German Green Energy Solutions

German-New Zealand Chamber of Commerce

AHK Repräsentanz der Deutschen Wirtschaft German-New Zealand Chamber of Commerce Inc.

Federal Ministry for Economic Affairs and Climate Action

Murihiku Regeneration

GNZCC OVERVIEW

German-New Zealand Chamber of Commerce Network in Numbers

IHK = German Chamber of Industry & Commerce

AHK = German Chamber of Commerce Abroad

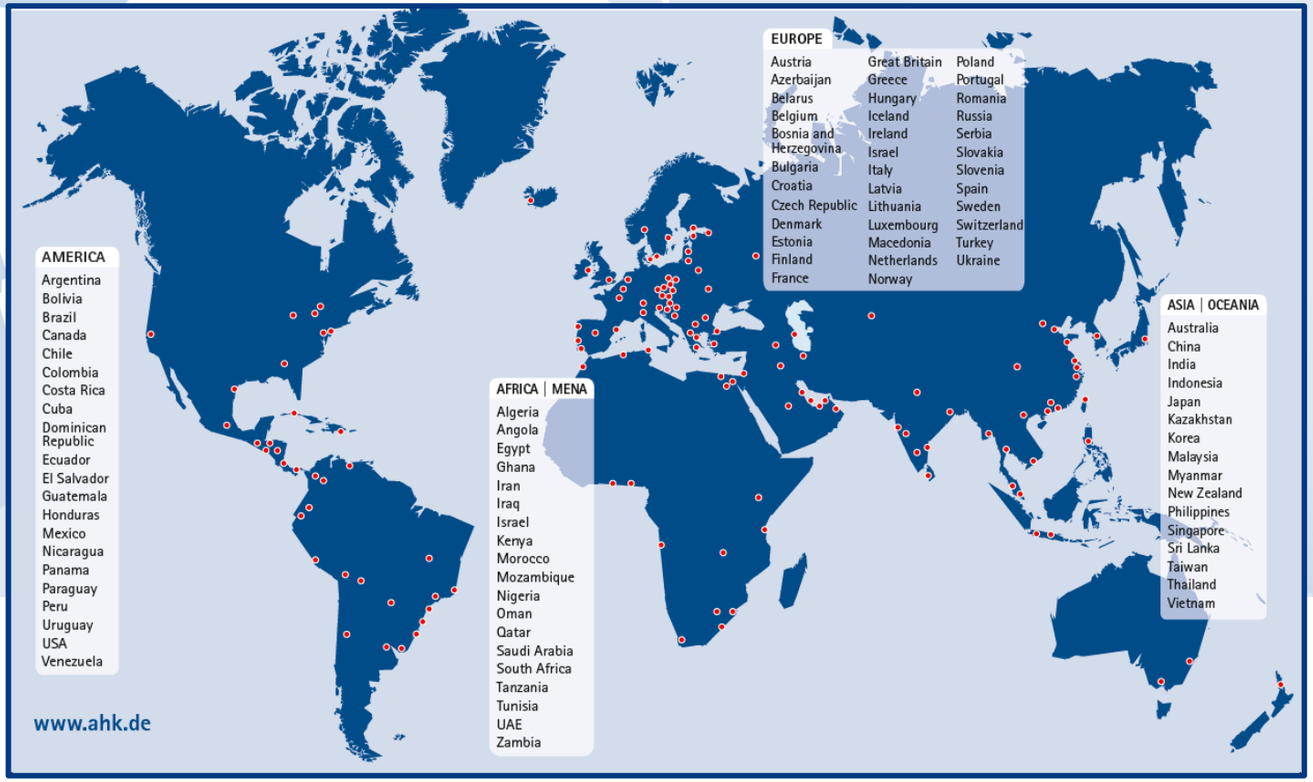
92 COUNTRIES

140
LOCATIONS

OVER
50.000
MEMBERSHIPS

SINCE
1894

126+
YEARS



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ZOOM - Housekeeping

German-New Zealand Chamber of Commerce

Good afternoon

- Your microphone will be muted during the webinar
- This webinar will be recorded
- Use Q&A function to ask questions during our panel discussion
- Use the chat function to message hosts

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Sir Tipene O‘Regan

Ngai Tahu, Upoko o Awarua

2022 New Zealander of the Year

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Murihiku Regeneration

Green Energy Opportunities Murihiku/Southland

May 2021

Vision and Purpose

- Established in 2020 in response to uncertainty surrounding the future of the Tiwai Aluminium Smelter.
- A *Collaboration* between four Papatipu Rūnanga of Murihiku.
- Work closely and collaboratively with the Crown, giving voice to the Treaty partnership.
- Exists to ensure a clear, coherent plan for a prosperous Southland.

Vision

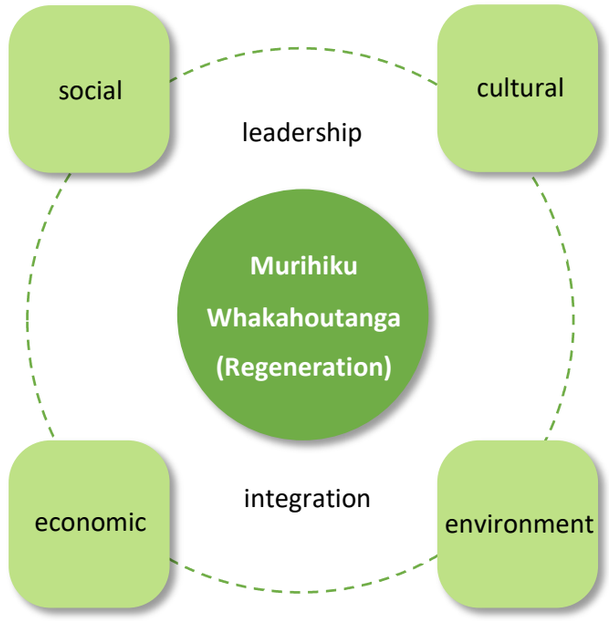
Our Murihiku Papatipu Rūnanga - are individually strong, collectively enabled and driving Rūnanga and Regional aspirations that will sustain our lifestyles in a thriving, healthy environment for our generations to come.

Purpose

Develop a long-term regeneration plan that meets our aspirations of the Four Pou (right).

Develop a whānau-centric model and plan.

Four Pou



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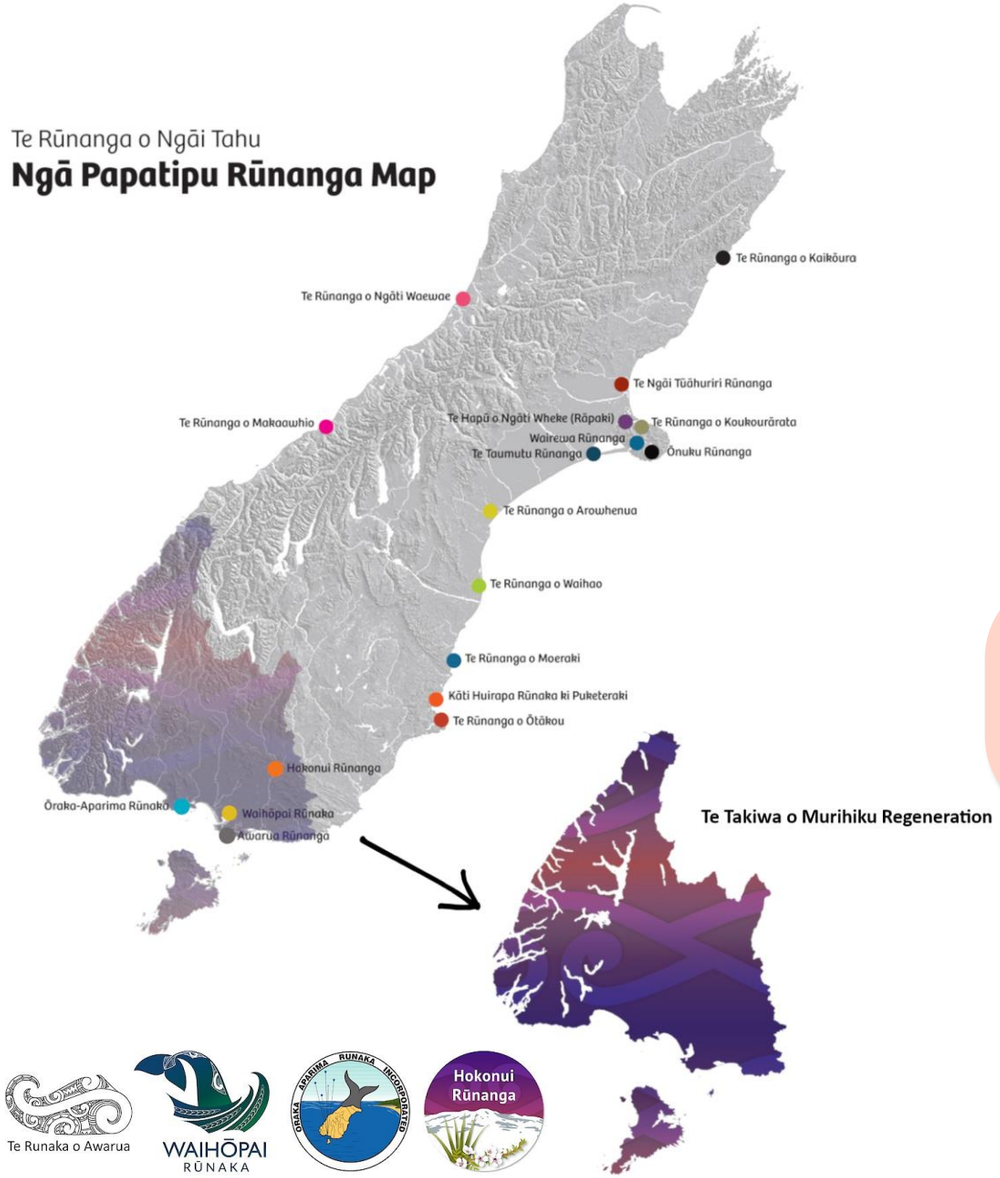
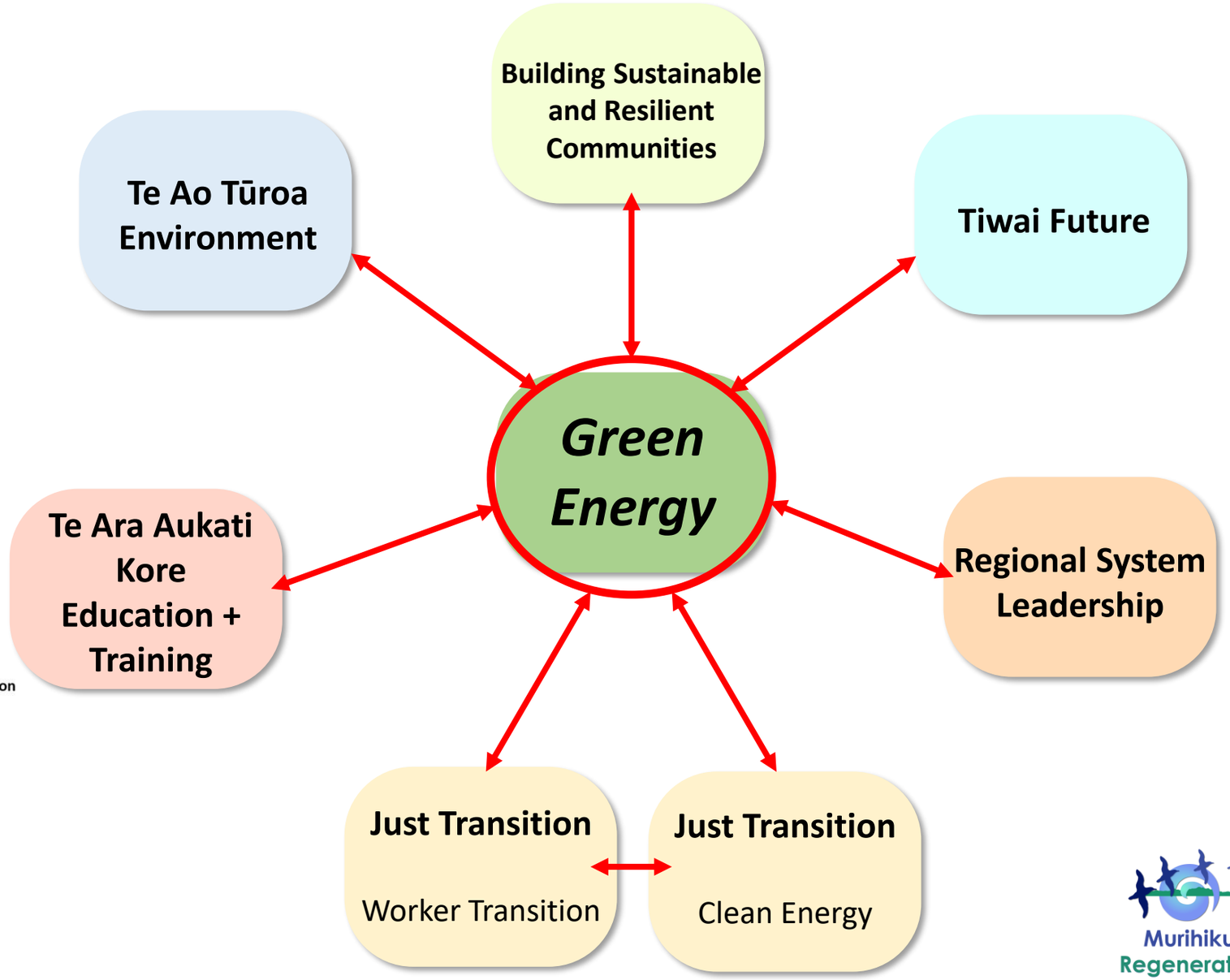
Location and Mahi





Te Runaka o Awarua

WAIHŌPAI RŪNAKA

Hokonui Rūnanga

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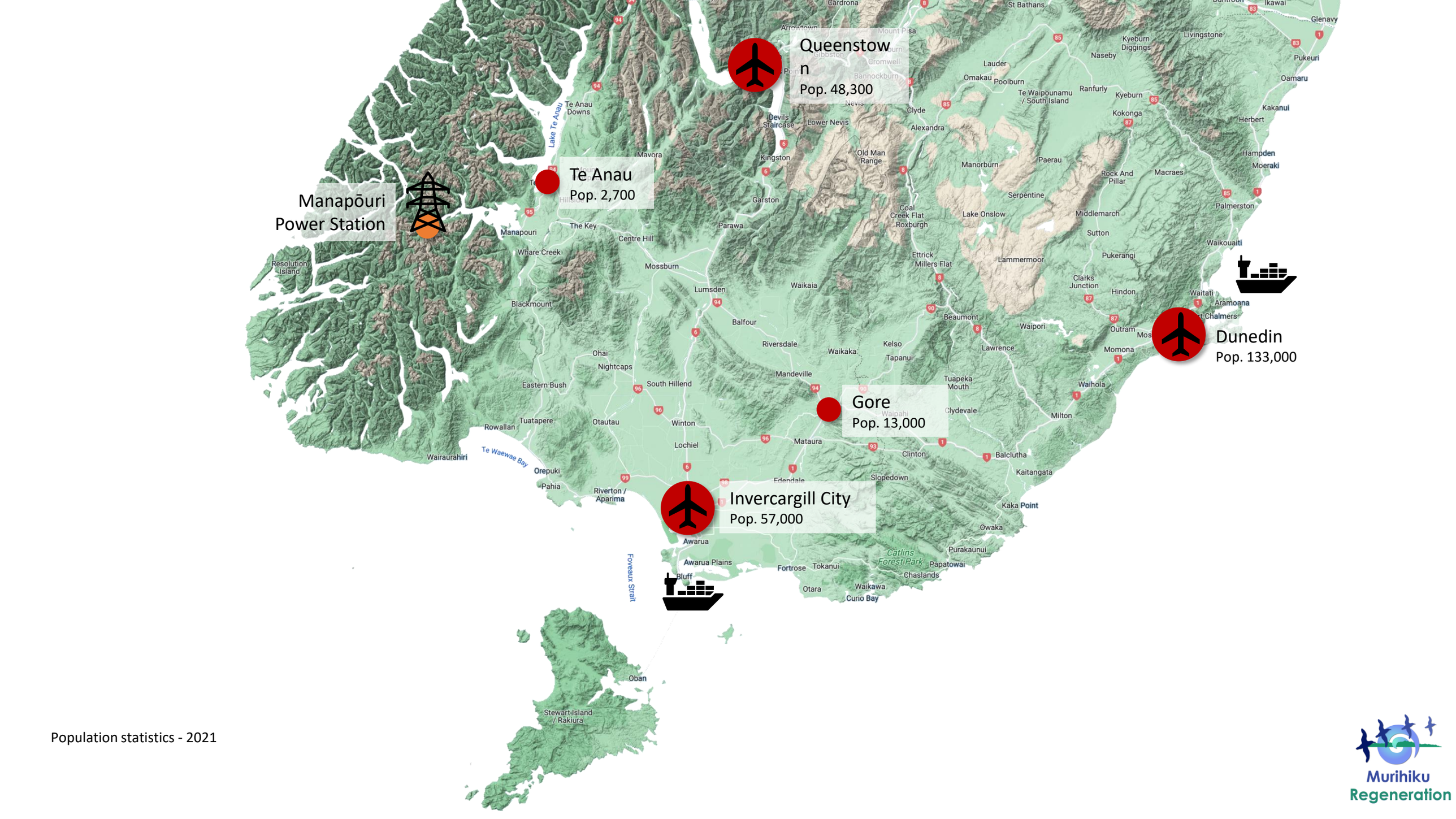

Population statistics - 2021

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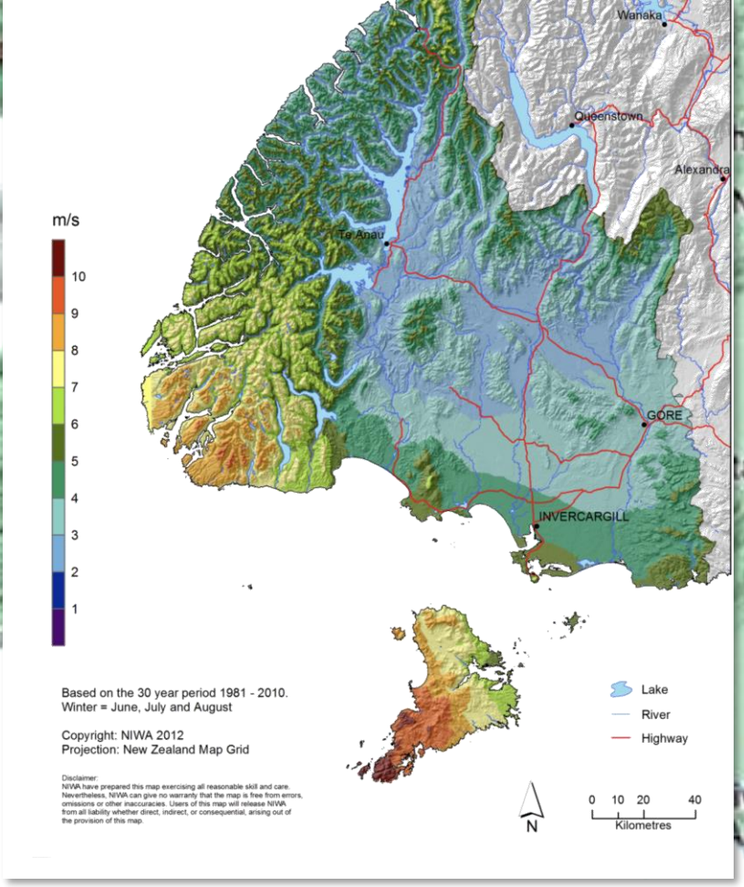

Riversdale
Waikaka
Kelso
Tapanui
Nightcaps
Tuapeka Mouth
South Hillend
Future opportunities
Gore
Waipahi
Clydevale
Winton
Lochiel
Mataura
Clinton
Edendale
Future opportunities
Slopedown
Invercargill
H_2
Future opportunities
Currently exists
Awarua
Awarua Plains
Bluff
Foveaux Strait
Future opportunities
Catlins Forest Park
Purakaunui
Papatowai
Fortrose
Tokanui
Chaslands
Otara
Waikawa
Curio Bay

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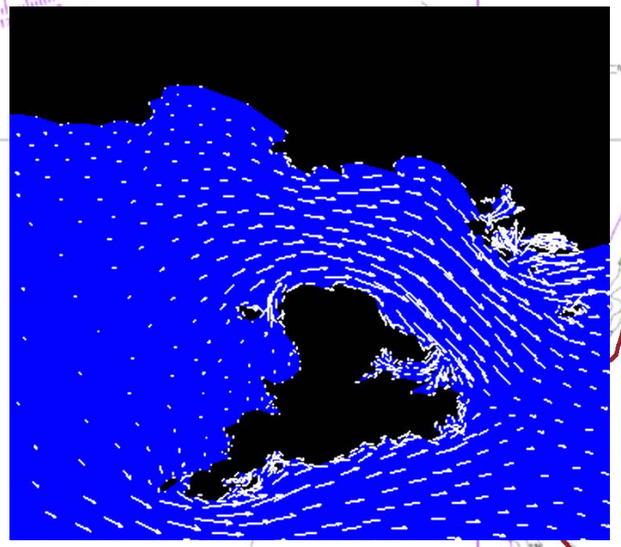
Foveaux Strait Bathymetry

200 metres

100 metres

50 metres



Key:

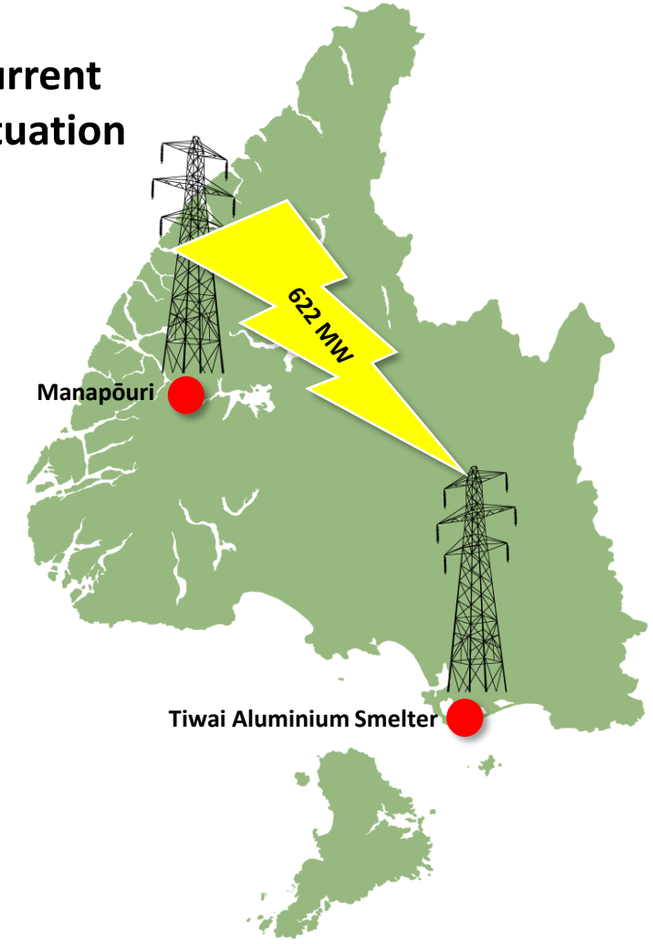
- = land
- = <2 metres deep
- = >2 - <10 metres
- = >10 - <30 metres
- = >30 metres

Hydrogen – the opportunity

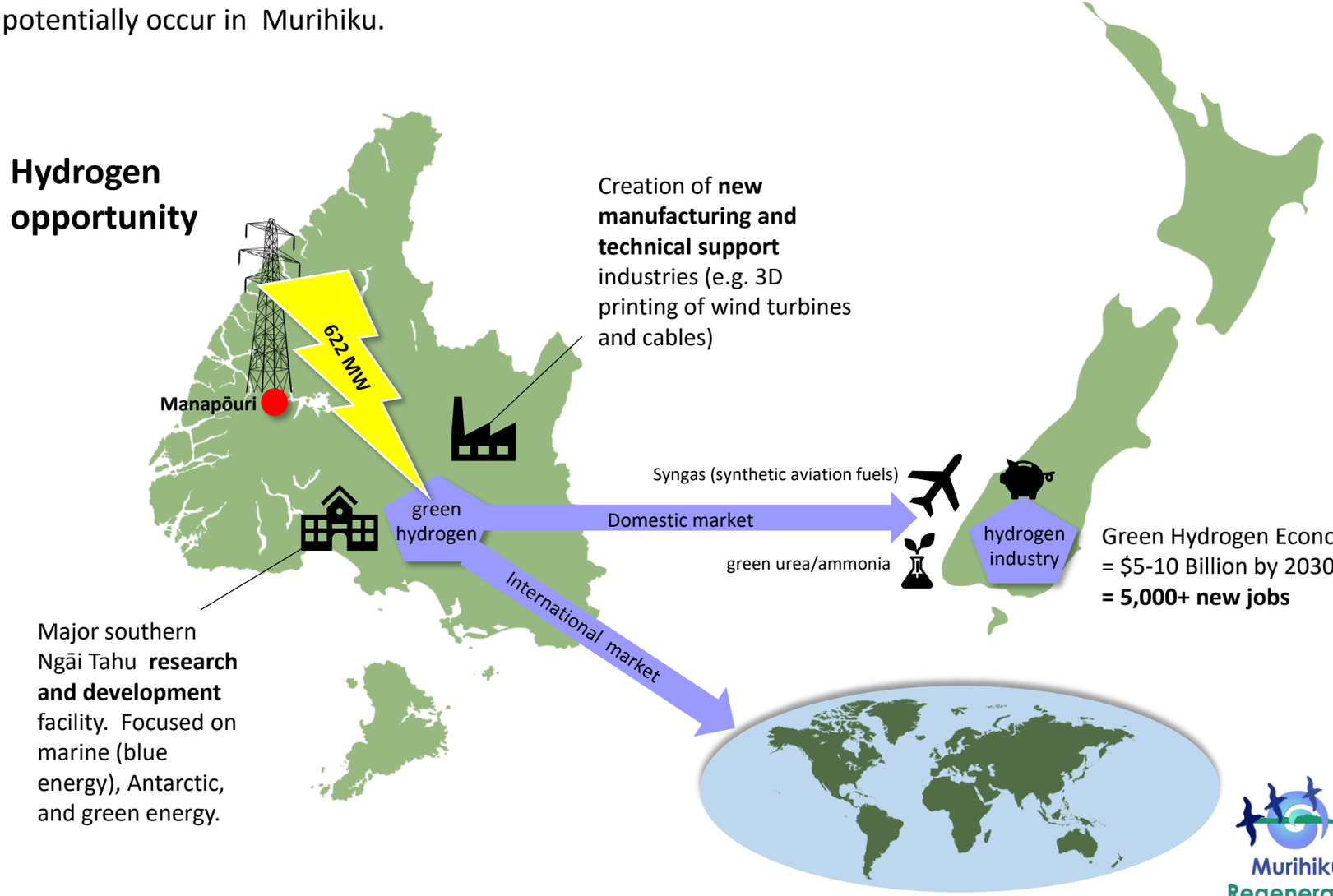
The renewable economy is projected to grow NZ GDP by $NZ180 billion by 2048:

- **70%** of that growth is likely to occur across Te Waipounamu.
- **60%** of that 70% will potentially occur in Murihiku.

Current situation



Hydrogen opportunity



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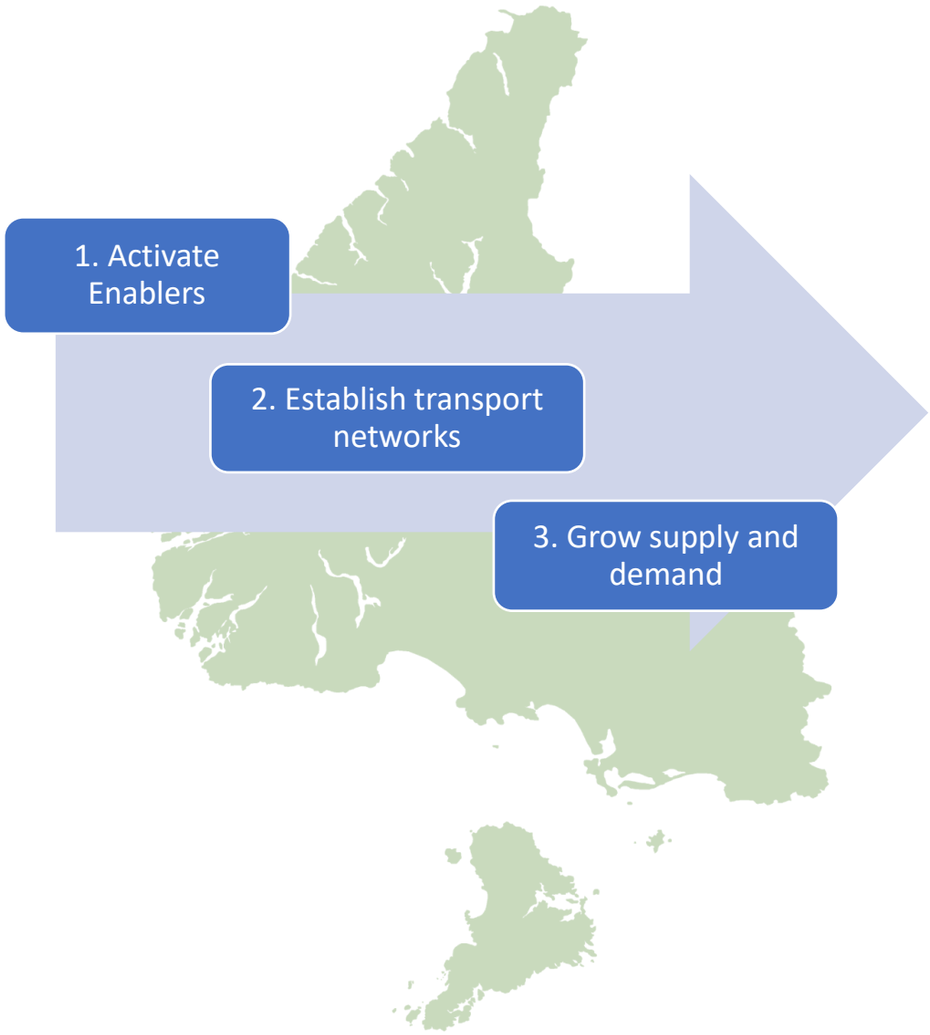
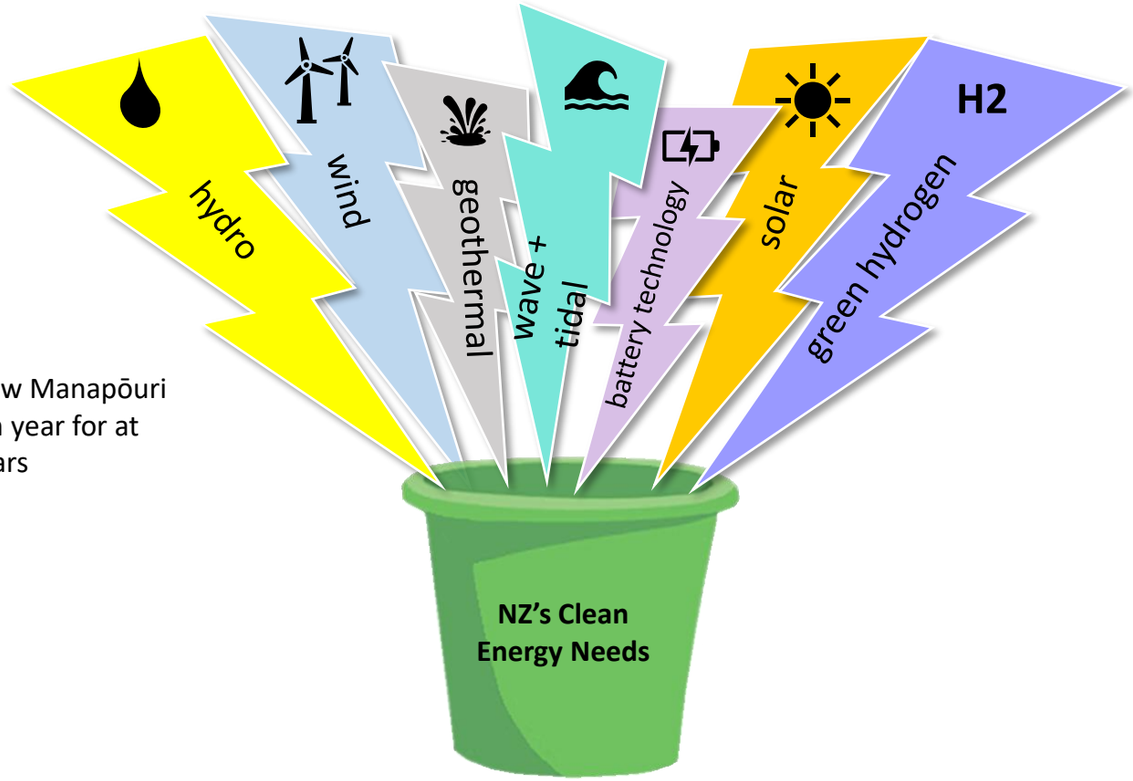
Strategic approach – 3 phases

Decarbonising existing industries, and growing new industries, will require a truly massive increase in renewable energy over the next 30 years.



The equivalent of a new Manapōuri supply (600 MW) each year for at least the next 7-10 years



Green hydrogen, and its derivatives, could provide one of many sources of clean energy for Aotearoa.

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The Foundation is the ***Local*** Supply of Low-Carbon Energy Resources

Ramping up existing *local clean energy* is not only the key to *decarbonising* existing industries, it is the basis for the creation of *new industries.*

Low carbon
energy supply

- Hydro power
- Onshore wind
- Offshore wind
- Tidal/wave power
- Biomass
- Battery technology
- Hydrogen

Decarbonising
existing **industries**

- Aviation
- Marine transport
- Road transport
- Agriculture
- Aquaculture
- Timber products
- Dairy products
- Animal protein
- District heat

Growing
new **industries**

- Aquaculture
- Data centres
- Crypto mining
- Hydrogen
- Ammonia/Urea
- Green steel

Hydrogen enables low-carbon power generation by serving an energy **vector**, as an energy **store**, and by **reducing curtailment.**

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Tū tahi ki te Kei

Let's all stand together in the stern of our waka

Murihiku Tītī a Kai, Tītī a Manawa

Murihiku, a land of resource, a people steadfast

Tauarutia ka aho ratarata

Follow our Southern Lights

Hon Dr. Megan Woods

Minister of Housing,

Minister of Energy & Resources

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Southland

Paul Ravlich

CEO, Siemens NZ Ltd and

Regional Manager NSW, Siemens Ltd

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EMERGENCY
STOP

Siemens Gamesa Renewable Energy Australia and New Zealand References
1,311 MW Under Operation and 176 MW under construction

PROJECTS REFERENCES

- **Snowtown 2 Wind Farm**, SA: 80 x SWT-3.0-108 and 10 x SWT-3.0-101, 270MW Customer: Trustpower, Commissioned 2014
- **Hornsdale 1**, SA: 30 x SWT-3.2-113, 96MW, Customer: Neoen, Commissioned: 2016
- **Hornsdale 2**, SA: 30 x SWT-3.2-113, 96MW, Customer: Neoen, Commissioned 2017
- **Hornsdale 3**, SA: 35 x SWT-3.2-113, 112MW, Customer: Neoen. Commissioned 2017
- **Bulgana Wind Farm**, VIC: 56 x SG 3.65-132, 204MW. Customer: Neoen, Commissioning 2019
- **Te Uku, Mill Creek and West Wind**, NZ: 116 x SWT-2.3 MW, 267MW. Customer: Meridian Energy, Commissioned 2011
- **Badgingarra Wind Farm**, WA: 37 x SWT-3.6-130, 133MW. Customer : APA Group, Commissioning 2019
- **Waipipi Wind Farm**, NZ: 31 x 4.3MW,133.3MW. Customer: Commissioning 2020, Tilt Renewables
- **Harapaki Wind Farm,** NZ: 41 x 4.3MW, 176.3MW. Customer: Meridian Energy, under construction


Snowtown II, SA


Hornsdale I,II & II ,SA


Badgingarra, WA


Bulgana, VIC


Mill Creek, NZ


West Wind, NZ


Te Uku, NZ


Waipipi, NZ

SIEMENS Gamesa
RENEWABLE ENERGY

Three business units strongly positioned in the market

Onshore

103.1 GW

installed since 1979

The **technological partner of choice** for onshore wind power project.

Offshore

19.3 GW

installed since 1991

Most experienced offshore wind company with the most reliable product portfolio in the market.

Service

83 GW

maintained

Commitment beyond the supply of the wind turbine **to reach the profitability goals.**

SIEMENS Gamesa RENEWABLE ENERGY

SIEMENS Gamesa
RENEWABLE ENERGY

Dr. Nils Goseberg

Professor of hydromechanics, coastal and ocean engineering

Managing director of the Coastal Research Center at Technische Universität Braunschweig

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Technische Universität Braunschweig

FZK COASTAL RESEARCH CENTRE

Leichtweiß-Institut

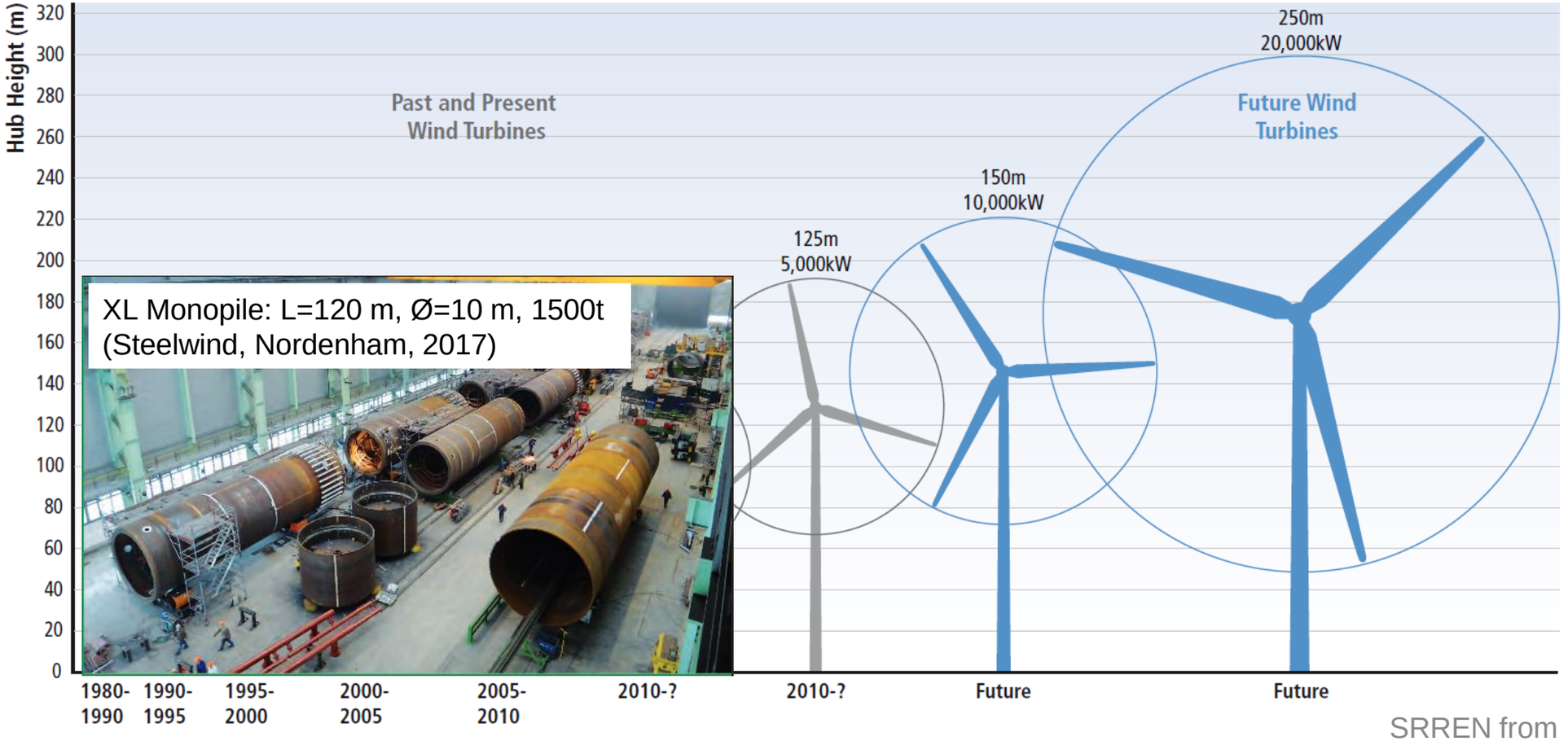
Large Wave Flume+ - R&D-environment for coastal and ocean research

Nils Goseberg* | Virtual-Roundtable “German Green Energy Solutions” | Zoom | 12.05.2022

*with Christian Windt, Clemens Krautwald, Stefan Schimmels, Torsten Schlurmann

Introduction/Background/Motivation I

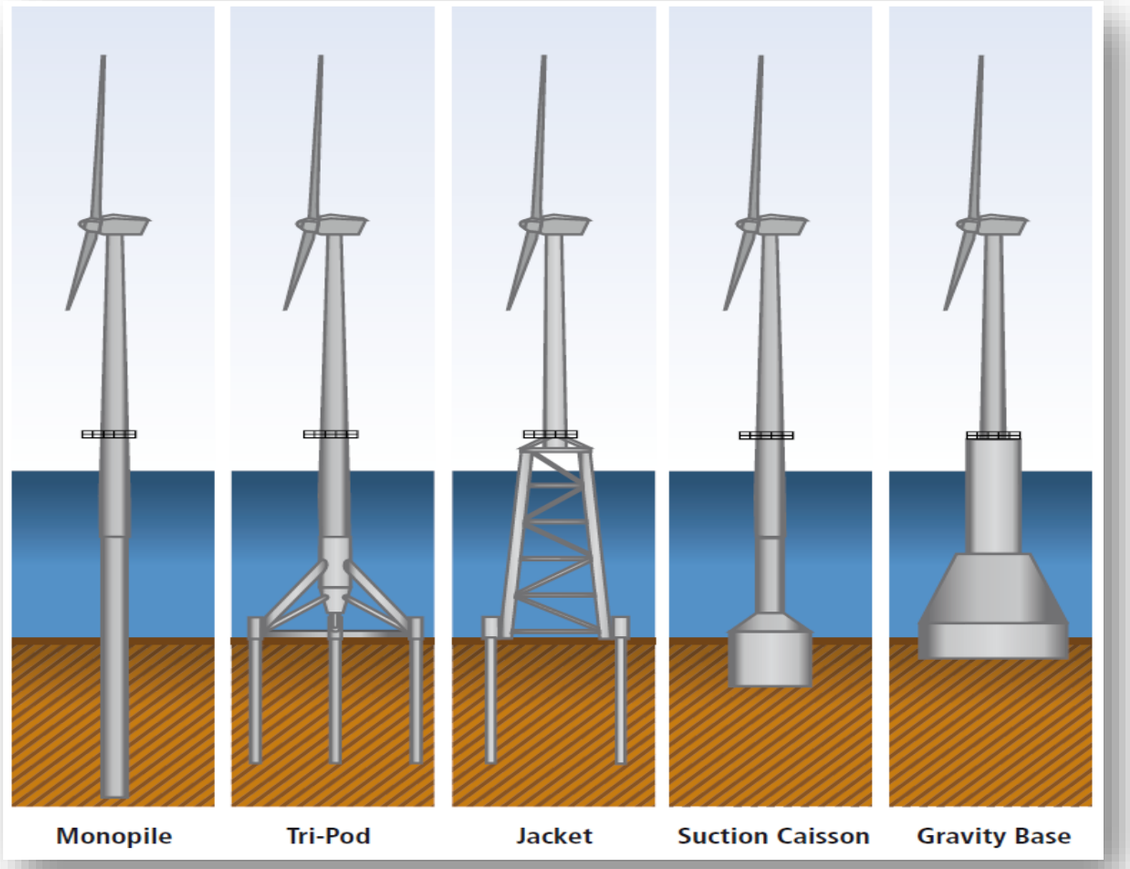
- Recent trends in offshore wind industry

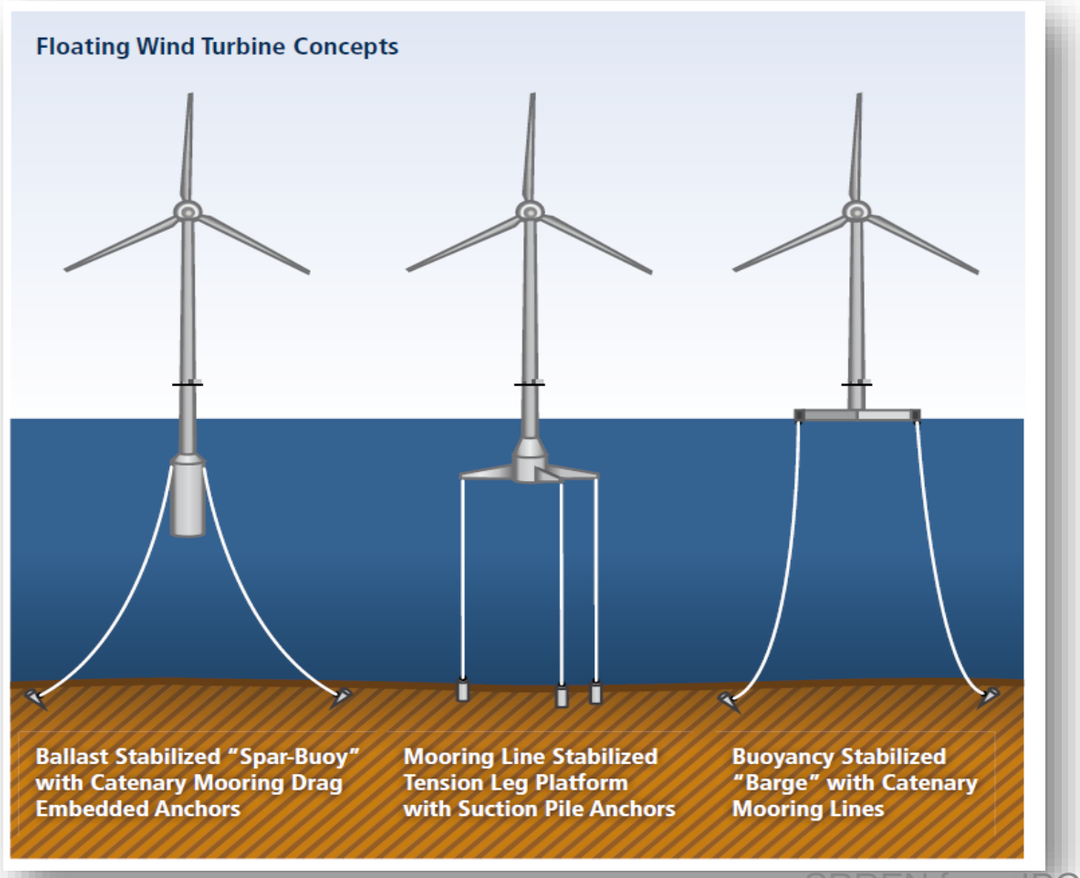


SRREN from IPCC, 2012

Introduction/Background/Motivation II

- Existing and novel structures used to develop offshore wind installations

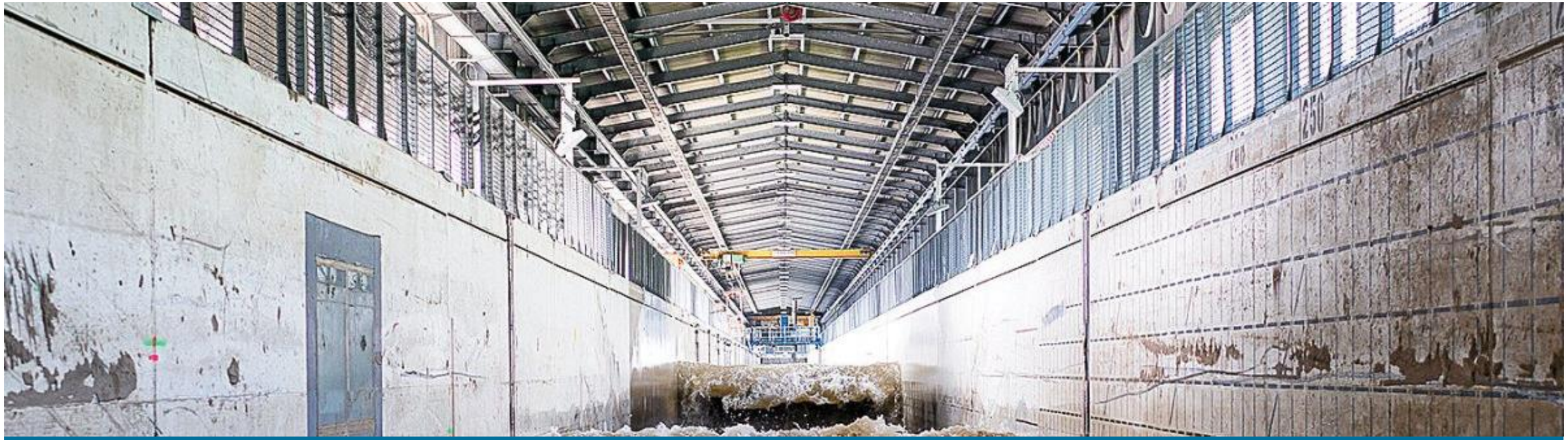




SRREN from IPCC, 2012

Introduction/Background/Motivation III

- Trends in wave (near-shore vs. offshore) & tidal energy (fixed and floating installations)

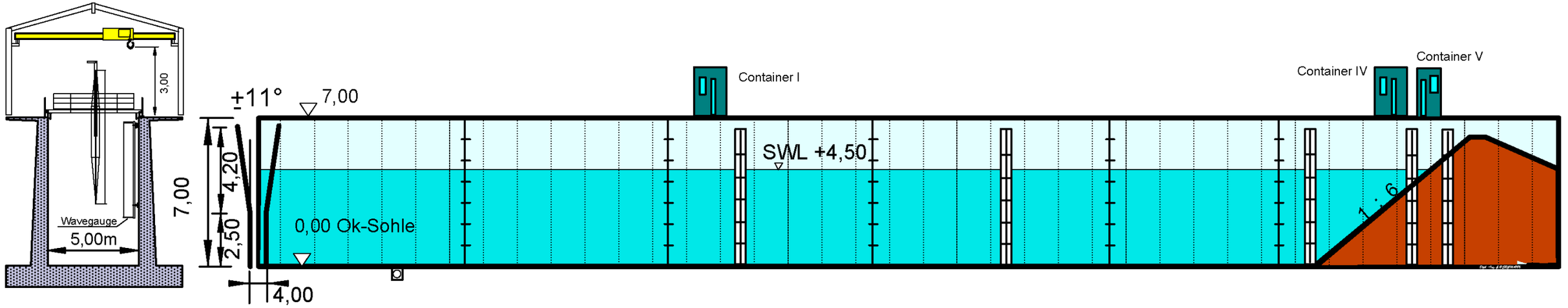


Coastal Research Center (CRC), Hannover, Germany

Joint Research Facility of Technische Universität Braunschweig and Leibniz University Hannover

Large Wave Flume+ - R&D environment

- Coastal Research Center operates Large Wave Flume since 1983
- Joint Research Facility of two leading technical universities in Hannover/Braunschweig, Germany
- Length: 307 m, width 5 m, depth 7 m, wave generation
- Refurbishment since 2019, 35 Mio. Euro investment of German government
- Upon completion: most versatile hydraulic, coastal & ocean engineering test facility worldwide



Features and rendering: Large Wave Flume+

Featured projects and sample applications

Offshore Wind Engineering I

- Testing structural foundations

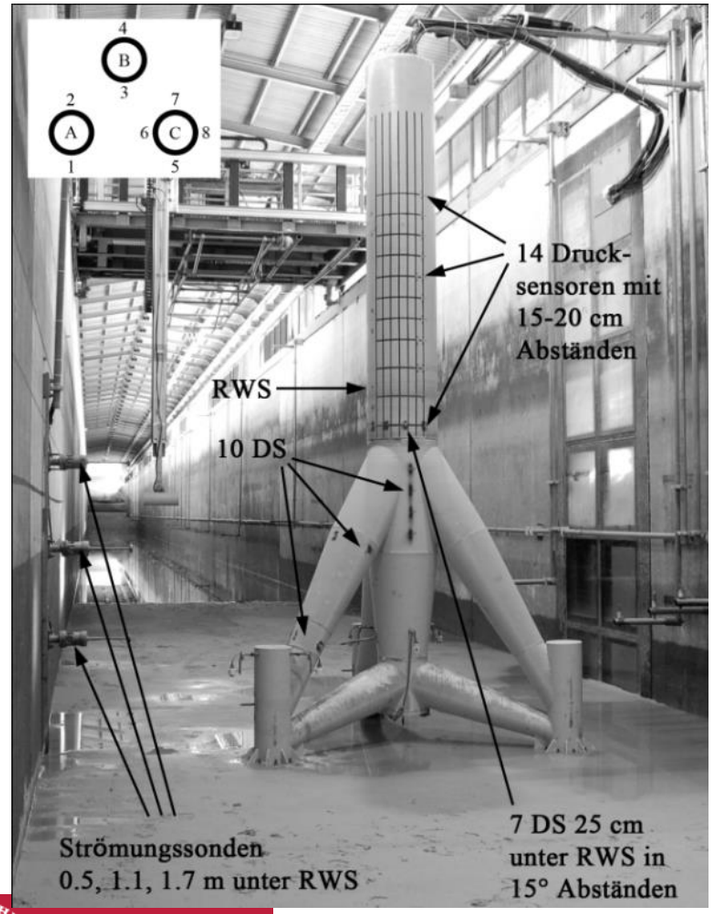
Tripod

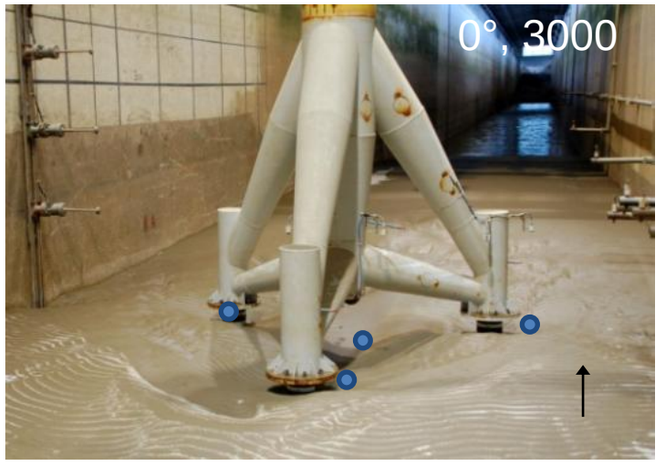
Gravity based

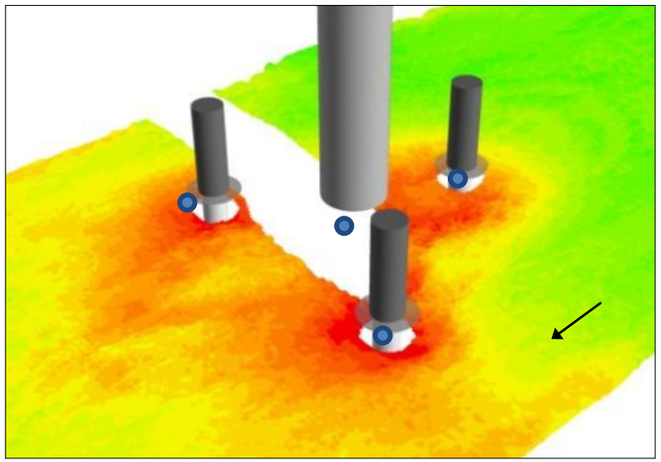
Jacket

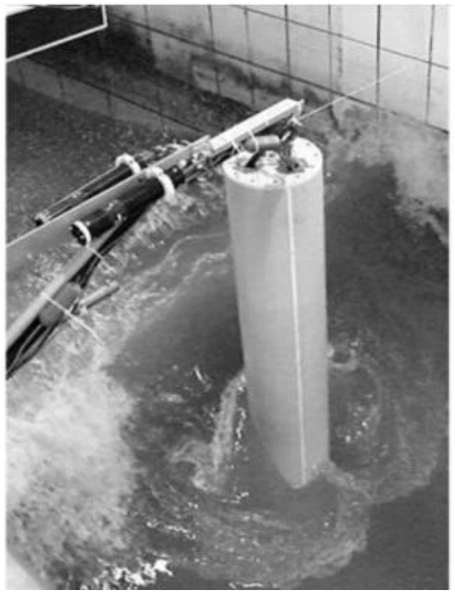
Offshore Wind Engineering II

- Wave impact on structures / scouring



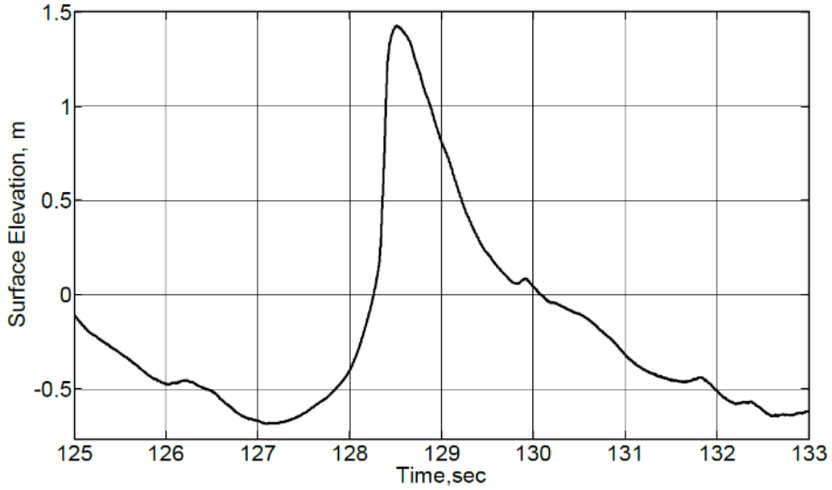


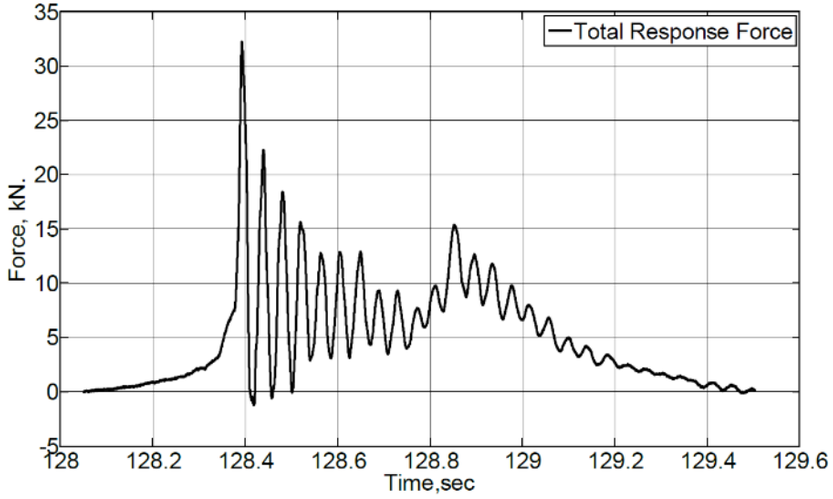




Offshore Wind Engineering III

- Loads on jacket structures

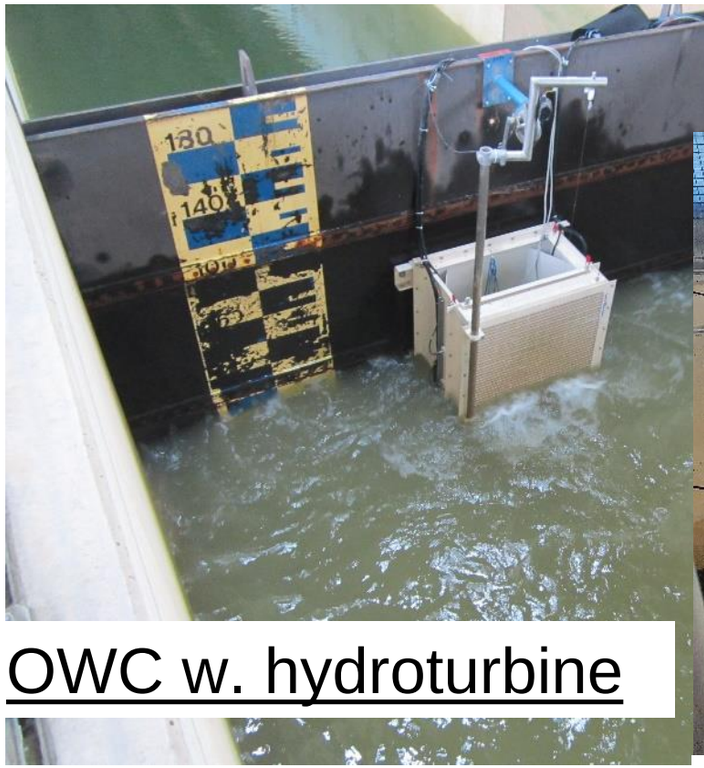




Ocean Renewables I

- Testing prototype Wave Energy Converters (WEC)

OWC



OWC w. hydroturbine

Floating device

Summary and Conclusions

- Transitioning our energy systems requires robust, reliable and innovative R&D environment
  - Academic partner for agile blue economy
  - Accessible for national and international research initiatives
  - Networking partner for future research!
  - Combining lab testing with NZ potential for field testing blue energy…

Technische Universität Braunschweig

Leichtweiß-Institut

Thank you for your kind attention!

Nils Goseberg* | Virtual-Roundtable “German Green Energy Solutions” | Zoom | 12.05.2022

*mit Christian Windt, Clemens Krautwald, Stefan Schimmels, Torsten Schlurmann

Dr. Carola Kantz

Deputy Managing Director

VDMA Power-to-X for Applications working group

AHK Repräsentanz der Deutschen Wirtschaft German-New Zealand Chamber of Commerce Inc.

Federal Ministry for Economic Affairs and Climate Action

Murihiku Regeneration

German Green Energy Solutions

Sustainable Aviation Fuels
Frankfurt/Brussels, 12 May 2022

The VDMA in a nutshell

- **125 years of experience – founded in 1892**
- **36 sector associations – from agricultural to woodworking machinery**
- **Foreign and domestic subsidiaries, working groups, forums, competence centers, reasearch associations, servive companies.**

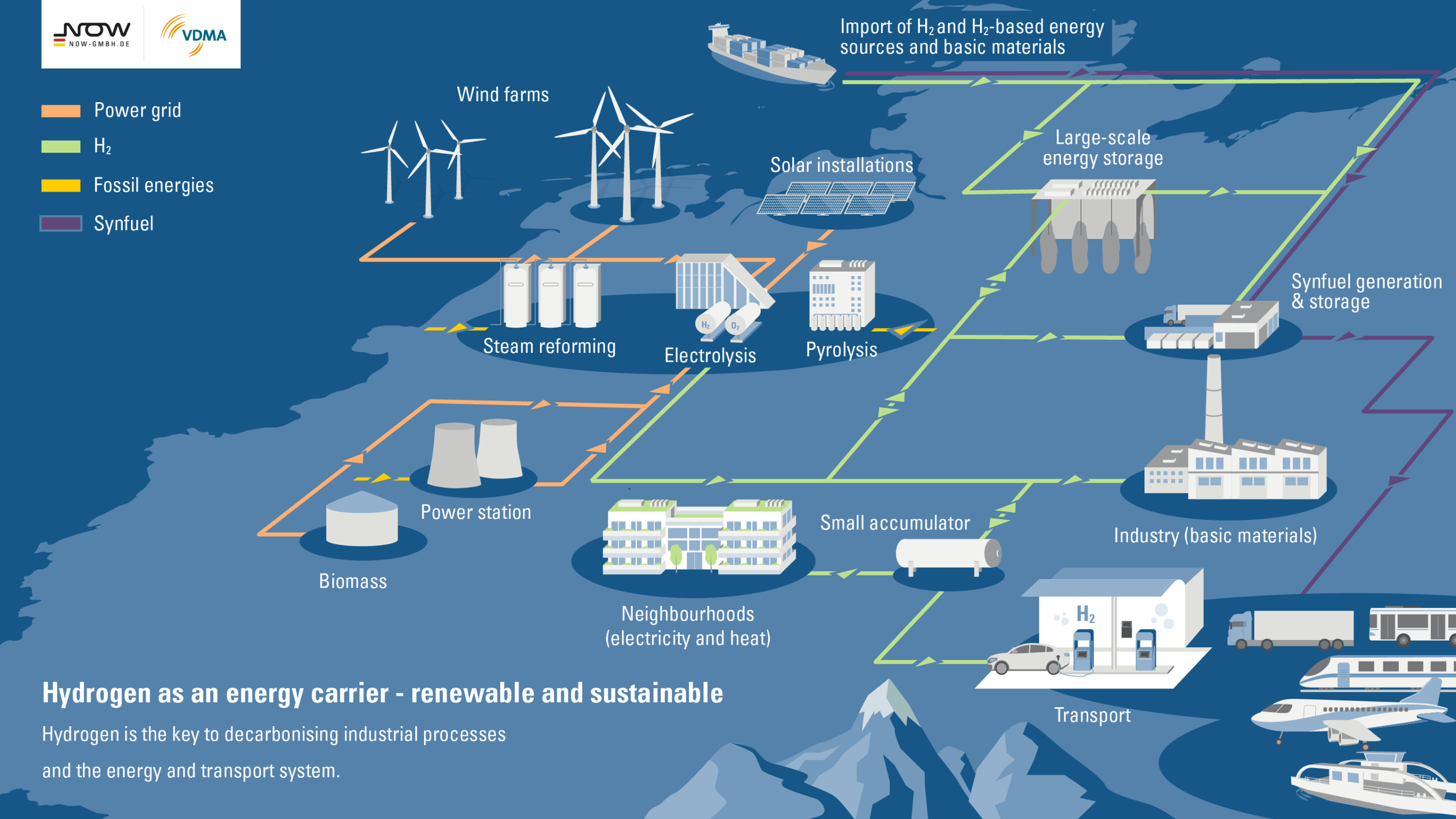
With more than 3,400 members, the Mechanical Engineering Industry Association is the largest network organization and important voice for mechanical engineering in Germany and Europe. The association represents the common economic, technical and scientific interests of this unique and diverse industry.

Mechanical engineering industry in Germany: Facts & Figures

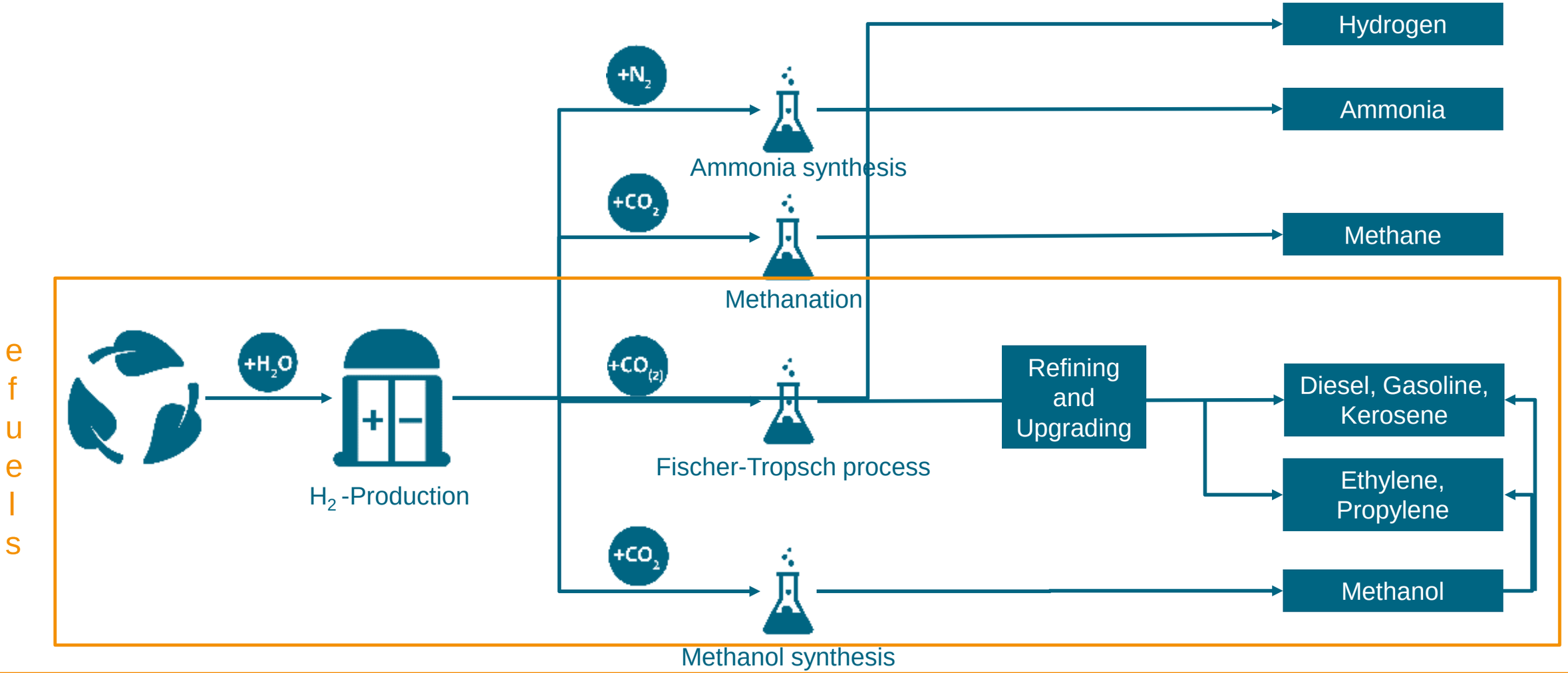
Employees:	**1,032 Mio. (2020)**
» Engineers:	199.800 (2019)
» Engineer quota:	17,1 % (2019)
» Training ratio:	6,0 % (2020)
Companies:	**ca. 6.647 (2019)**
» Ø number of employees:	184 (2019)
» companies <250 staff:	86 % (2019)
Members:	**> 3.400**
» Represented turnover:	ca. 90% of German mechanical engineering turnover
Turnover:	**203,5 bn € (2020)**
Ø Revenues per employee:	**ca. 197 Tsd. € (2020)**
Export quota:	**ca. 81% (2020)**

Power-to-X for Applications

160+ members from the complete value chain

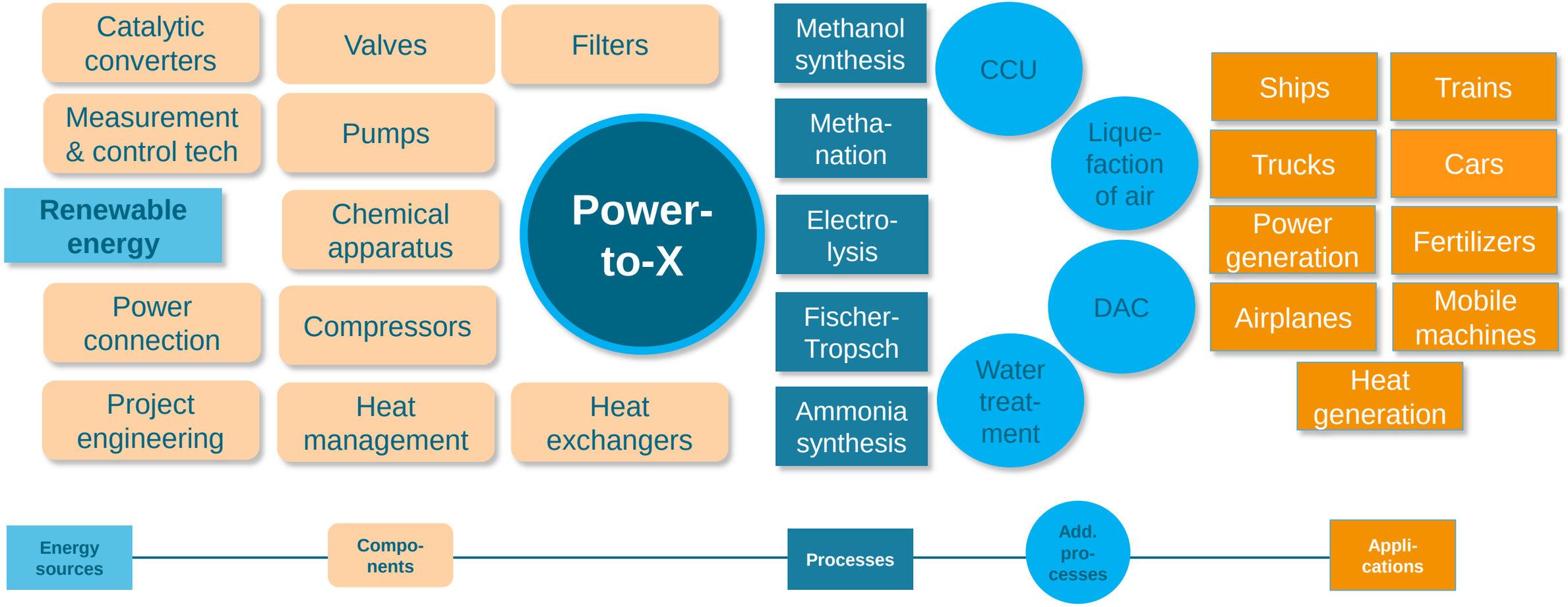

NOW
NOW-GMBH.DE
VDMA
Power grid
H_2
Fossil energies
Synfuel
Import of H_2 and H_2-based energy sources and basic materials
Wind farms
Solar installations
Large-scale energy storage
Synfuel generation & storage
Steam reforming
Electrolysis
Pyrolysis
Power station
Biomass
Neighbourhoods (electricity and heat)
Small accumulator
Industry (basic materials)
H_2
Transport
Hydrogen as an energy carrier - renewable and sustainable
Hydrogen is the key to decarbonising industrial processes
and the energy and transport system.

Power-to-X for Applications
Production and products



Power-to-X has a long value chain – European SMEs are leading

The PtX eco system



Global opportunities to produce power-to-X

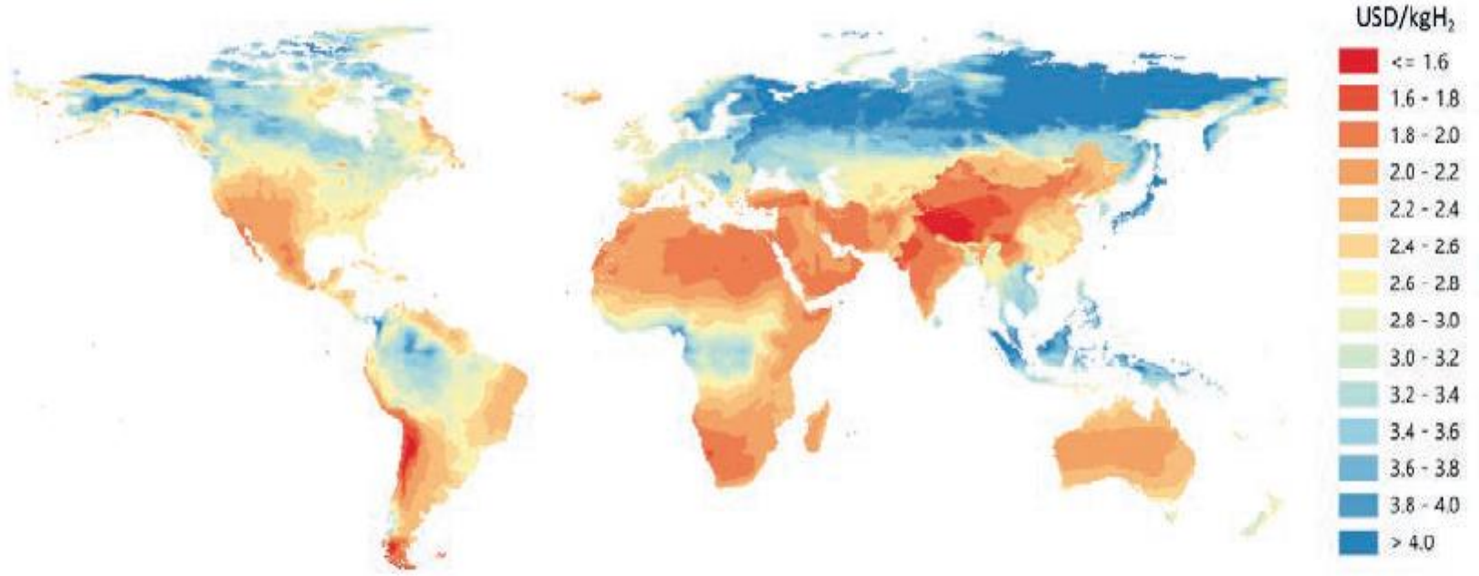
» **Political stability**
Trading renewable energy may become crucial for countries that have built their business models on fossil energy in the past.

» **Energy diversification**
It also becomes a new opportunitiy for „newcomers“: countries that do not have fossil resources but favorable wind and sun conditions.

» **Maintaining the balance of trade**
It is important to have economically strong partners for an export-oriented EU.

» **PtX- contribution**
Hydrogen cannot be transported easiliy without a pipeline. Liquid fuels can be traded with exisiting infrastructure and enable an global renewable energy market.

Hydrogen costs from hybrid solar PV and onshore wind systems in the long term



Source: IEA; https://www.iea.org/reports/the-future-of-hydrogen

To unleash the global potential, establish a European lead market

Several PtL projects were announced* – Rapid upscaling requires political support

	norsk e-fuel	Nordic Blue Crude	Mo Industripark as	WESTKÜSTE 100	REPSOL	Liquid Wind	Copenhagen Methanol[1]	CARBON RECYCLING INTERNATIONAL	SIEMENS energy	ENGIE	SIEMENS energy	NEOM نيوم	zenid
Scale [million l/a]	10 (alpha) 100 (beta)	10	100	n/a	2.1	55	100	100	0,75 (pilot) 55 (alpha) 550 (beta)	tba	tba	tba	tba
Product	FT-Crude	FT-Crude	Methanol	Methanol	FT-Crude	Methanol	Methanol	Methanol	Methanol	Synthetic kerosene	Synthetic fuels	Synthetic fuels	Synthetic kerosene
Target Market	Aviation	Aviation	Road	Aviation	n/a	Shipping	Aviation, Shipping	n/a	Road	Aviation	Aviation, Road, Shipping	Aviation, Road, Shipping	Aviation
Start of production	2023 (alpha) 2026 (beta)	2023	n/a	2025[3)]	2024	2023	2027	2023	2022	n/a	n/a	n/a	n/a
Electrolysis Technology	SOEC	LTE	LTE	LTE	n/a	LTE	n/a	LTE	LTE	n/a	PEM	n/a	n/a

Production capacity > 450 million liters / year (0.8% of EU jet fuel demand) announced until 2027

* This list is exemplary and does not cover all planned PtL projects.

Source: VDMA

German hydrogen strategy

- The German national hydrogen strategy was launched in 2020 and will be updated this year. It
  - focuses on **scaling-up & application of H_2** as essential,
  - increases of the electrolysis target to **10 GW by 2030**,
  - facilitates **international trade** by establishing H_2 energy partnerships with future producer countries
- Hydrogen will be mostly used in industry applications (steel & chemical sector) and transport (heavy duty, shipping & aviation). Germany launched a blending mandate for 2% of synthetic kerosene by 2030.

The European Green Deal

The Green Deal is the central strategy to transition towards climate neutrality. It aims at reconciling ambitious climate targets and a strategy for industrial growth. For P2X, it provides many opportunities:

- **EU Hydrogen Strategy** and its 2 x 40GW objective
- **The Fit-for 55 Package**
  REDII-Revision with RFNBO quotas for 2030 in transport and industry | Renewable fuels for aviation & maritime shipping | Revision of the Energy Tax Directive | A new “fuels” emission trading system | A gas package setting up a regulatory framework for hydrogen
- **RePowerEU**
  To decrease dependency from Russian energy imports the EU aims to increase the availability of hydrogen up to 20 mt by 2030 (equals 278 GW)

Source: Shutterstock

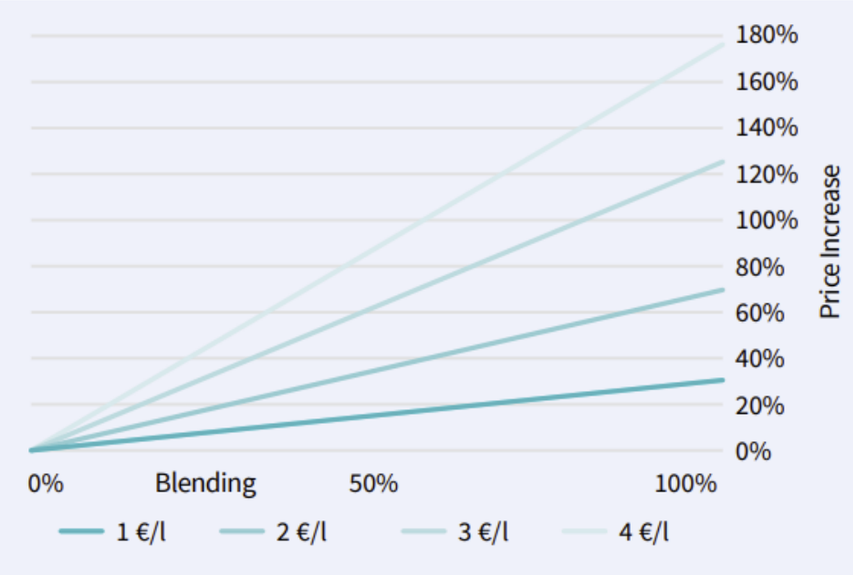
EU initiative: Making Aviation more sustainable

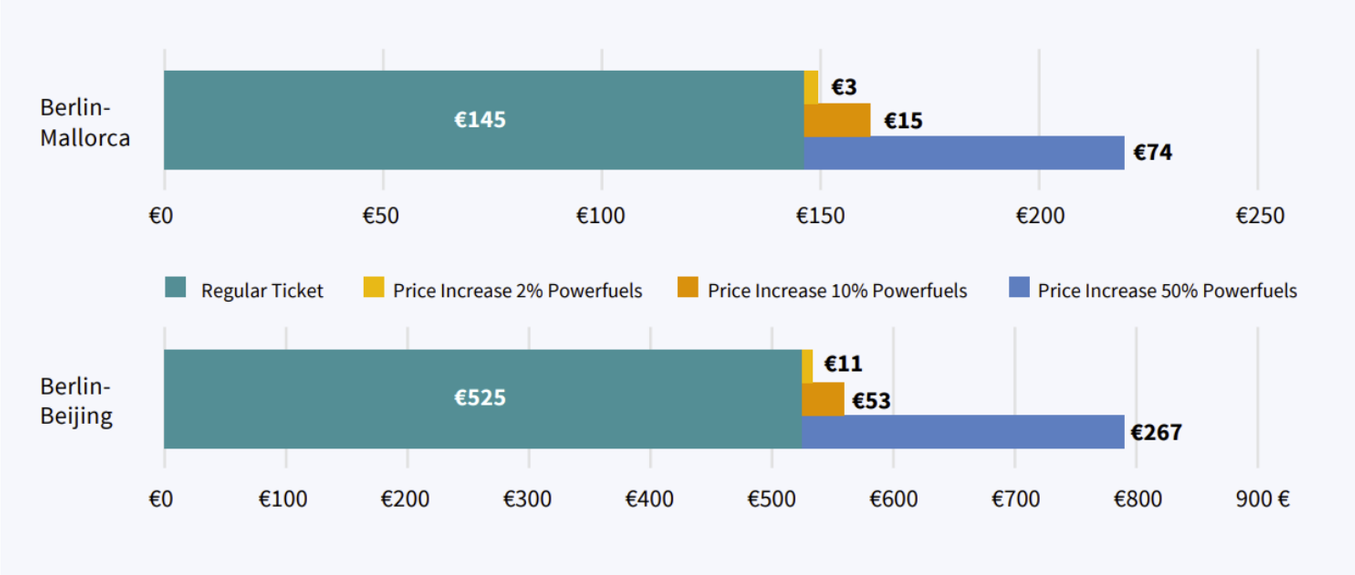
ReFuelEU Aviation

- EU initiative with an obligation for airlines and fuel suppliers to gradually increase the share of SAFs.
- The blending mandate concerns both flights within the EU and flights connecting EU airports and airports from third countries.

Shares in the fuel mix (in %)	2025	2030	2035	2040	2045	2050
SAF ramp-up out of which:	**2**	**5**	**20**	**32**	**38**	**63**
Sub-mandate - advanced biofuel (incl. waste lipids)	2	4.3	15	24	27	35
Sub-mandate – green synthetic fuels	-	0.7	5	8	11	28

The costs of PtL is high – but the effects can be minimised

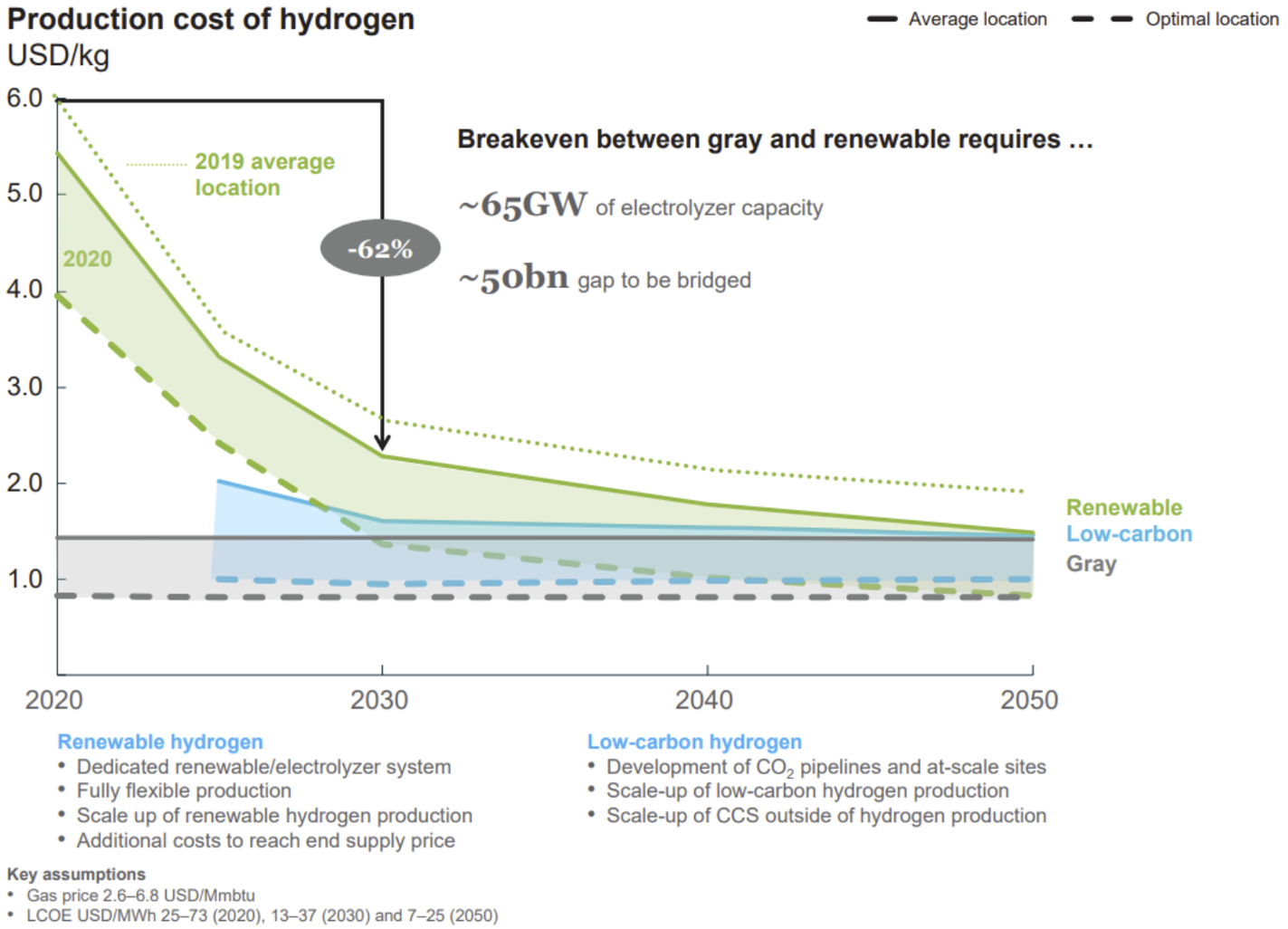




- The cost for airline tickets increase depending on the specific cost estimates for PtL and the degree of blending
- To compensate for a doubling in the ticket price, the aviation would need a CO_2 price of 180 Euro.

Source: Powerfuel Alliance 2019

Renewable hydrogen could break even with grey H2 before 2030 in optimal regions

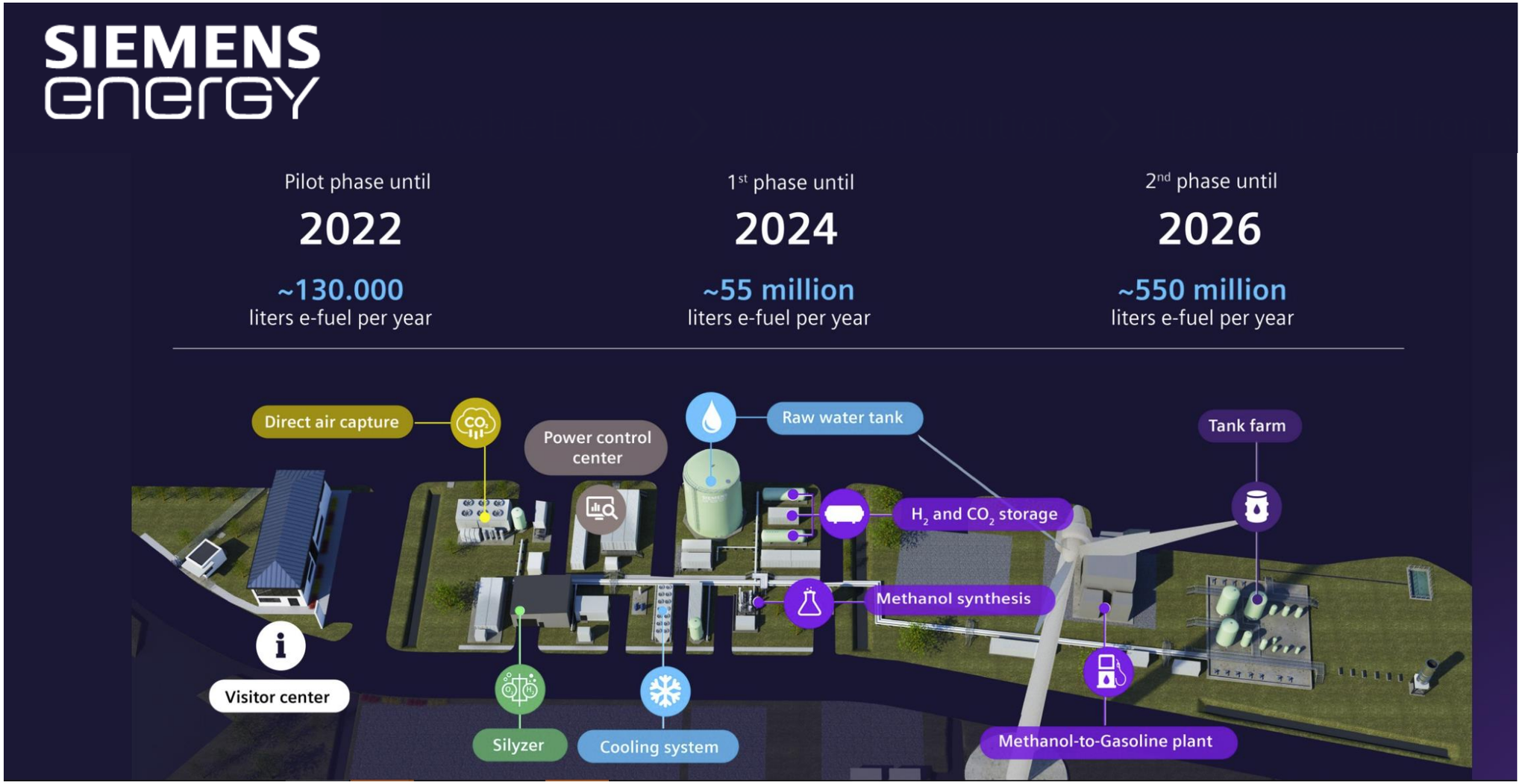


Three factors contribute to decreasing prices:

- Drop in CAPEX due to faster scale-up of electrolyzer supply chains
- Decrease of levelized cost of energy (LCOE) in optimal locations (best locations include Spain, Chile, and Middle East)
- More large-scale, integrated renewable hydrogen projects achieving higher electrolyzer utilization levels

Source: Hydrogen Insights, 2021; pg. 12

Fuel from wind and water: E-fuel pilot plant in Chile



That's enough fuel for over one million people to drive their car for nearly a year!

Source: Siemens Energy

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Federal Ministry for Economic Affairs and Climate Action

Murihiku Regeneration

Panel Discussion

AHK Repräsentanz der Deutschen Wirtschaft German-New Zealand Chamber of Commerce Inc.

Federal Ministry for Economic Affairs and Climate Action

Murihiku Regeneration

Dr Michael Feiner

Deputy Head of Mission

German Embassy in Wellington

Sir Tipene O‘Regan

Ngai Tahu, Upoko o Awarua

2022 New Zealander of the Year

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Federal Ministry for Economic Affairs and Climate Action

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Ngā mihi nui
Vielen Dank
Thank You

for joining our event

German Green Energy Solutions

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