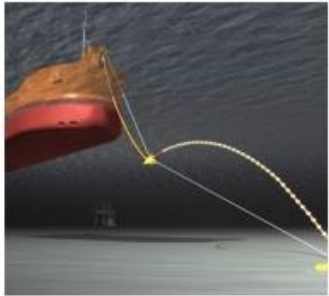
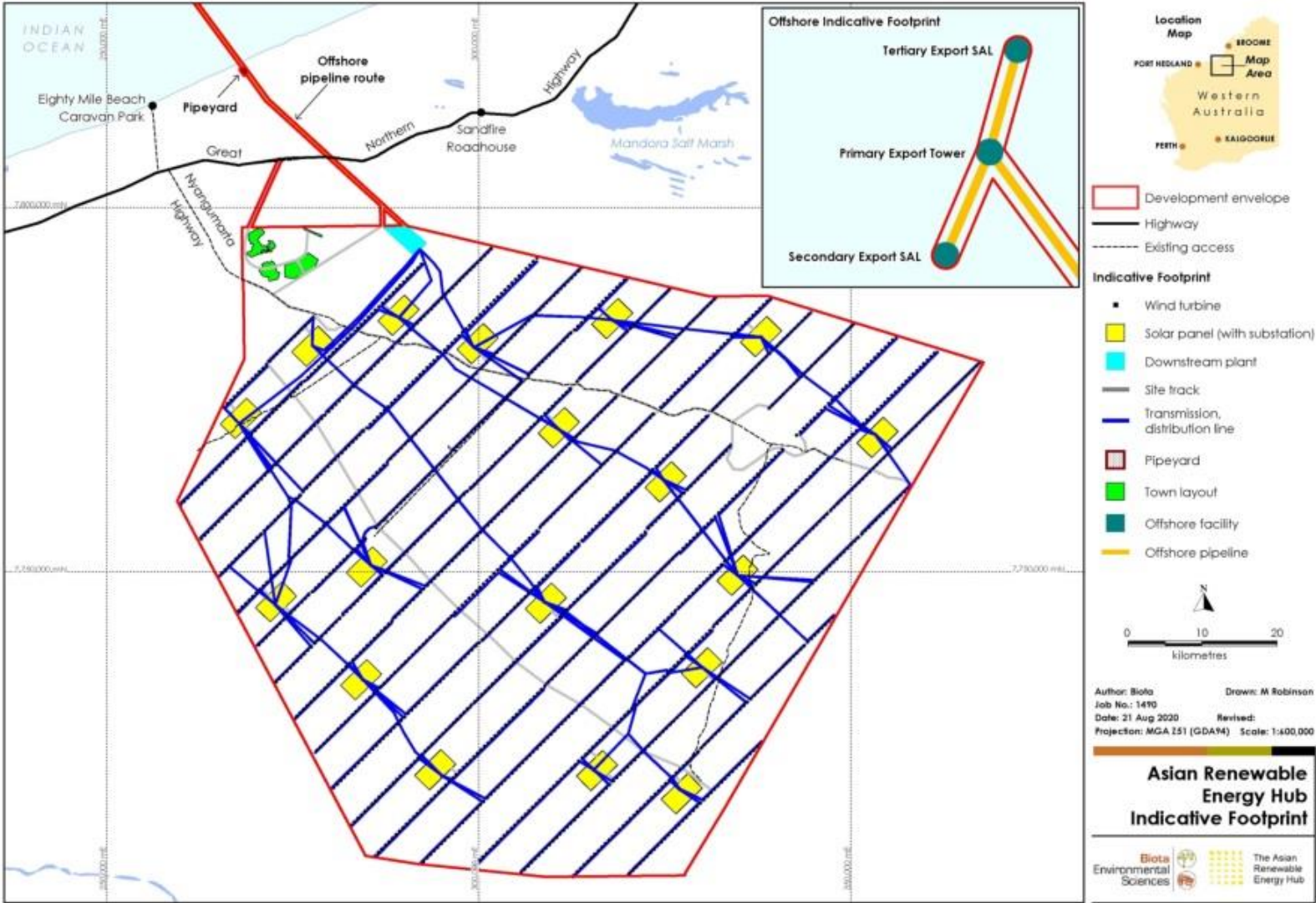


# GREEN AMMONIA PRODUCTION AND EXPORT SCHEMATIC

From wind and sun, to electrons, to molecules



# ASIAN RENEWABLE ENERGY HUB (AREH)



# BY THE NUMBERS: ASIAN RENEWABLE ENERGY HUB

Feasibility Study conducted in 2019 by thyssenkrupp for full project scope.

**16GW** wind generation

**+ 10GW** solar generation

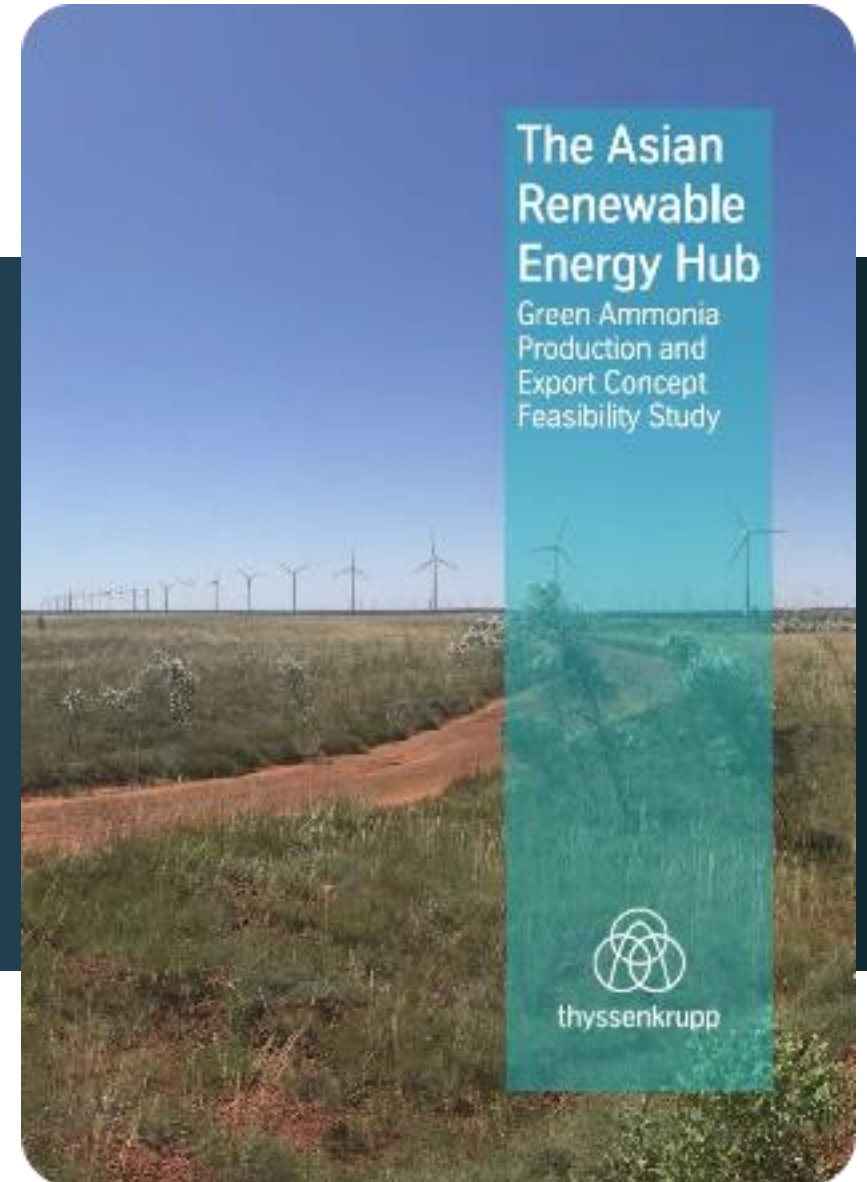
**= 98 TWh** annual generation

**into 14GW** electrolyzers

**>70% capacity factor** of the electrolyzers

**= 1.75 million** tpa of green hydrogen

**= 9.9 million** tpa green ammonia (27,000 tpd)





# CWP GLOBAL'S 100+ GW PORTFOLIO OF P&X PROJECTS

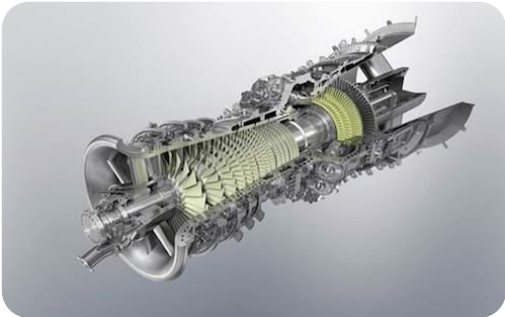
Renewable energy at oil and gas scale



# KEY MARKETS

Multiple scalable markets, as  $\text{NH}_3$  and/or  $\text{H}_2$

## Power generation



## Shipping



## Fuel cell vehicles



## Green steel & other industry



Consumption as hydrogen after ammonia cracking

Consumption as ammonia

# BENEFITS OF GREEN NH<sub>3</sub> / H<sub>2</sub> PROJECTS

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## **Deliver green hydrogen / ammonia & where when the markets need it**

- Projects on different continents to service different regional markets.
- Projects are developed in phases & are highly modular, to grow supply as demand scales.

## **Highly competitive hydrogen and ammonia supply**

- Excellent renewable resources: wind and solar.
- Windy at night, sunny during the day. High electrolyser utilisation factor.
- Large economies of scale. Costs decrease in successive project phases.

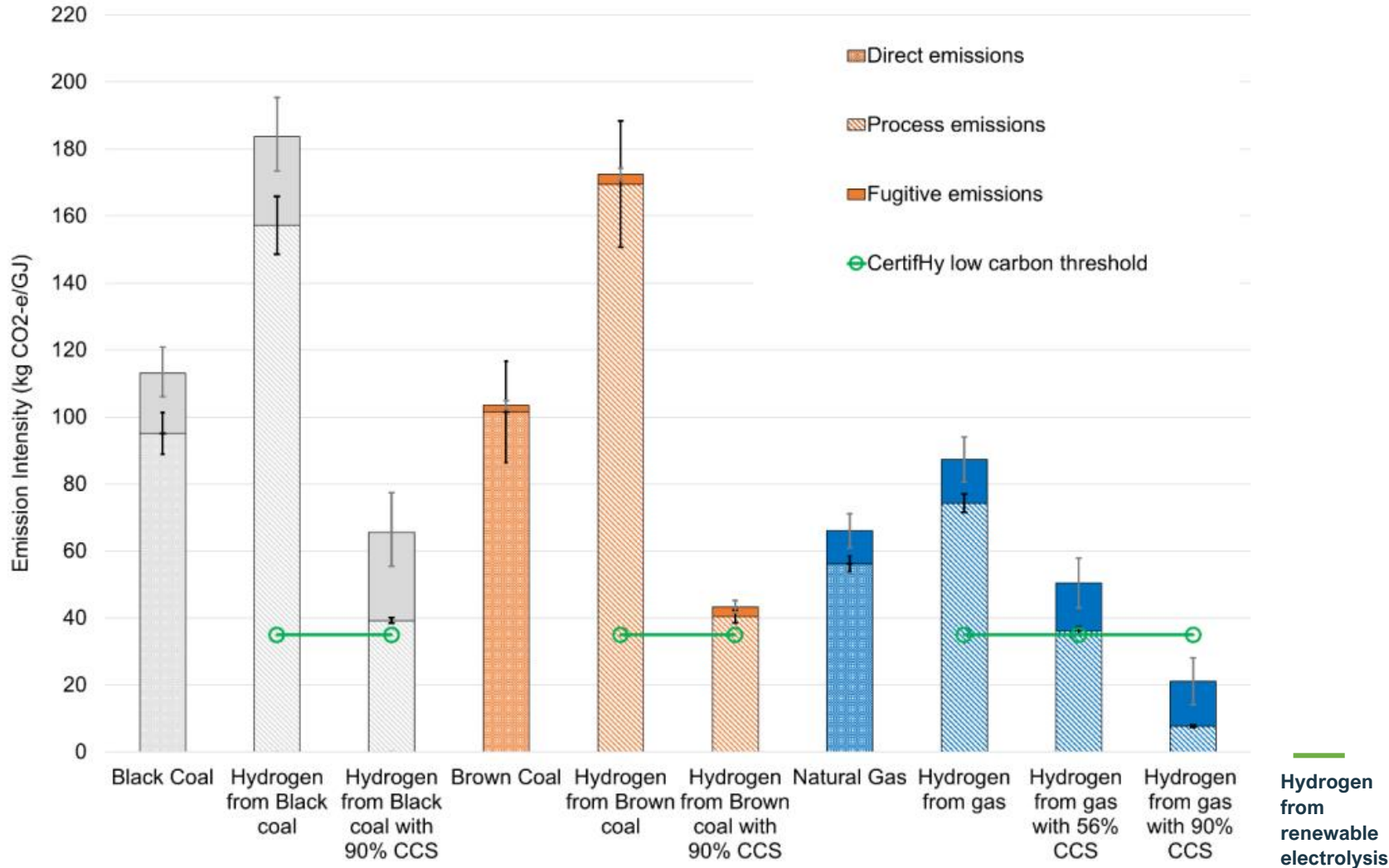
## **Long term fixed priced product**

- Fossil fuel hydrogen pricing will be indexed to other commodities such as HH, JKM or Brent. Green supply will not – there's no fuel cost.
- Green hydrogen does not have commodity price exposure, enabling long term and stable price certainty.
- Stable fixed pricing provides confidence to the private sector and to governments for the development of new industries and markets.

## **Zero carbon and climate change regulatory risk**

- The green H<sub>2</sub> and NH<sub>3</sub> produced from green projects will have no carbon production footprint and thus will not be exposed to any future carbon pricing or related regulation that imposes additional costs on fuels with a carbon footprint.

# CARBON EMISSION INTENSITY OF DIFFERENT FUELS



The emissions from hydrogen production vary widely depending on the feedstock and process used.

'Low-C' hydrogen from fossil fuels will always have substantial emission intensities.

It is critical to account for fugitive emissions as well as direct and process emissions, especially for gas based hydrogen production.

Certification of Low-C hydrogen is essential, to quantify and agree on the emissions and compare Low-C products.

Source: Australian National University, Zero Carbon Energy for the Asia Pacific research programme





## **Andrew Dickson**

Development Manager  
CWP Global

m: +61 (0)418 866 470

w: [www.cwp.global](http://www.cwp.global)

e: [andrew.dickson@cwp.global](mailto:andrew.dickson@cwp.global)