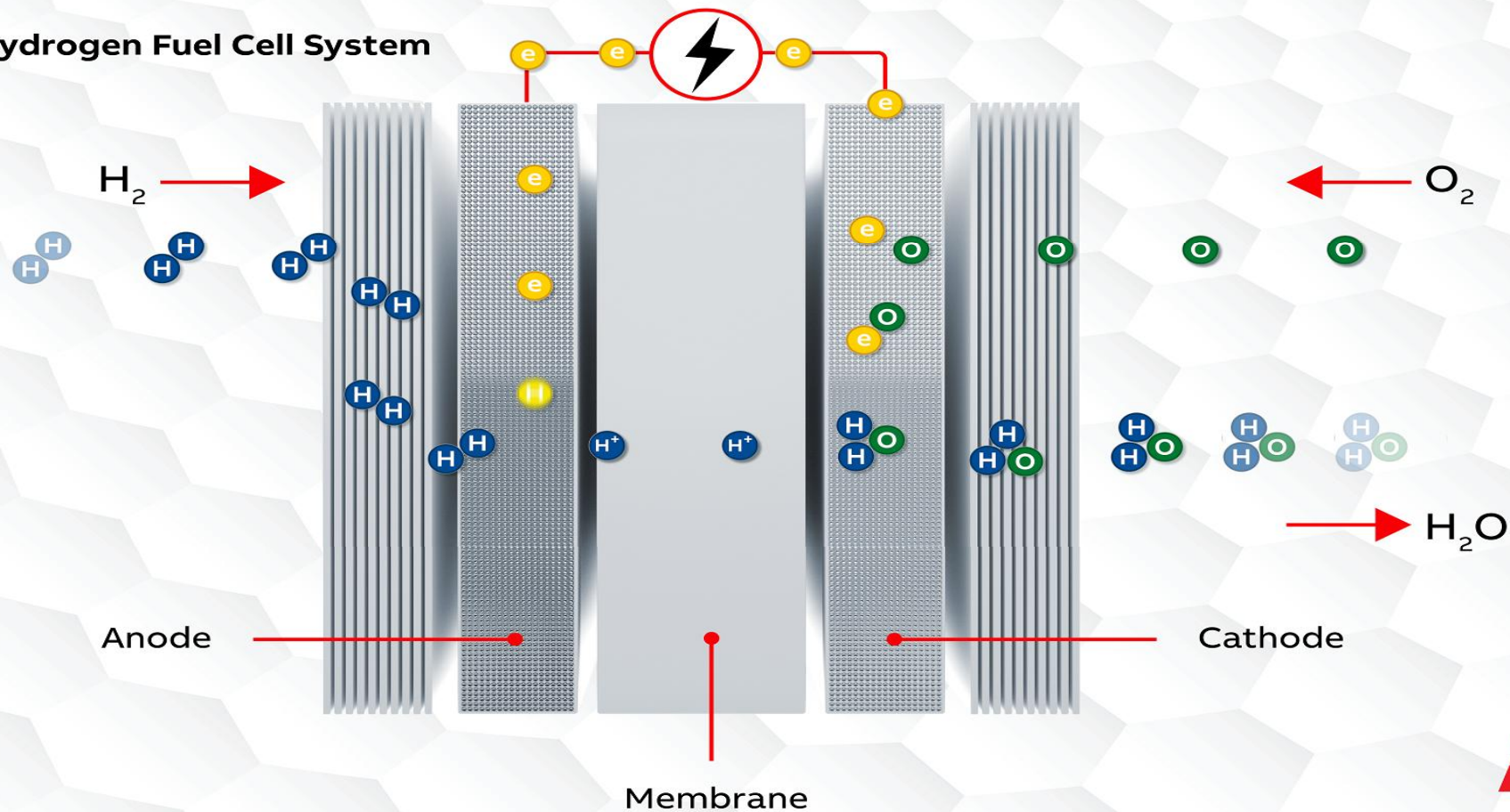


ABB Hydrogen Fuel Cell System



4TH SEPTEMBER 2018, KLAUS VÄNSKÄ

H_2 - future fuel for shipping

Opportunity for Chile to be a global supplier of renewable H_2

IMO (International Maritime Organization) initial greenhouse gas strategy (April 2018)



Reduce **CO2** emissions by at least

40% by 2030

and pursuing efforts towards

70% by 2050

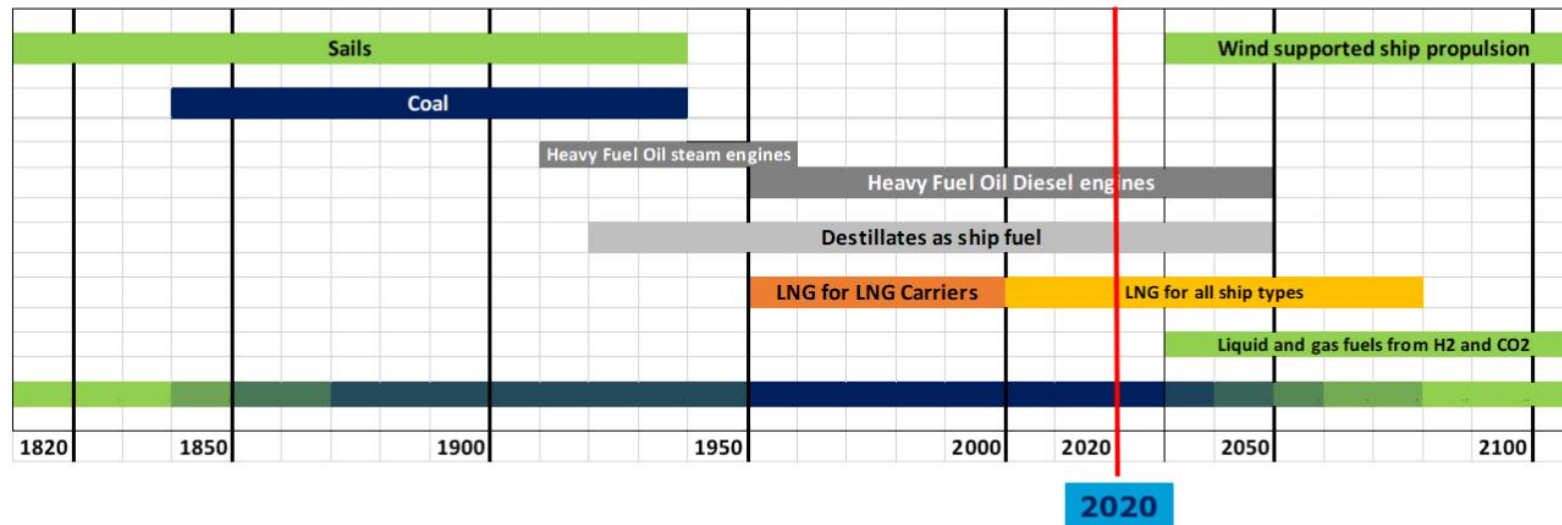
Reduce total annual **GHG** emissions by at least
compared to level of 2008

50% by 2050

New technology and fuels needed to achieve targets

Renewable H₂ will have a big role in the future

How will ship propulsion power look like in the future?



- "Paris Agreement", 2015-12-12 → UN's climate science panel says net zero emissions must happen by 2070 to avoid dangerous warming.; IMO ambition to reduce GHG emission by 50% within 2050 (April 2018)
- Until now there are no taxes on ship fuel.

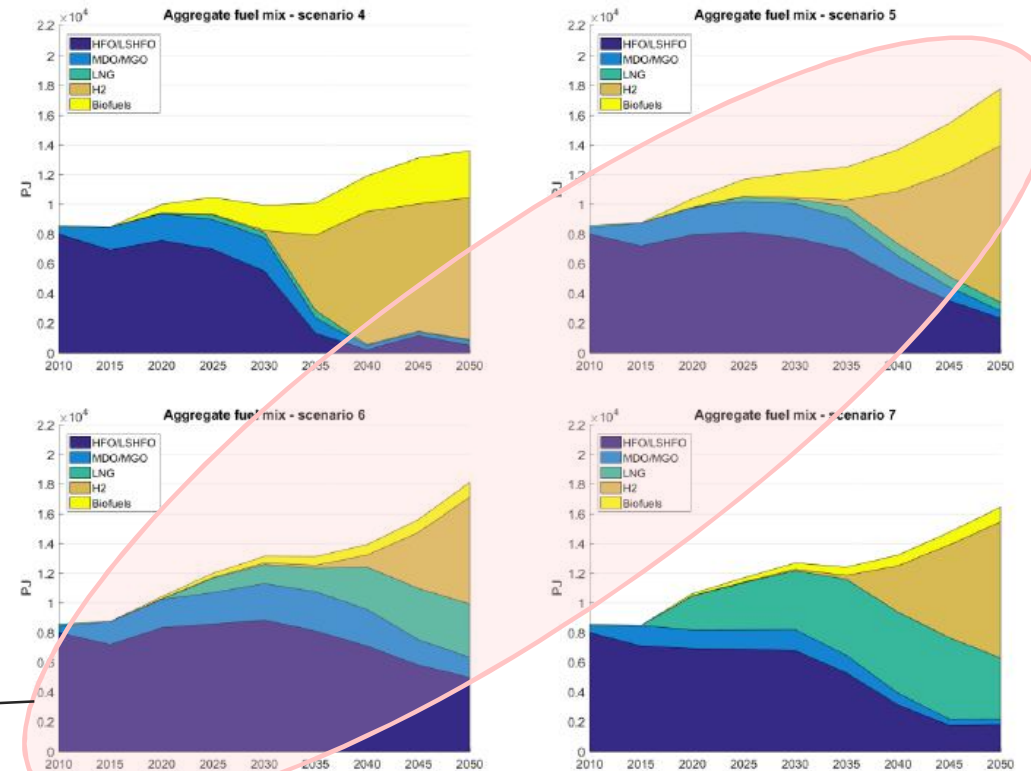
50 to 80 Million tonnes of renewable H₂ needed only for shipping

Different fuel scenarios

Efficiency improvements defines the split between different fuels

- Is the target limit global warming to 1,5 or 2.0?
- With fossil fuels CO₂ is released in direct relation to consumed fuel
- Amount of released Co₂ varies between different fossil fuels
- Other GHG emissions to be considered too
- Improvements in energy efficiency and better control of methane slip would extend usage of LNG in transition phase

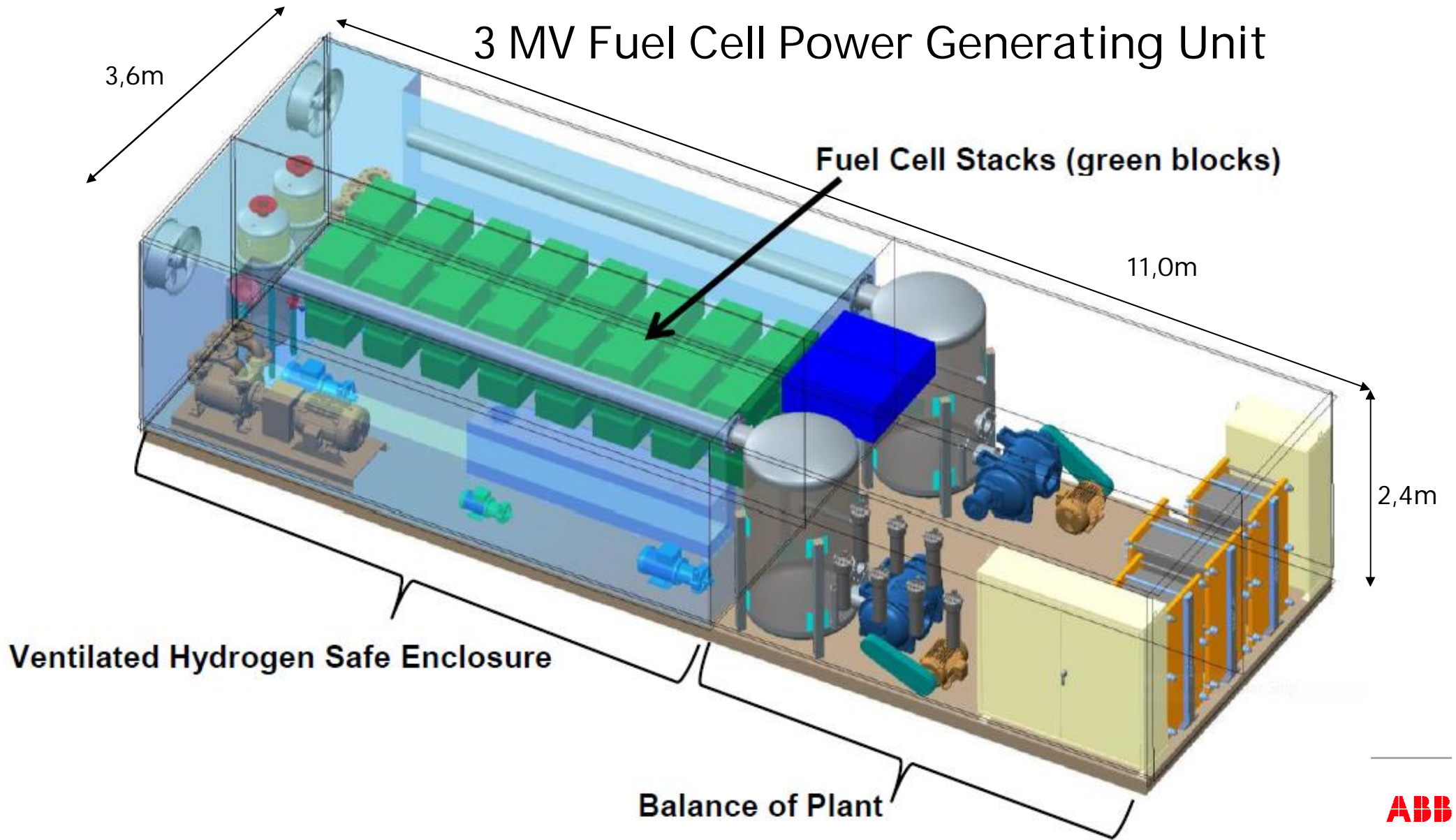
ABB: Most possible scenario somewhere between these two



Source: Co₂ emissions from shipping:

Bibliographical details: Smith, T., Raucci, C., Haji Hosseinloo S., Rojon I., Calleya J., Suárez de la Fuente S., Wu P., Palmer K. CO₂ emissions from international shipping. Possible reduction targets and their associated pathways. Prepared by UMAS, October 2016, London.

3 MV Fuel Cell Power Generating Unit



Chile has unique possibility to be a global supplier of renewable H₂

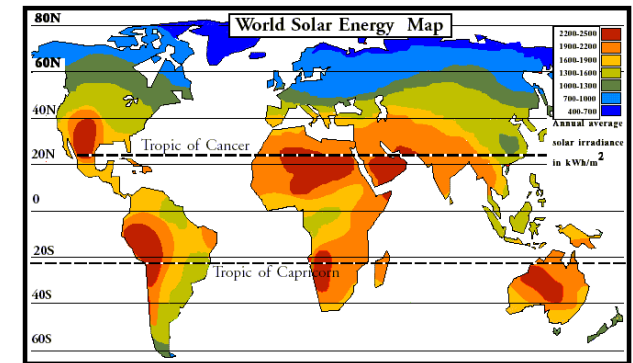
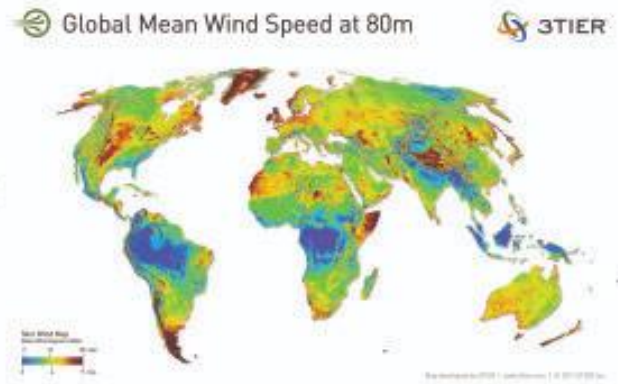
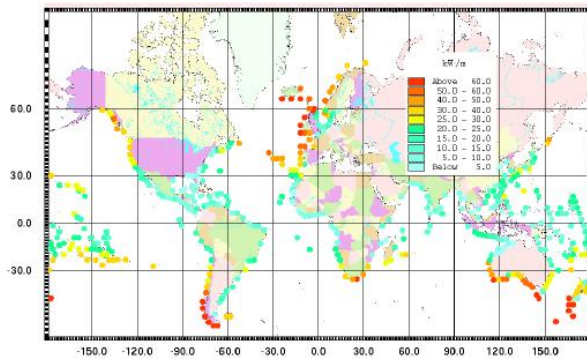
Spots of renewable energy



Wave energy spots in coastline

Wind energy spots

Solar radiation spots



Energy cost is not an issue!

AABB