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Scottish Government



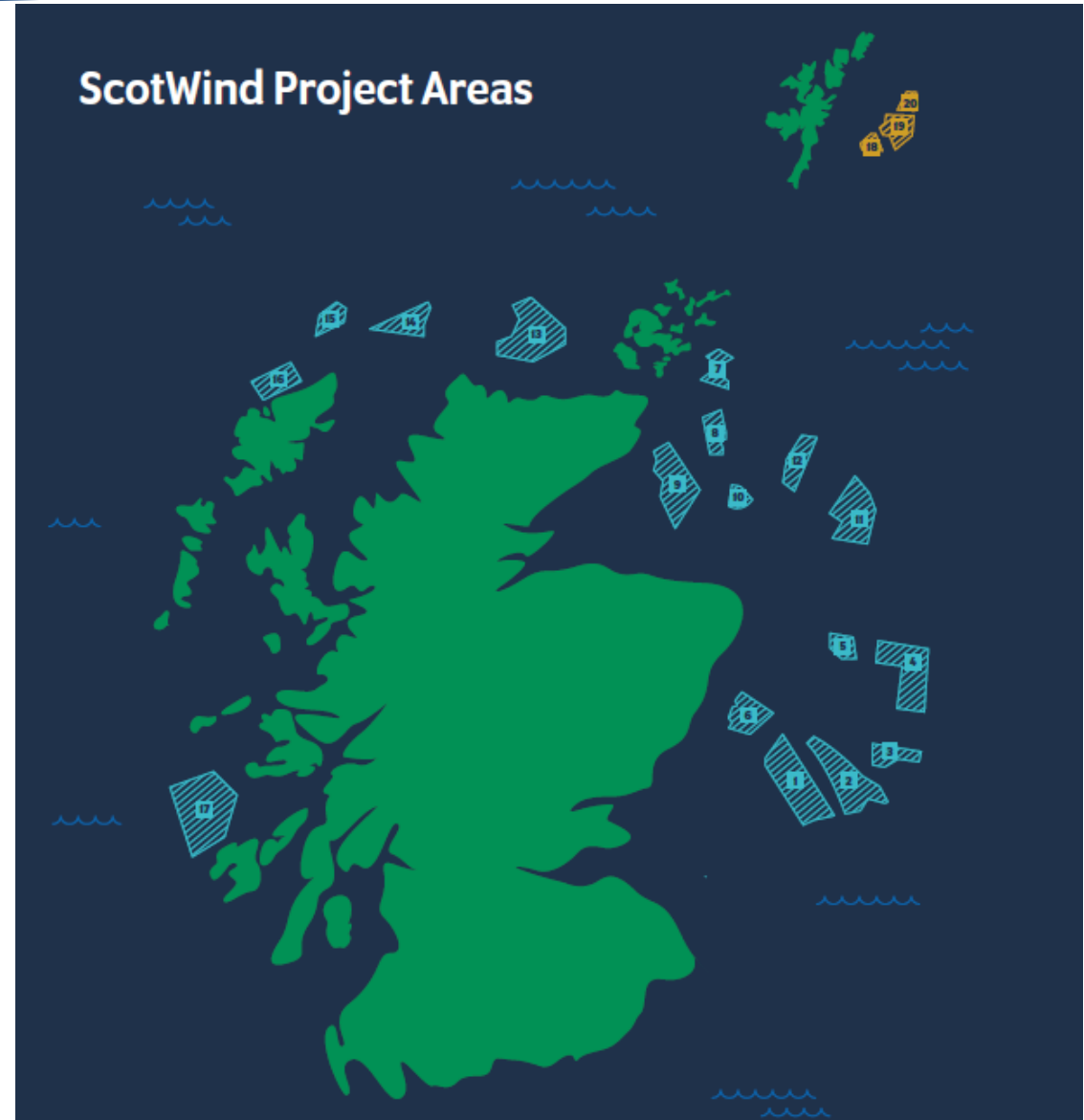
# Scottish Hydrogen Policy



- **Ambition of 5GW installed hydrogen production capacity by 2030 and 25GW by 2045**
- Significant proportion of UK ambition for 10GW by 2030 will come from Scotland
- Supported by UK and Scottish investment package
  - Net Zero Hydrogen Fund, Hydrogen Business Model, Emerging Energy Technologies Fund
- Both renewable and low-carbon hydrogen will play an important role in our transition to net zero in 2045
- Vast renewable resources in Scotland will support both a domestic and export market for hydrogen



- Scotland is already a net exporter of electricity
- The amount of **renewable electricity generated** in **Scotland** in **2021** is the equivalent of **powering all households in Scotland** for almost **three years**.
- Significant opportunity for green hydrogen production



# Learning by doing

## End User

- **01** Eden Mill distillery
- **02** Glasgow Hydrogen Gritters
- **03** HECTOR project
- **04** HyDIME
- **05** HyFlyer
- **06** HySeas III
- **07** HySpirits
- **08** HyTransit Project – Aberdeen Hydrogen Buses
- **09** Hytrec and Hytrec2
- **10** Kirkwall Airport Decarbonisation
- **11** Liquid Organic Hydrogen Carriers (LOHC) for the transportation of hydrogen
- **12** Project HyLaddie
- **13** Scottish Hydrogen Train project
- **14** TimberLINK
- **15** Uist Distilling Company
- **16** HIMET

## Multi-vector

- **17** Aberdeen Hydrogen Hub
- **18** Aberdeen Vision
- **19** BIG HIT
- **20** GENCOMM – AD
- **21** ITEG – Integrating Tidal Energy into the European Grid
- **22** North of Scotland Hydrogen Programme
- **23** OHLEH – Outer Hebrides Local Energy Hub
- **24** Orion Project
- **25** PITCHES
- **26** ReFLEX (Responsive Flexibility) Project
- **27** SWIFTH2
- **28** The PURE Project
- **29** Flotta Hydrogen Hub
- **30** Inverness hydrogen transport hub
- **31** Argyll Hydrogen Hub
- **32** GreenNH3

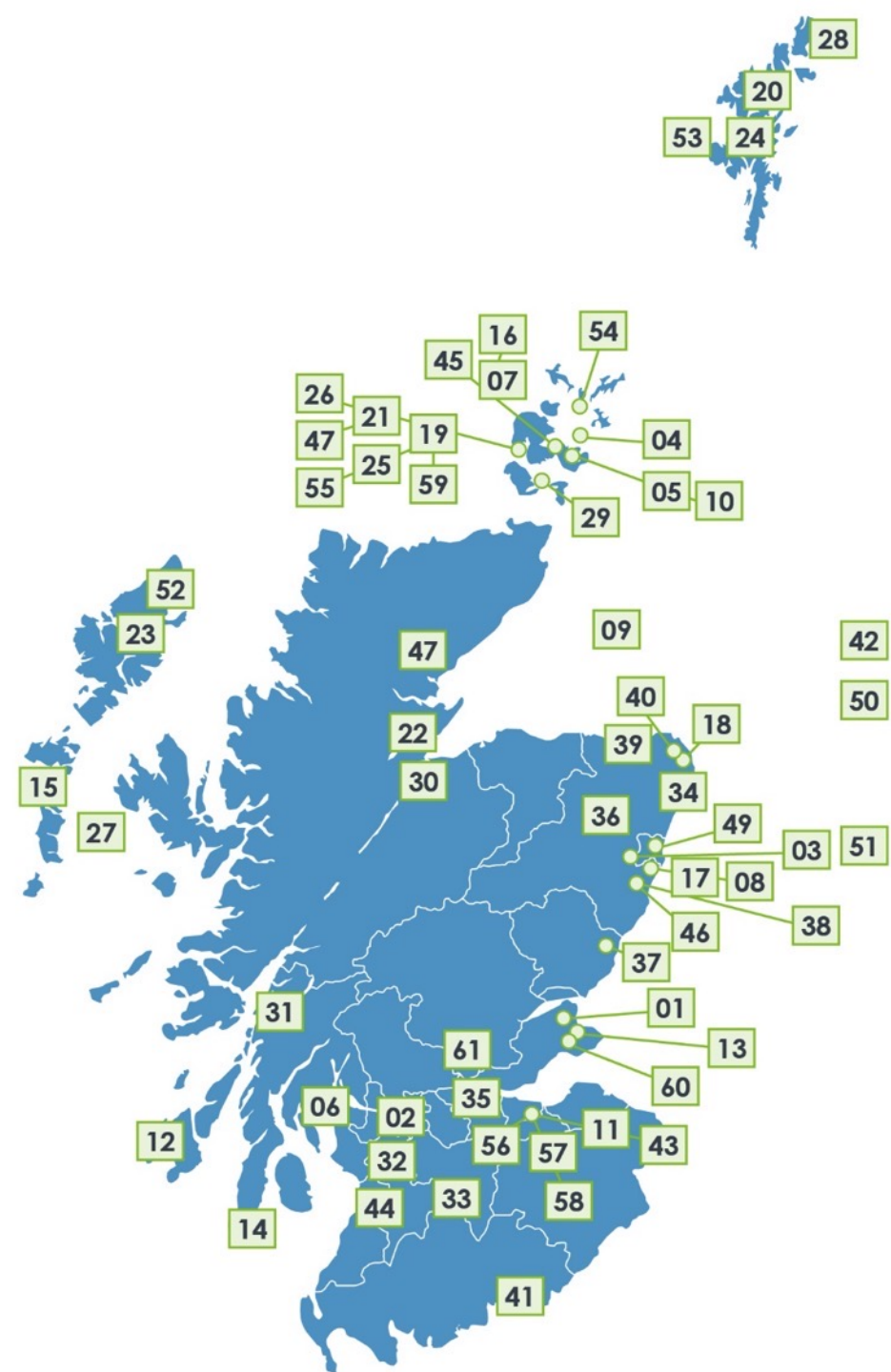
- **33** Hy2Go
- **34** Holistic Low-Carbon Energy Facility/ Renewable Energy Village
- **35** INEOS Low-Carbon Hydrogen Plant
- **36** Inverurie Energy Hub

## Production

- **37** Arbikie Distillery
- **38** Aberdeen City Hydrogen Energy Storage (ACHES)
- **39** Acorn CCS
- **40** Acorn Hydrogen
- **41** Chapelcross Initiative
- **42** Dolphyn Project
- **43** Edinburgh International Festival decarbonisation project
- **44** Green Hydrogen for Glasgow
- **45** Hammars Hill Green Ammonia project
- **46** Kittybrewster Refuelling Station
- **47** Surf 'n' Turf
- **48** Gordonbush Hydrogen Demonstrator Project
- **49** Hydrogen Turbine 1 (HT1)
- **50** ERM Dolphyn – Commercial scale demonstration
- **51** Project Haldane
- **52** Comhairle nan Eilean Siar – Net Zero Hub
- **53** Northern Horizons

## Storage

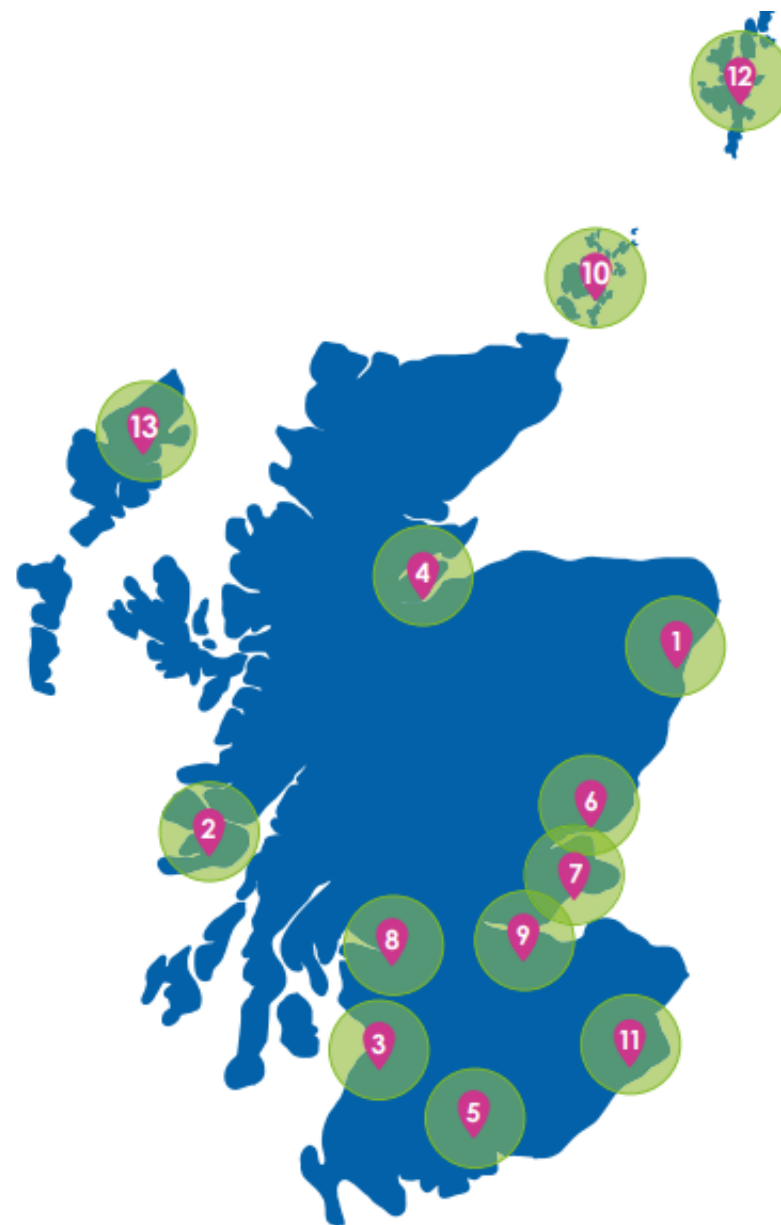
- **54** Eday Flow Cell Battery Project
- **55** HyAI
- **56** HyStorPor Project
- **57** HyProducer: Cascade Tank System for Hydrogen Storage & Delivery from LOHC
- **58** Bulk scale storage and transportation of hydrogen using LOHC
- **59** SHyLO: Solid Hydrogen at Low pressures
- **Transmission/distribution**
- **60** H100 Fife project
- **61** Local Transmission System – Grangemouth to Granton



# Regional Hydrogen Hubs

Scotland is actively supporting the creation of Regional Hydrogen Hubs across the country that are host to the entire hydrogen value chain, from production, storage and distribution to end-use.

1. **ABERDEEN**
2. **ARGYLL & ISLANDS**
3. **AYRSHIRE**
4. **CROMARTY**
5. **DUMFRIES & GALLOWAY**
6. **DUNDEE**
7. **FIFE**
8. **GLASGOW**
9. **GRANGEMOUTH**
10. **ORKNEY**
11. **SCOTTISH BORDERS**
12. **SHETLAND**
13. **WESTERN ISLES**



# SCOTLAND'S REGIONAL HYDROGEN HUBS

1



## ABERDEEN

- One of Europe's most pioneering hydrogen cities
- Two public refuelling stations and one of Europe's largest hydrogen fleets
- Ambitious hydrogen production projects in planning
- New South Harbour – the UK's largest marine infrastructure project
- Energy Transition Zone (ETZ) – catalyst for high-value manufacturing, R&D & hydrogen development
- Other projects include Dolphyn (ERM), VT1 (Vattenfall), ACORN (Storegga) and North East Vision (SGN)

2



## ARGYLL & ISLANDS

- Plans to establish a green hydrogen production and distribution site at Machrihanish Airbase
- Former military aerodrome
- Community-owned business park
- Vast development space
- Over 1000 acres (400+ hectares) of properties, development land and assets
- Airport on site

3



## AYRSHIRE

- Emerging hub of hydrogen activity
- Several projects looking at production and end-use of hydrogen and derivatives
- Hunterston–
  - ideal landing point for nearby offshore wind farms
  - Vast industrial options for hydrogen production and export
  - Strong grid connections
  - Existing marine infrastructure
- Prestwick Aerospace
  - Home to Scotland's aerospace sector
  - Aviation as key end-user



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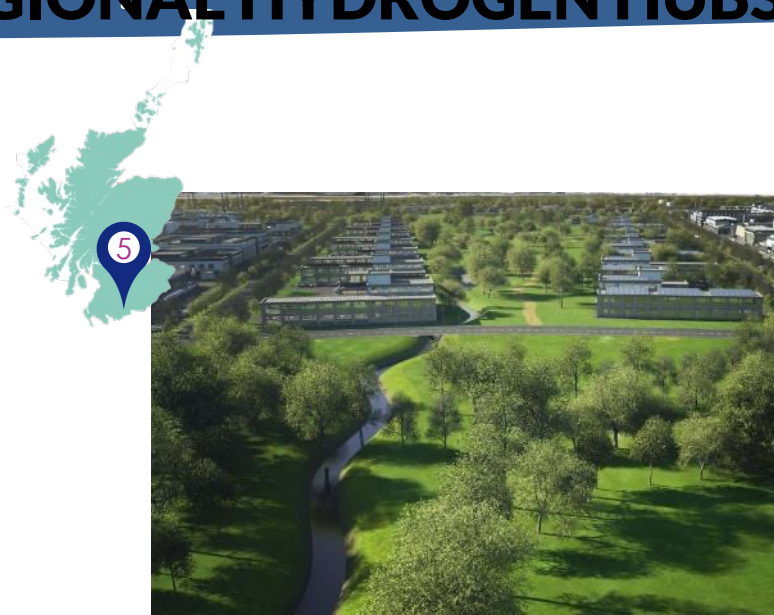


# SCOTLAND'S REGIONAL HYDROGEN HUBS



## CROMARTY

- Driving ambition for region to become a hydrogen economy
- Home to the North of Scotland Hydrogen Programme
- State-of-the-art hub to produce, store and distribute green hydrogen at scale
- Will service the local area and UK and export to Europe
- Proximity to large-scale renewable electricity supply
- Huge local demand from distilleries, industry, transport and domestic
- Skilled and experienced supply chain



## DUMFRIES & GALLOWAY

- Produces 11% of Scotland's renewable energy
- Offers easy access to existing gas transmission pipelines and future 'Project Union' and 'European Backbone' transmission infrastructure
- Existing hydrogen supply chain cluster, including hydrogen-enabled industrial boilers
- Key development sites include Chapelcross – which offers up to 500 acres



## DUNDEE

- Ambitions to deploy hydrogen production, refuelling infrastructure and hydrogen vehicle fleets
- Proximity to offshore windfarms
- Michelin Scotland Innovation Parc (MSIP) – focused on driving innovation and R&D in sustainable mobility and low carbon energy
- MSIP offers industrial spaces, cutting-edge research facilities and a Skills Centre of Excellence



# SCOTLAND'S REGIONAL HYDROGEN HUBS



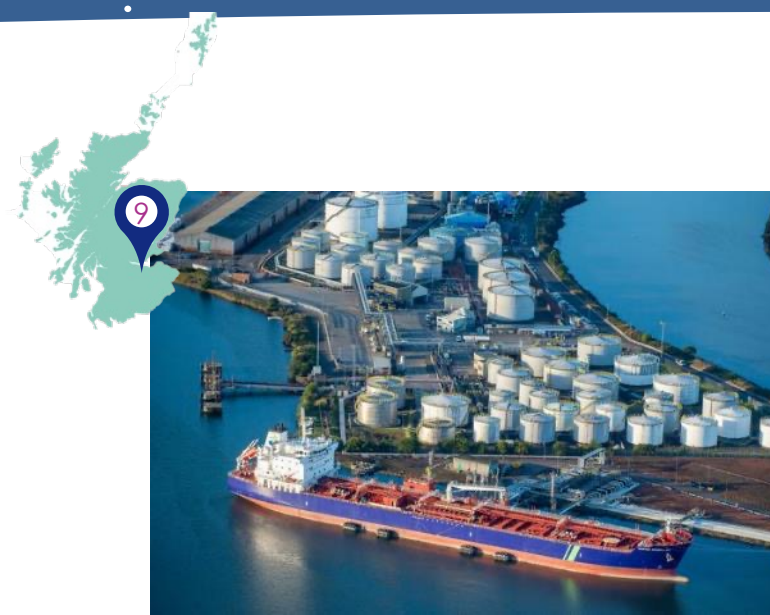
## FIFE

- H100 project to be deployed in 2023:
  - World-first 100% hydrogen network
  - Heat to 300 homes
  - Clean gas produced by a dedicated electrolysis plant
- Legacy of the Hydrogen Office:
  - Launched in 2011 with a 750kW wind turbine and 30kW electrolyser
  - Added a solar PV, smart microgrid, fleet of 17 hydrogen vehicles, 250kW of electrolysis and 100kW fuel cell



## GLASGOW

- Scotland's largest city
- Sustainable Glasgow initiative – net zero by 2030
- Projects include hydrogen refuse collection vehicles and new refuelling infrastructure
- Whitelee wind farm, one of Europe's largest onshore wind farms, will be home to the UK's largest electrolyser (20MW)
- Hy2Go project – green hydrogen production and refuelling park off the M74 motorway



## GRANGEMOUTH

- Scotland's largest industrial area
- Huge opportunity to decarbonise
- New energy plant due to commission in late 2023 – designed to fuel switch to hydrogen in the future
- Large-scale hydrogen production plant will export captured carbon offshore for permanent storage via the ACORN project
- SGN project could repurpose existing pipeline to transport hydrogen to Edinburgh





# SCOTLAND'S REGIONAL HYDROGEN HUBS



## ORKNEY

- Flotta Hydrogen Hub – ambitious multi-billion project
- Industrial-scale green hydrogen production on an existing oil terminal
- Will export hydrogen to Europe and the UK gas grid at St Fergus by 2030
- Forms the foundation for an International maritime green hydrogen refuelling hub



## SCOTTISH BORDERS

- Large onshore windfarms in the region
- Proximity to offshore windfarms on Scotland's East Coast
- Easy access to the European Hydrogen Backbone initiative
- Gas transmission pipelines to England
- 'Project Union' infrastructure
- Strong electrolyser supply chain potential from local engineering firms



## SHETLAND

- ORION Clean Energy Project – world-leading clean energy hub
- Maximises wind, wave and tidal resources
- Green energy to power homes, businesses and vehicles
- Electrify oil and gas installations
- Serve hydrogen export markets
- Existing infrastructure includes Shetland Gas Plant and Sullom Voe, a deepwater port/oil terminal

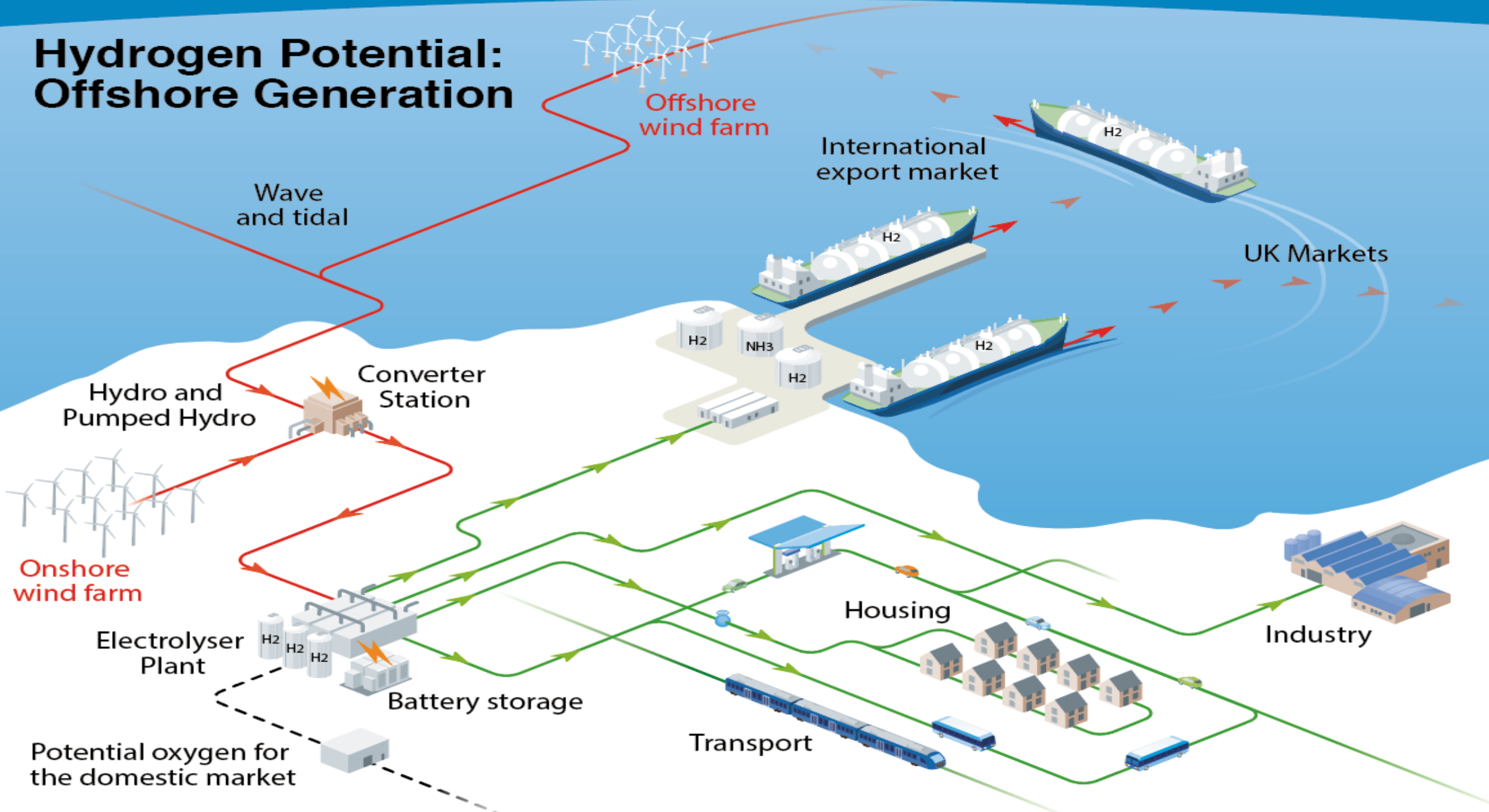


## WESTERN ISLES

- Hydrogen production, storage and distribution opportunities
- The Outer Hebrides Energy Hub – maximise the islands' abundant onshore and offshore wind resources
- Will produce green hydrogen to power the islands
- Export to the UK domestic and international markets
- Experienced maritime infrastructure



# Hydrogen Potential: Offshore Generation



Offshore wind farm

Wave and tidal

International export market

UK Markets

Converter Station

Hydro and Pumped Hydro

Onshore wind farm

Electrolyser Plant

Battery storage

Potential oxygen for the domestic market

Housing

Transport

Industry

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$H_2$

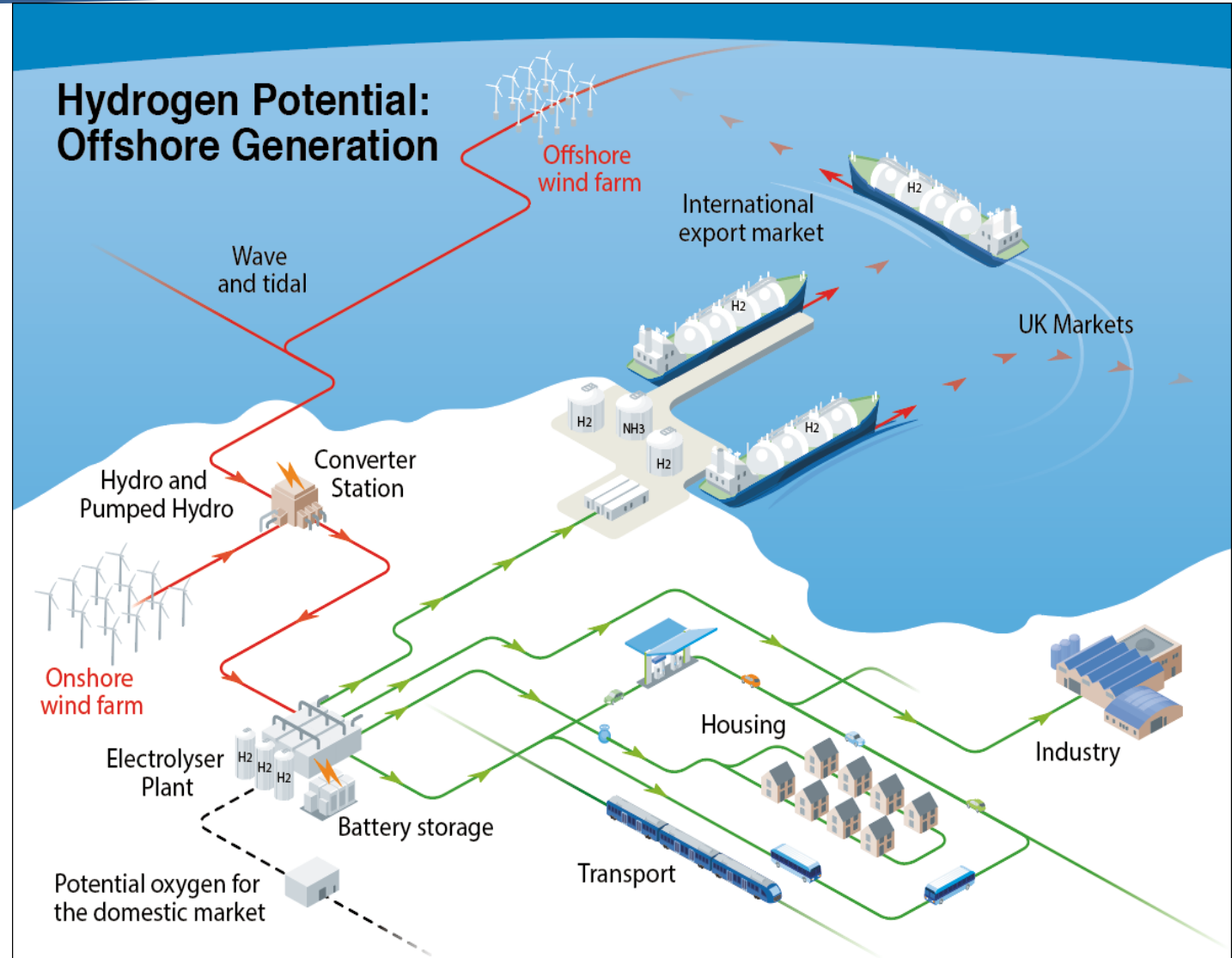
$H_2$

$H_2$

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# Scottish Hydrogen Economy

- ✓ Abundant natural resources
- ✓ Experienced energy exporter
- ✓ Skilled energy supply chain
- ✓ Research and innovation expertise
- ✓ Supportive policy environment





## SCOTLAND'S OPPORTUNITIES ELECTROLYSER MANUFACTURING

- Ideal location for electrolyser manufacturing to service Scotland's huge project pipeline and export markets
- Global leader in high value and advanced manufacturing
- Transformational investment in infrastructure, innovation and skills initiatives
- Opportunities for the integration of knowledge and skills hubs, training academies and research centres
- Range of sites suitable for large-scale manufacturing facilities
- Reduce your carbon footprint with Scotland's low carbon and green electricity

## SCOTLAND'S OPPORTUNITIES HYDROGEN STORAGE, CONVERSION AND DISTRIBUTION

- Opportunity for innovative technologies and equipment to store, convert and transport hydrogen
- Ideal location for Carbon Capture, Utilisation & Storage (CCUS) projects
- Proximity to offshore CO<sup>2</sup> storage resources
- Readily available natural gas supplies
- Existing oil and gas infrastructure and technical expertise
- Transferable skills from the oil and gas sector
- World-leading offshore and subsea expertise
- R&D and innovation facilities to support the development and deployment of new technologies



- [Hydrogen Action Plan](#)
- [Hydrogen Policy Statement](#)
- [2020 Hydrogen Assessment](#) report
- [Think Hydrogen, Think Scotland](#) (Scottish Hydrogen Investment Proposition)
- [Assessment of electrolysers: report](#)
- Guidance on [Emerging Energy Technologies Fund](#)

## Hydrogen Action Plan



Thank You

