

Valentia Island: Carbon to H₂-zero-emissions

Replacement of Fossil Fuels by H₂

Valentia Island: Carbon to H₂-zero-emissions

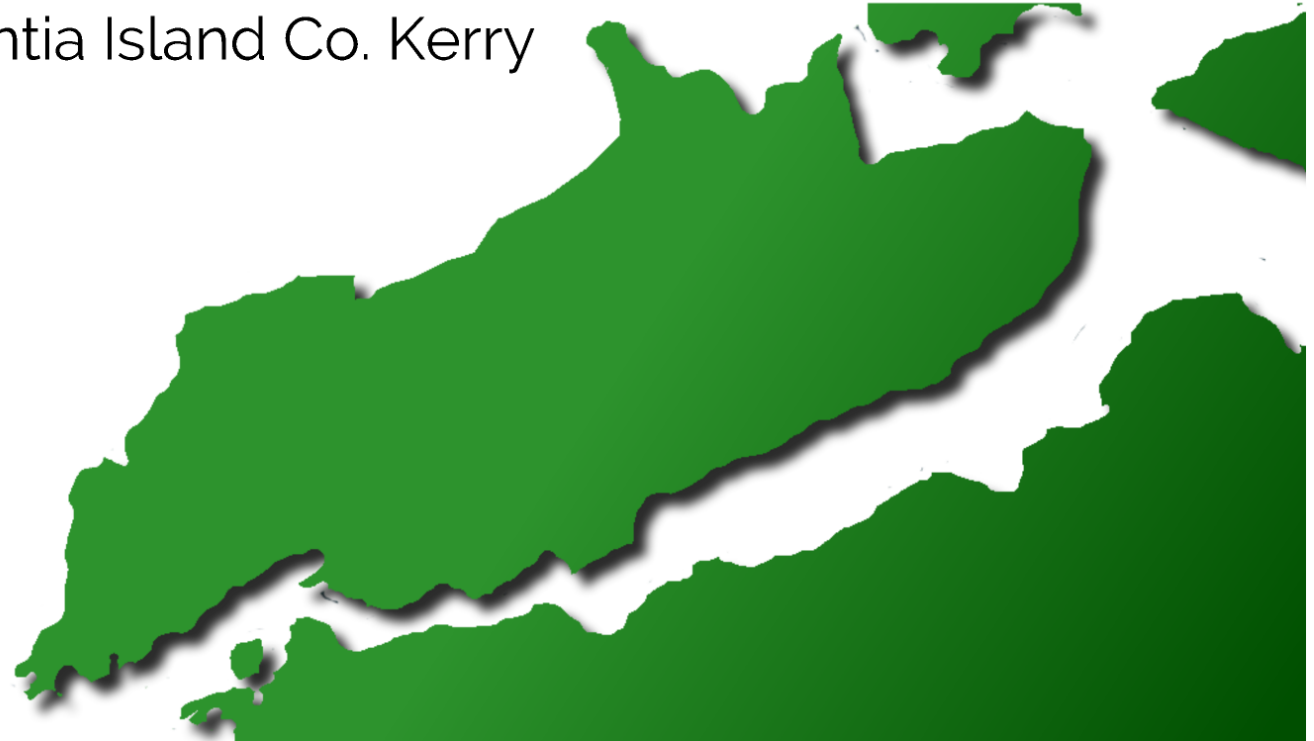
Replacement of Fossil Fuels by H₂

Valentia Island Co. Kerry

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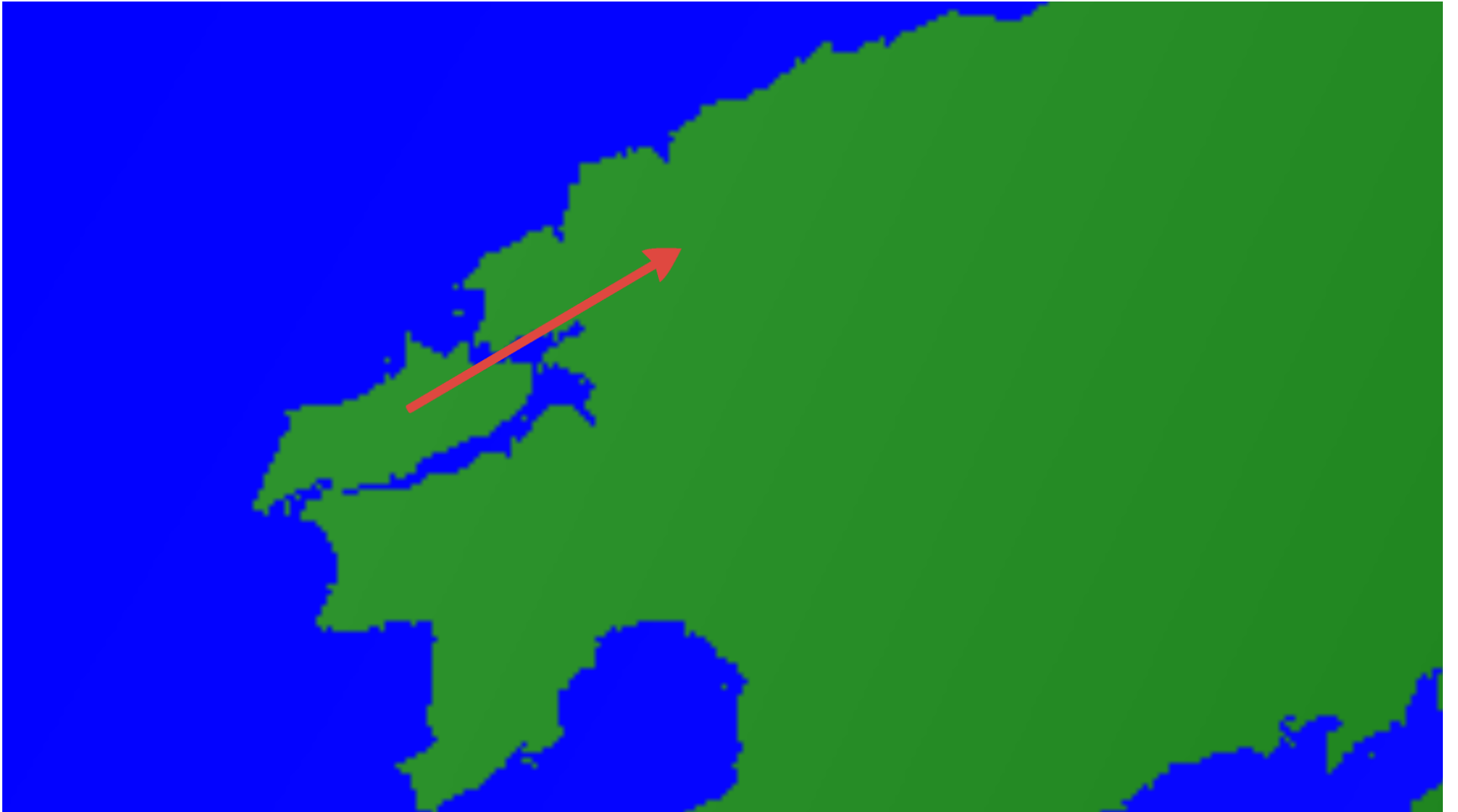


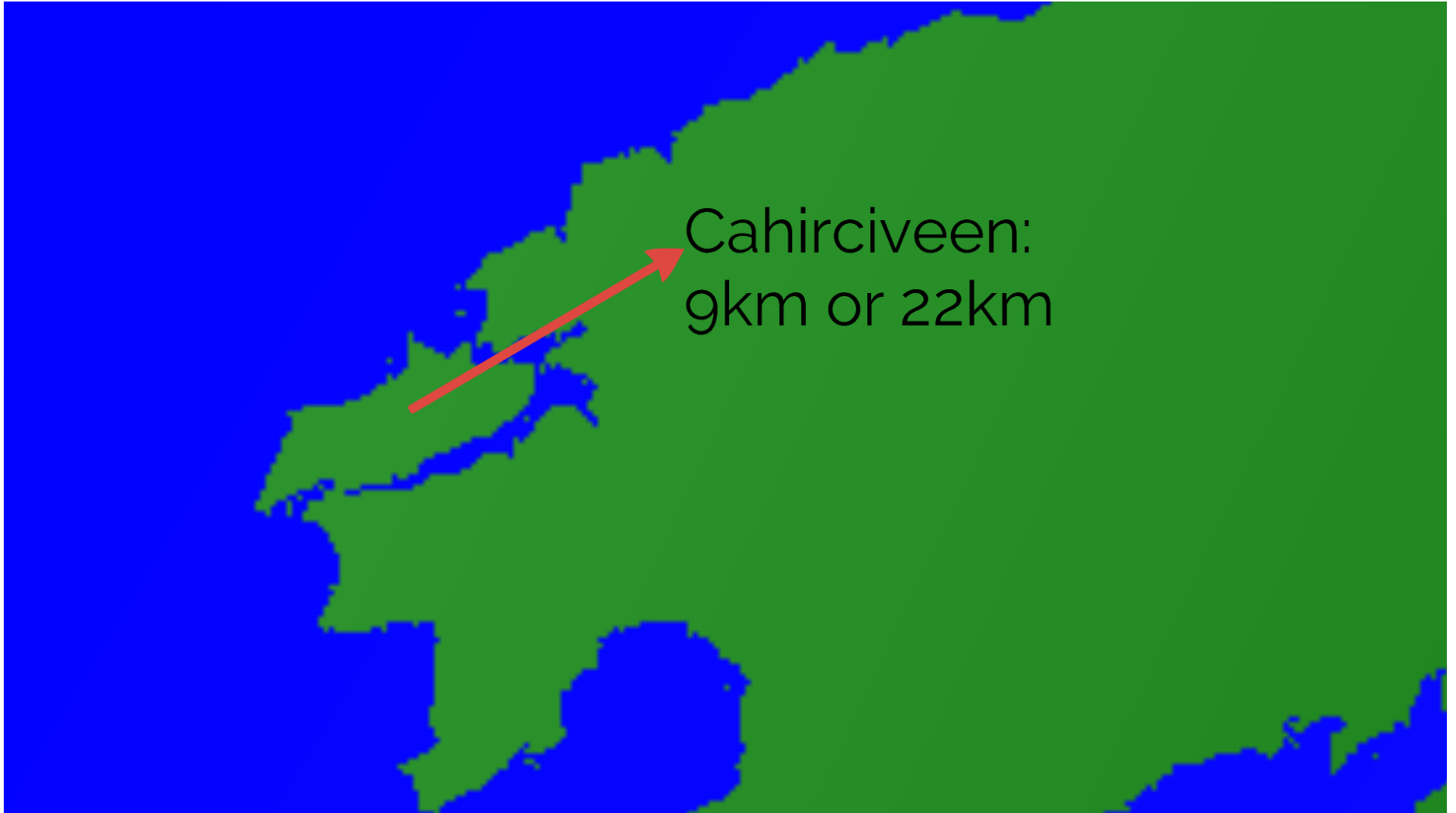
Geography & Transport

Geography & Transport













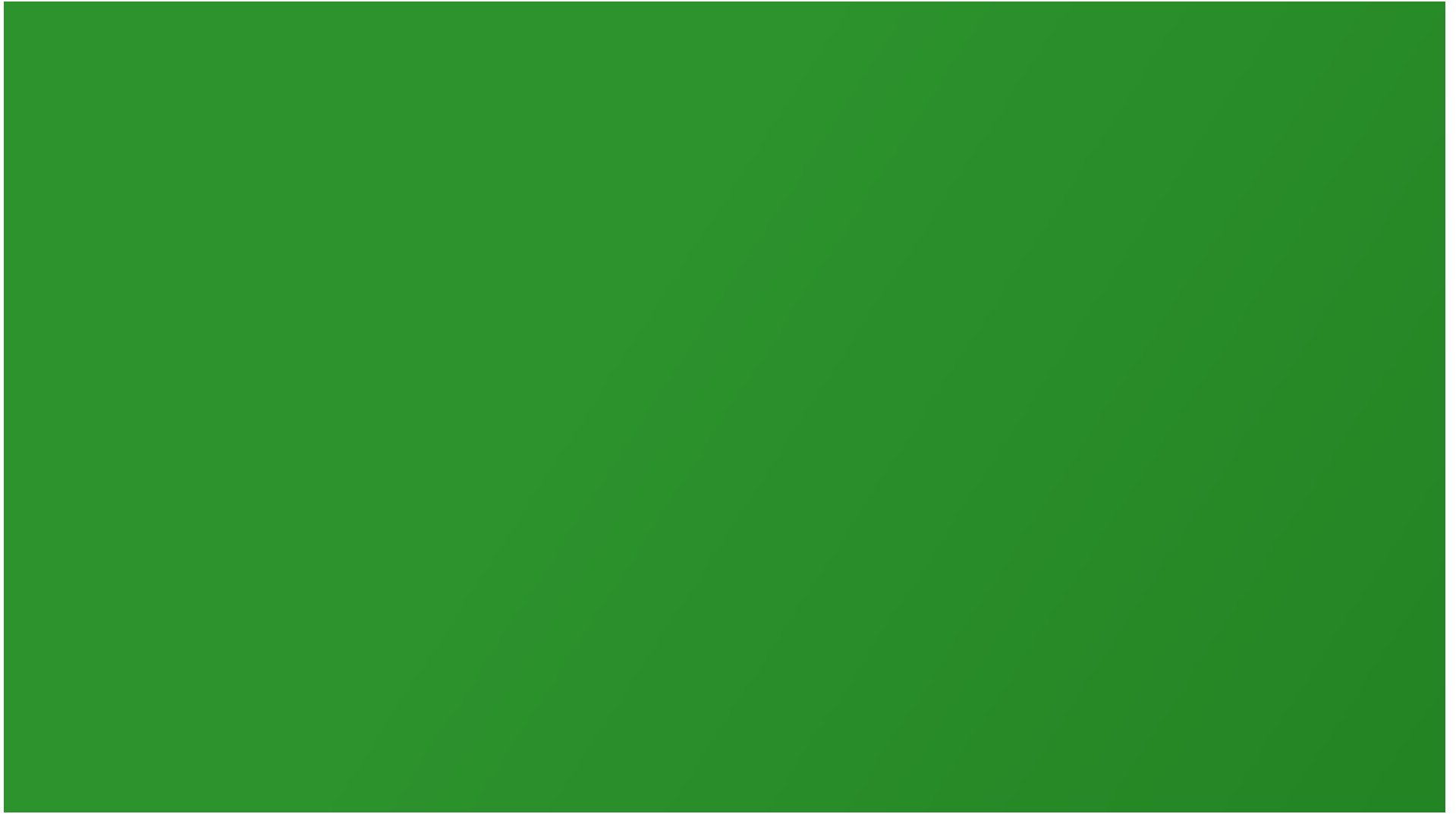












CSO 2016

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Population: 657

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Occupied Houses: 255 (39%)

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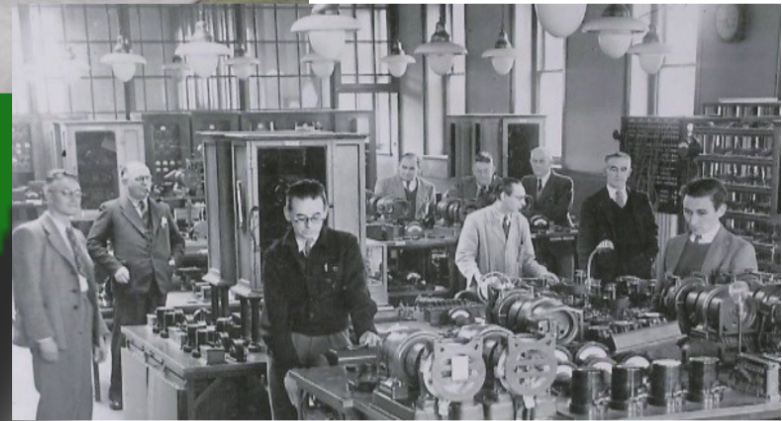
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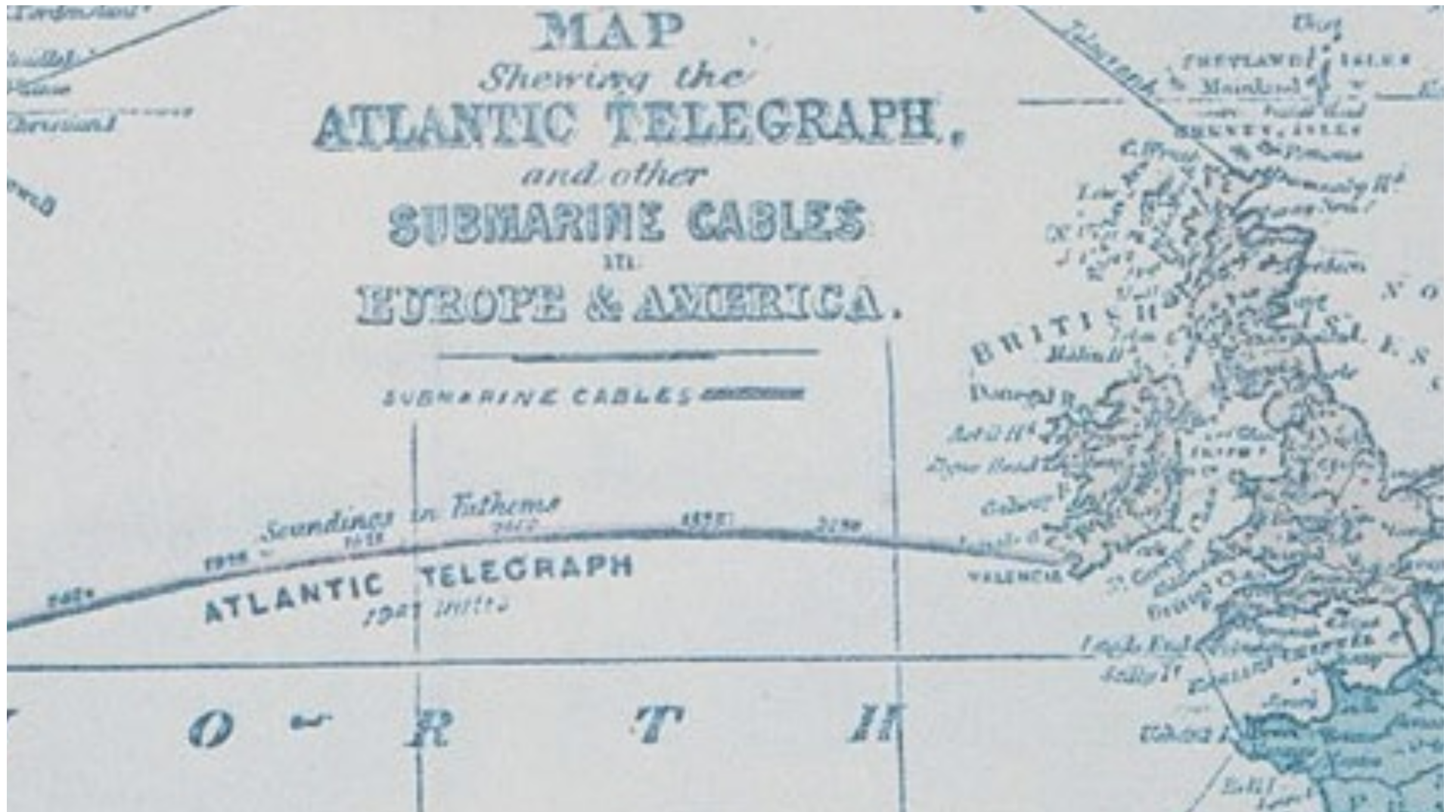
Unoccupied houses: 85 (13%)



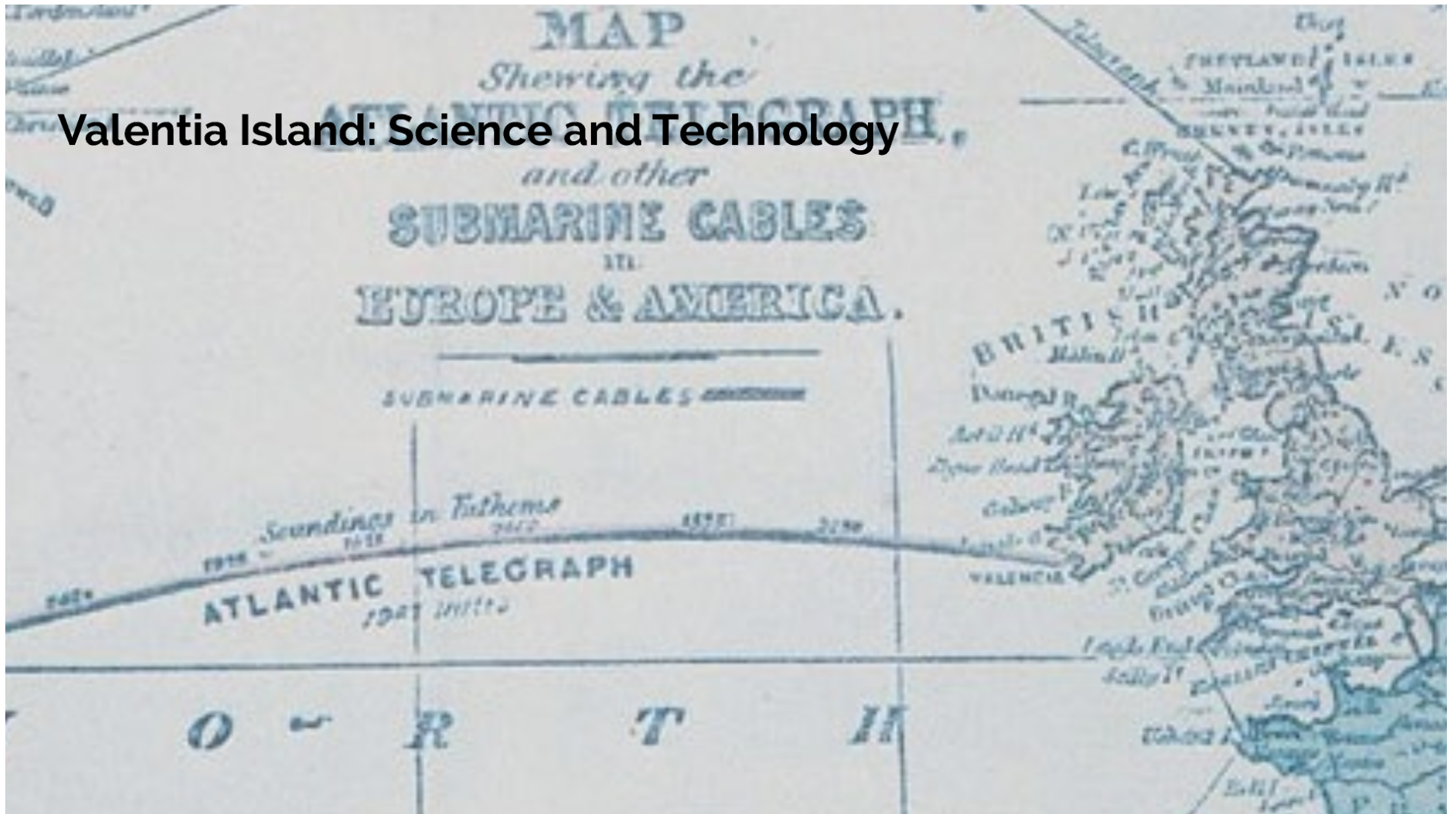


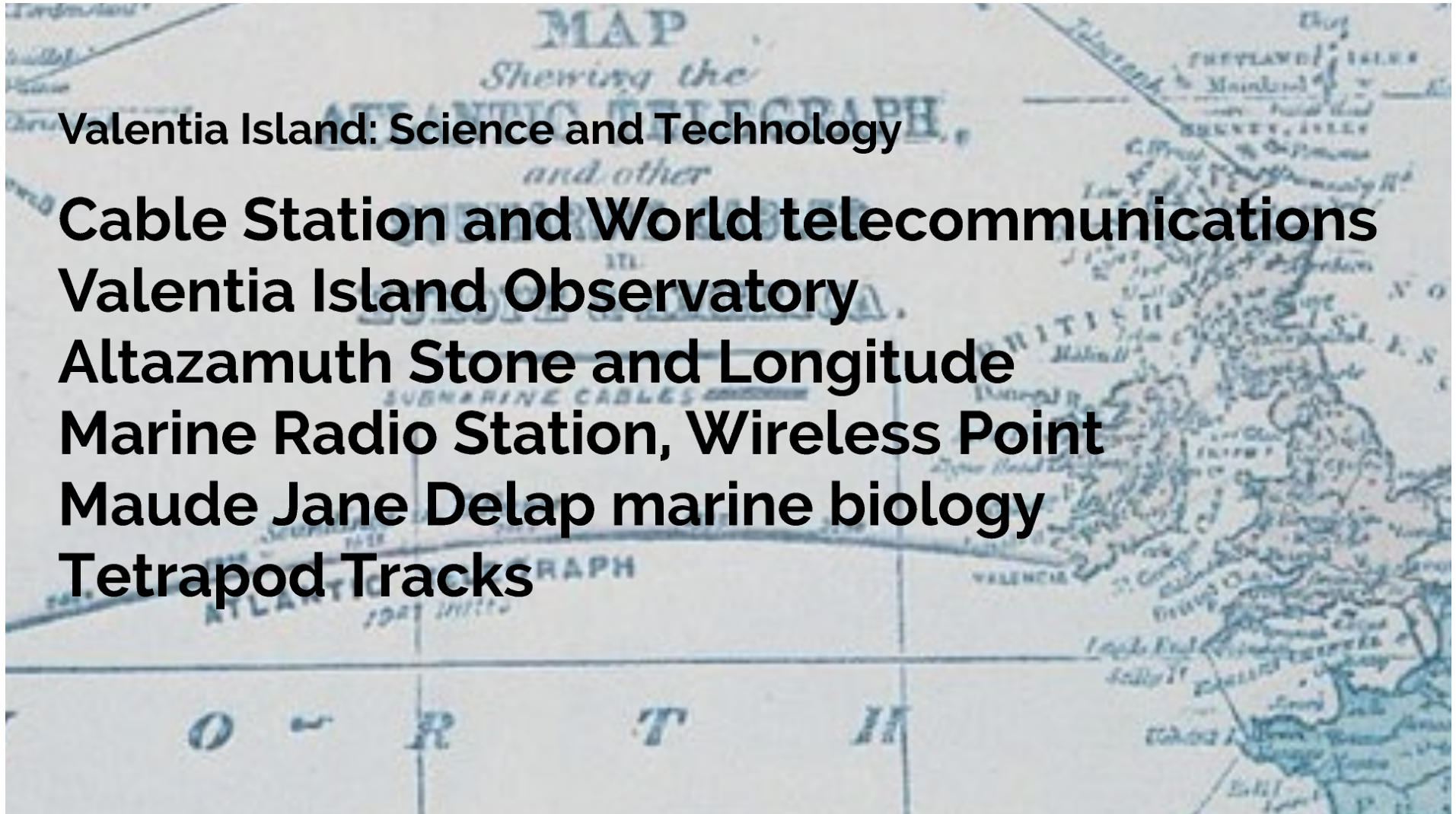






Valentia Island: Science and Technology





Valentia Island: Science and Technology

Cable Station and World telecommunications

Valentia Island Observatory

Altazimuth Stone and Longitude

Marine Radio Station, Wireless Point

Maude Jane Delap marine biology

Tetrapod Tracks

Valentia Island Development Committee
Valentia Island Sustainable Energy
Valentia Energy Master Plan (SEAI, XD Consulting,
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11 CONCLUSION & STRATEGY

Valentia Energy Co-op should be commended for proactively looking to improve energy efficiency and mitigate the impacts of climate change in the Valentia geographical area. Valentia Island has excellent energy savings opportunities across the island from small scale to large scale solutions as identified in this report and in particular in the Register of Opportunities. Improving Ireland's energy efficiency is a fundamental part of the Government's energy policy. The government have committed to achieve a 20% reduction in energy demand across the whole economy through energy efficiency measures by 2020. The object of the Energy Efficiency Directive (EED) is to help citizens, public authorities and business better manage their energy consumption. This Directive was transposed in to Irish legislation through the European Union (Energy Efficiency) Regulations 2014.

In addition to government policy, volatility in global energy prices is predicted to remain a constant feature in the global economy over the coming years. There are fact based predictions that recent very low oil price levels are not sustainable and future energy price volatility will remain a constant challenge over the next ten years and beyond. For these reasons Valentia Island Energy Co-op need to focus on two key areas:

1. Improving energy efficiency through the delivery of energy efficiency projects across all sectors of the island, and,
2. Deliver renewable energy solutions both small and large scale to reduce the dependence on fossil fuel based energy supplies

Valentia Island Strategic Objectives to 2023:

Listed below are 6 key strategy objectives for Valentia Energy Co-op:

1. Deliver a 20% reduction in energy consumption over 2017 levels by 2023.
2. Conduct a feasibility study on the potential of developing a renewable energy sourced hydrogen fuel cell ferry for Valentia Island. Energy Co-ops Ireland (ECI) identified the concept and will act as strategic partner on this initiative.
3. Implement cost effective renewable energy solutions in line with Government Policy and contribute towards meeting the requirement to have of 16% of energy consumption from renewable sources.
4. Seek out appropriate sources of funding to deliver energy efficiency projects, such as vendor financing, pay as you save mechanisms, energy service companies (ESCOs), etc. Similarly utilise government supports for energy efficiency projects including the energy efficiency obligations scheme, Department of Communications, Climate Action and Environment (DCCA) funding, SEAI grant aid, etc.
5. Implement a programme of education and awareness across the community to increase efficiency of energy use.
6. Ensure that all new buildings and refurbishment projects are as energy efficient as possible, and comply with current and future national guidelines and regulations pertaining to energy efficiency standards.

Valentia Island Development Committee Valentia Island Sustainable Energy Valentia Energy Master Plan (SEAI, XD C and Purthill Energy Consulting Ltd)

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Deliver renewable energy solutions both small and large scale to reduce the dependence on fossil fuel based energy supplies

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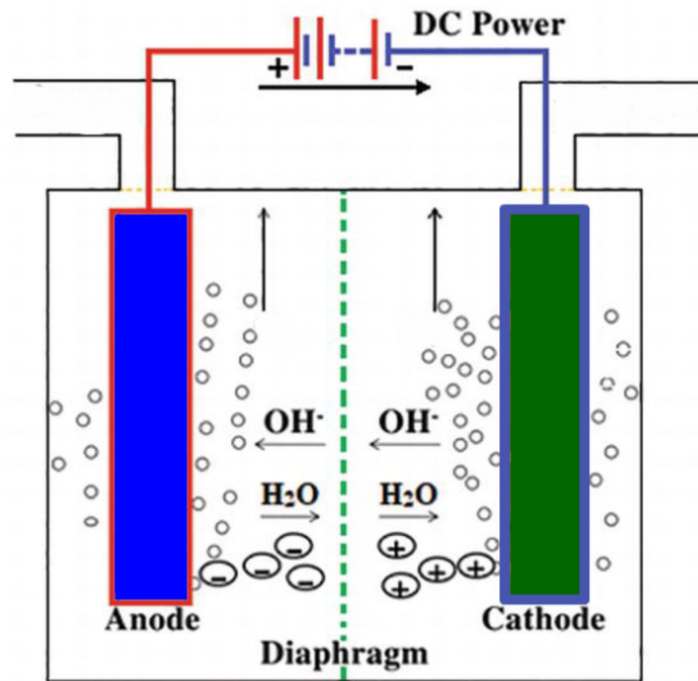
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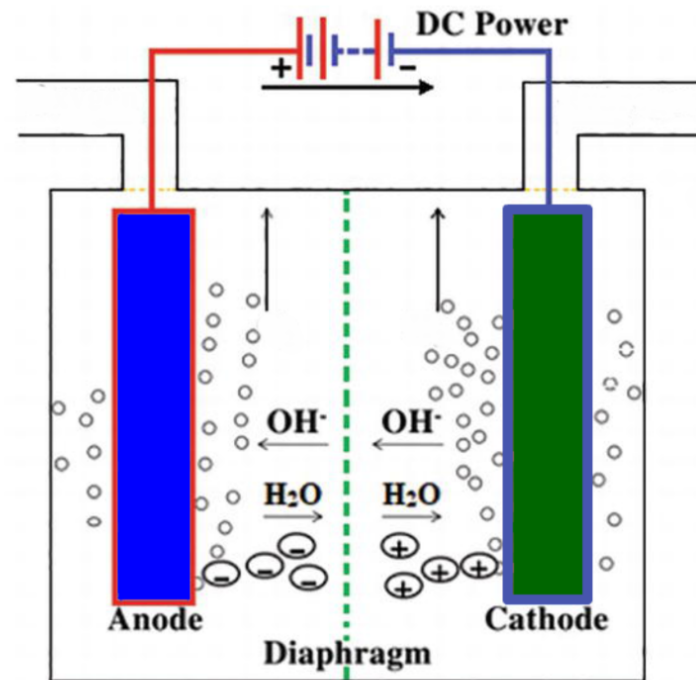
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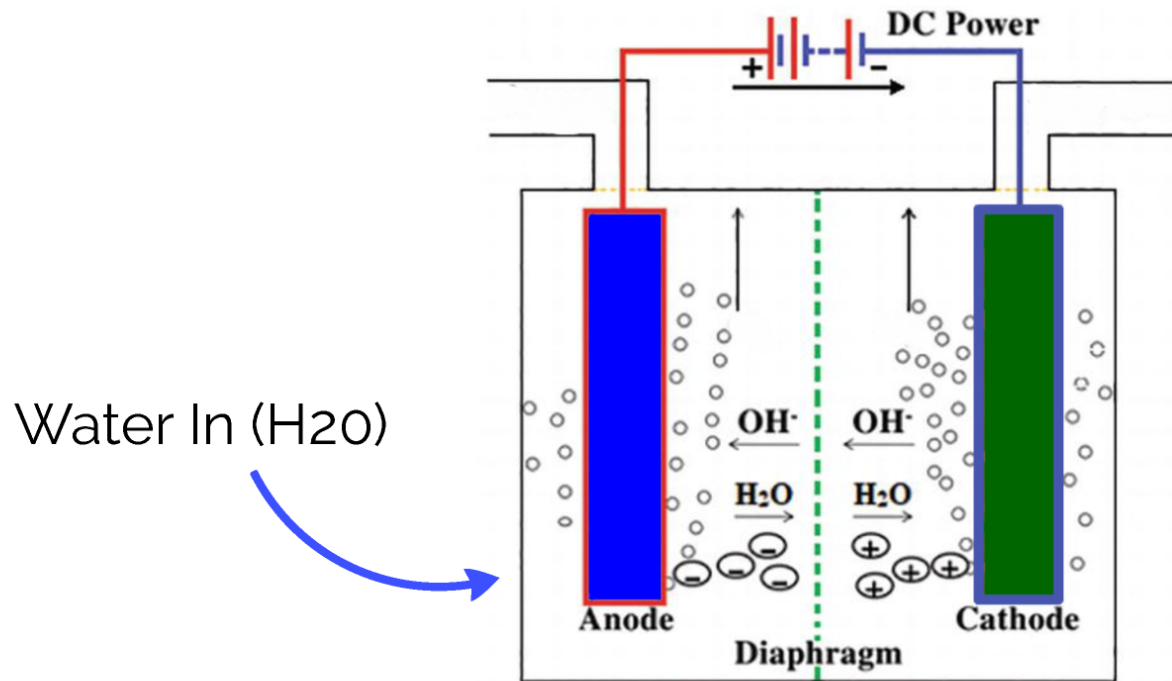
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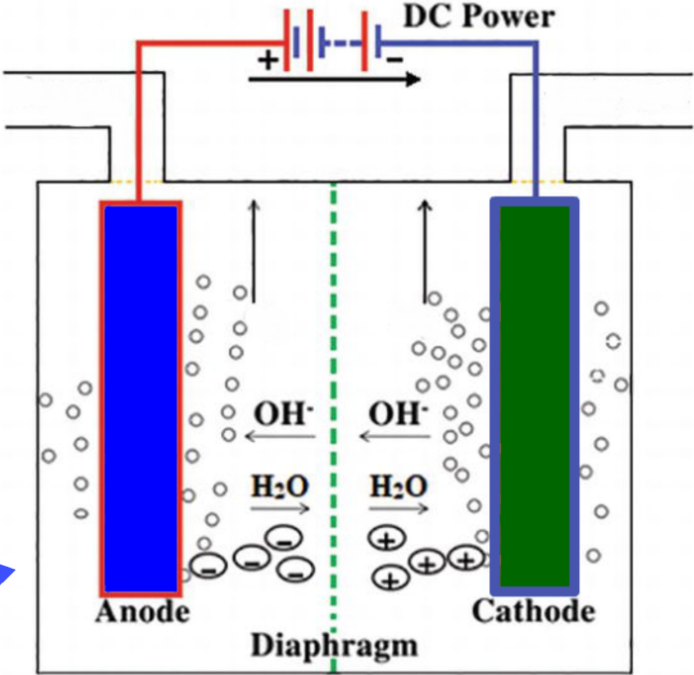


Water In (H₂O)

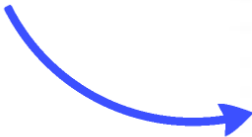




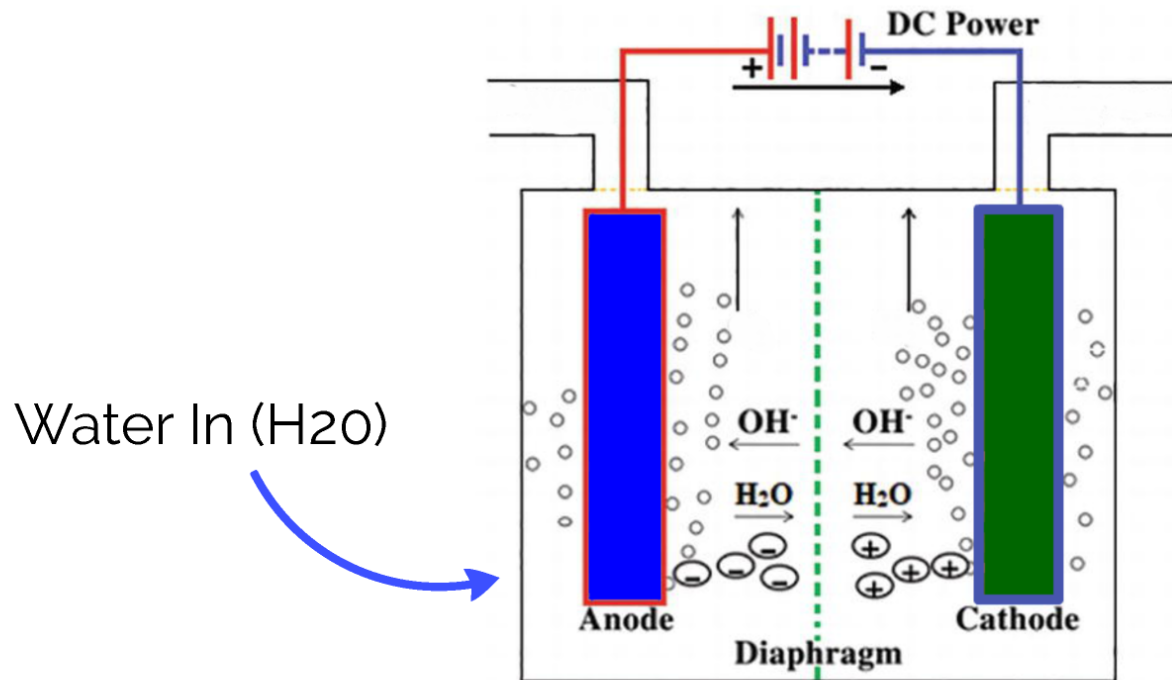
Electricity Supply In



Water In (H_2O)



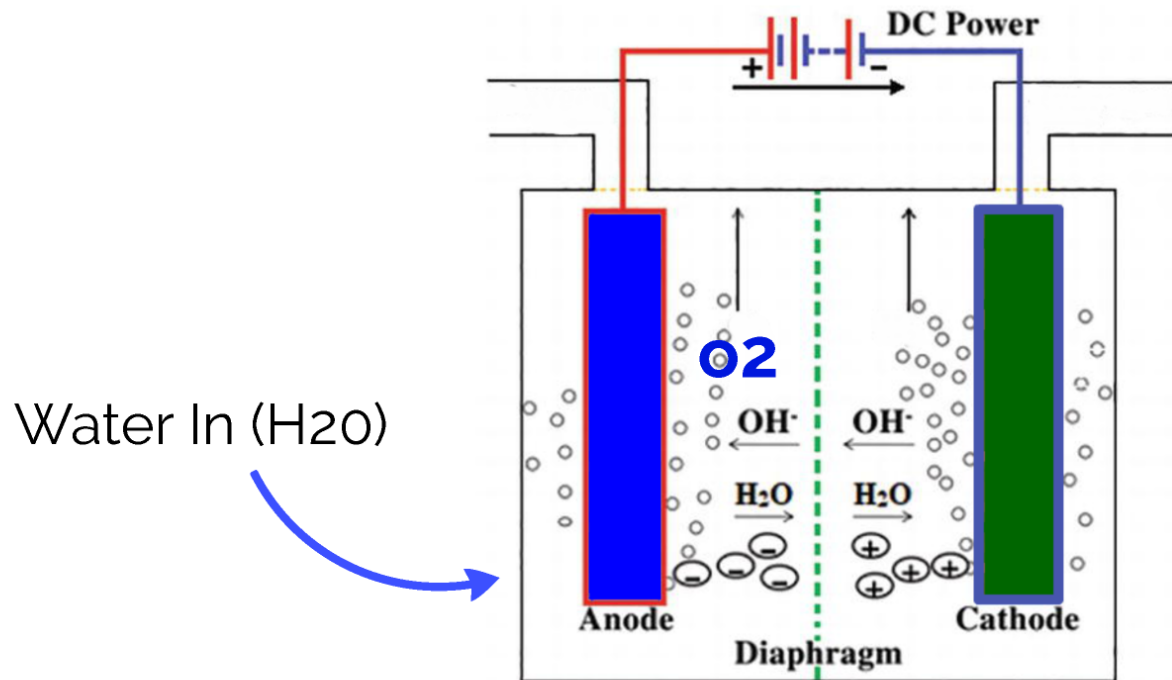
Electricity Supply In



Oxygen Separated from Hydrogen



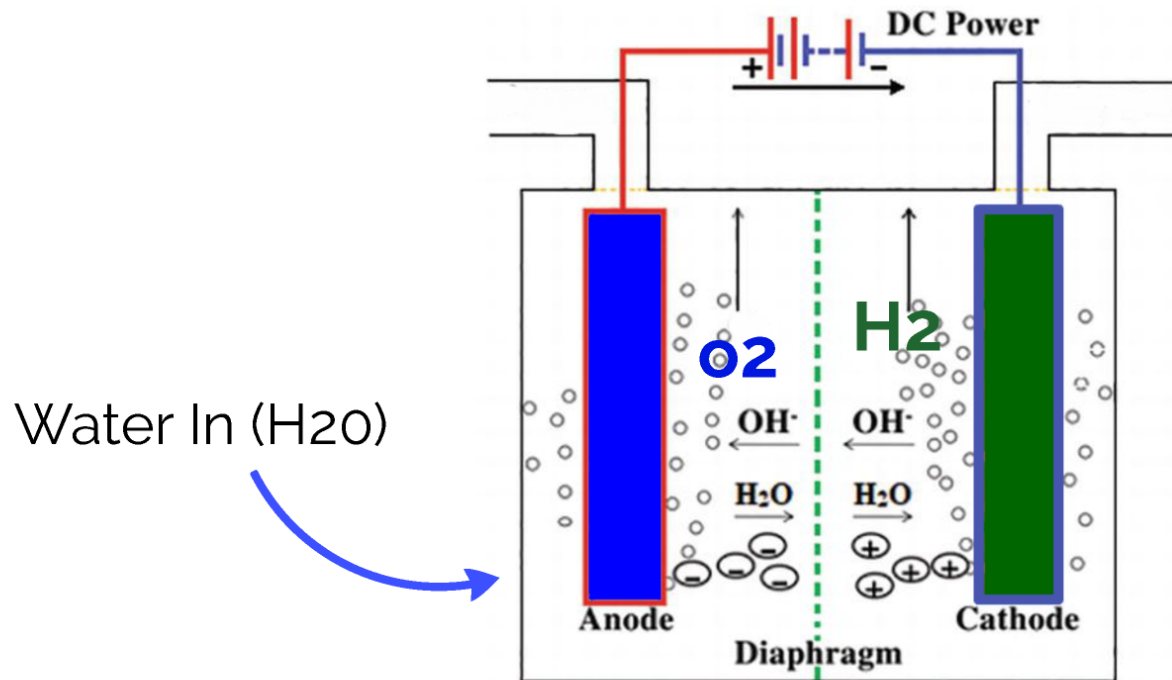
Electricity Supply In



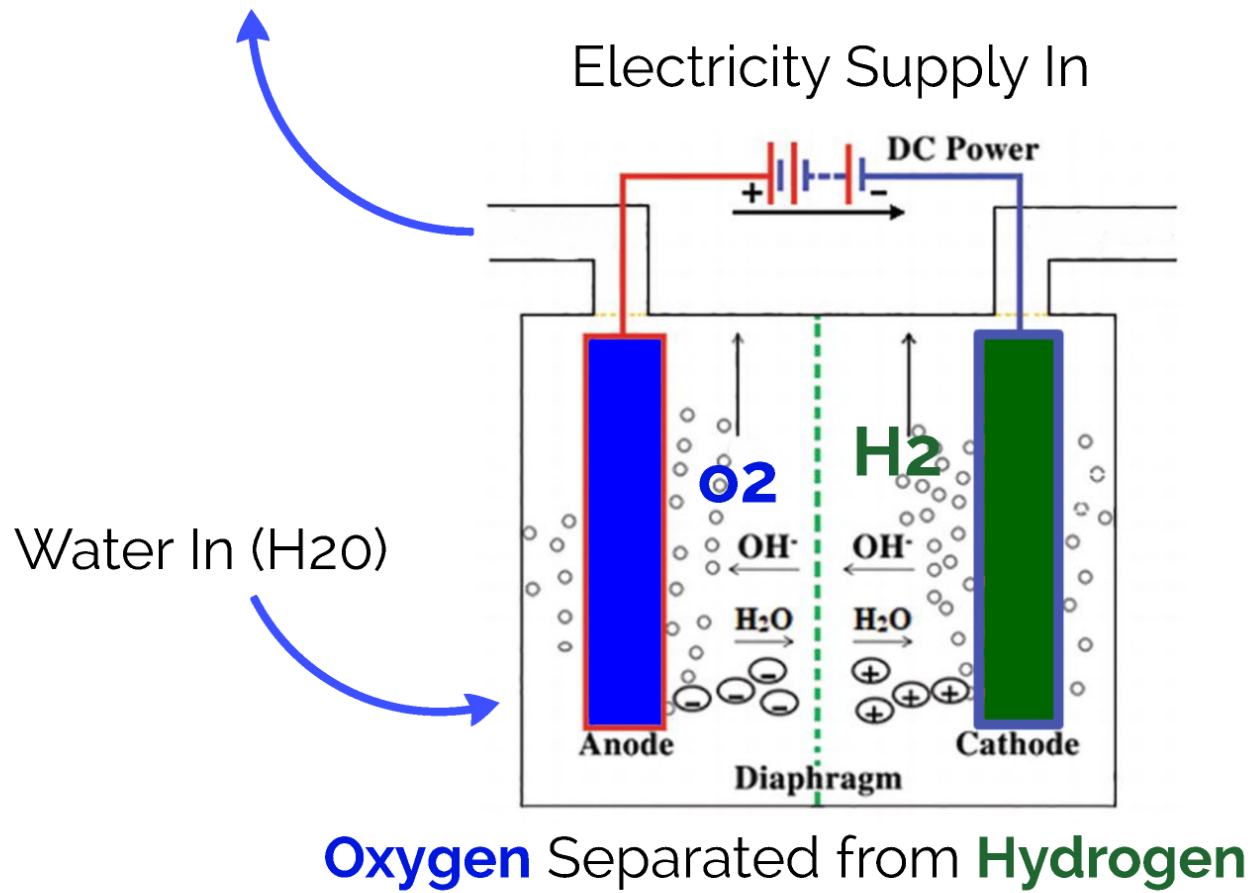
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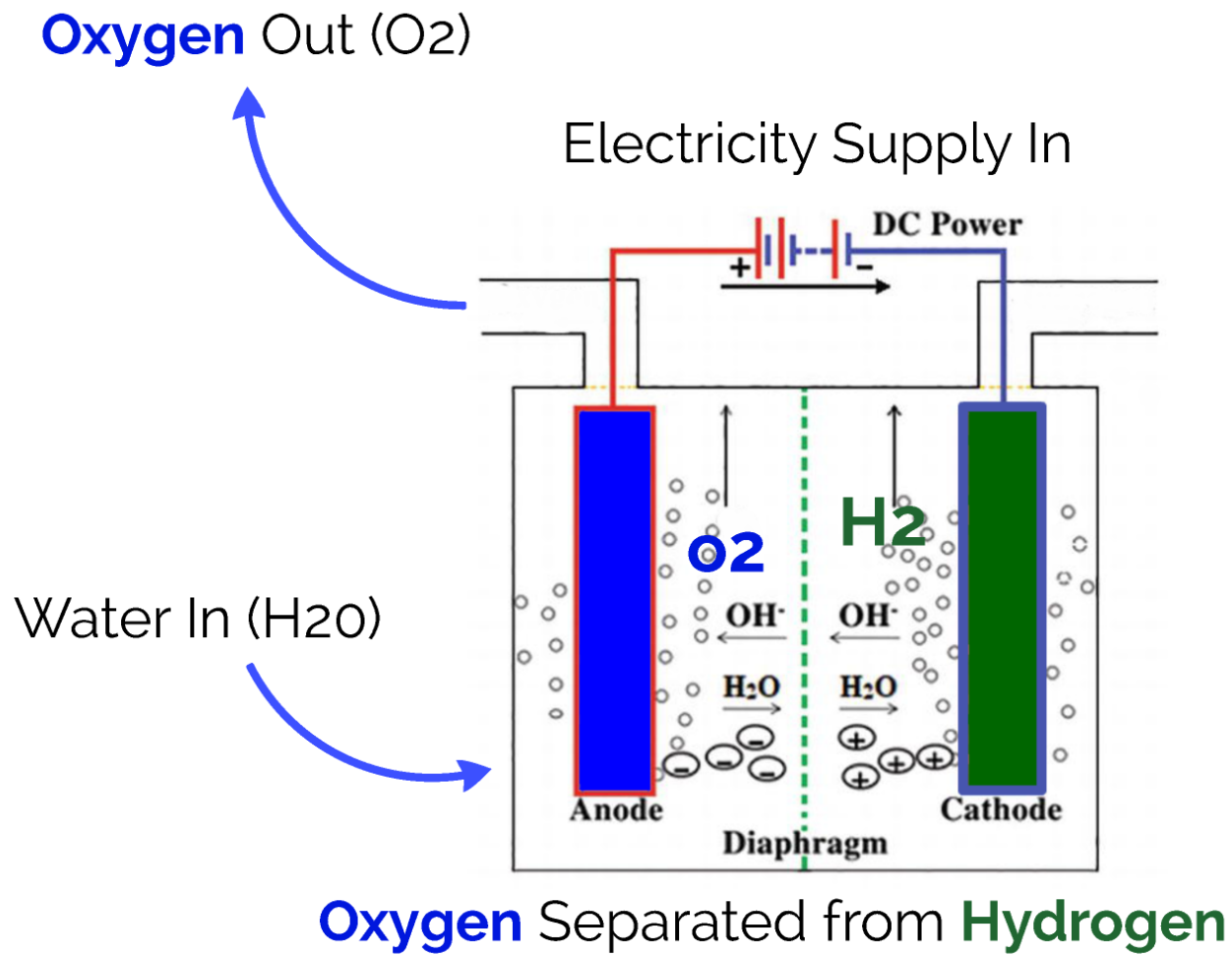


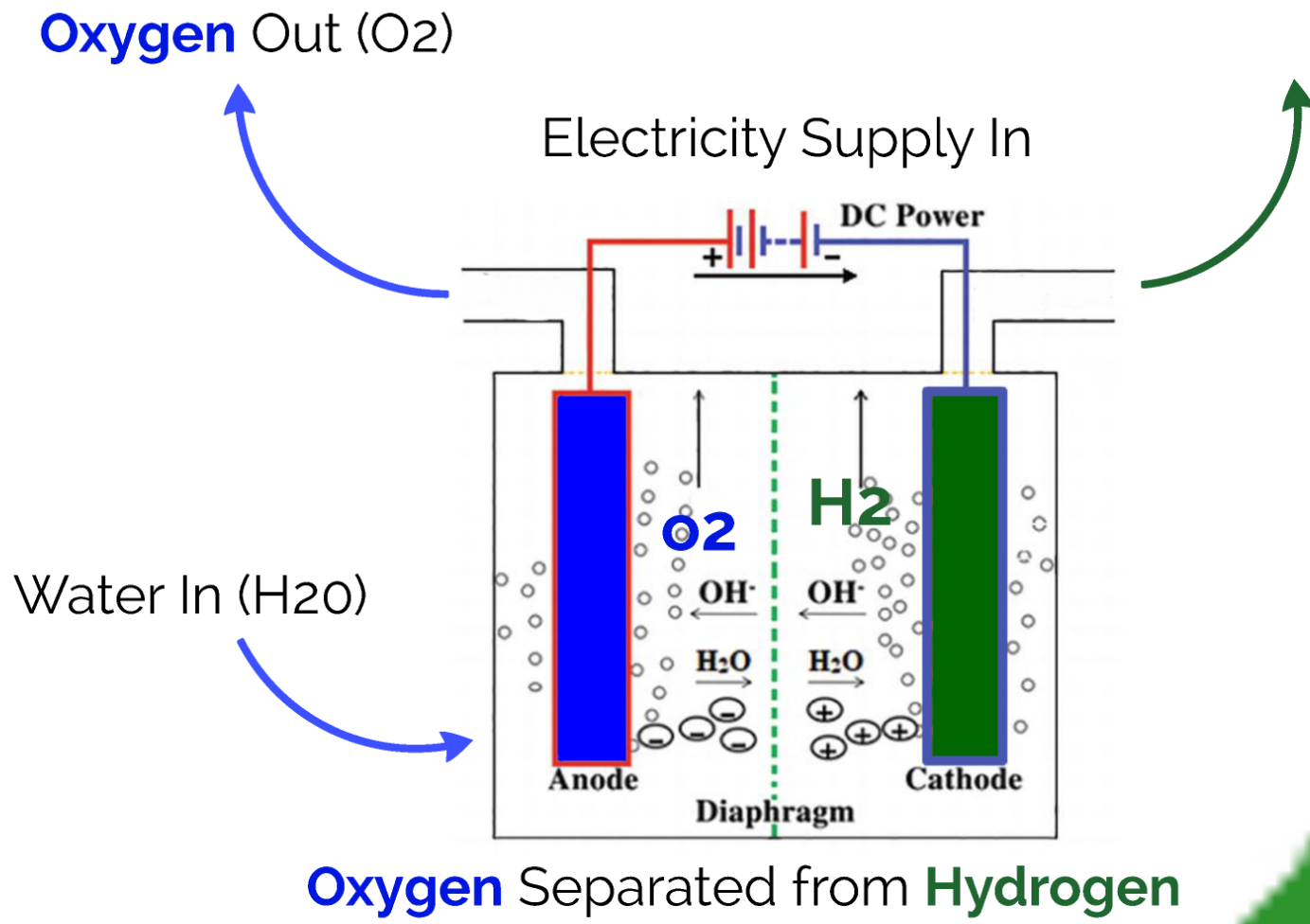
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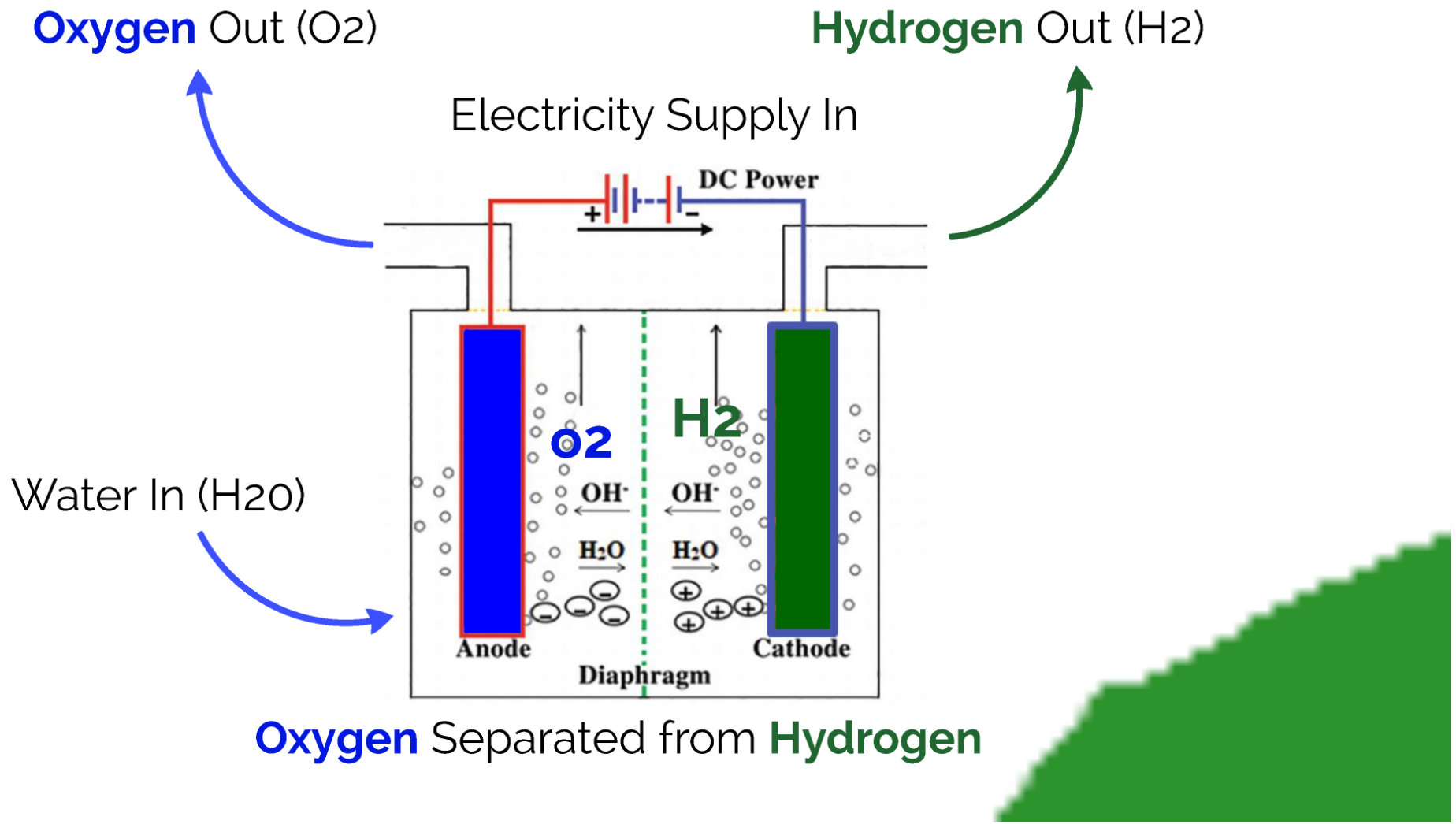


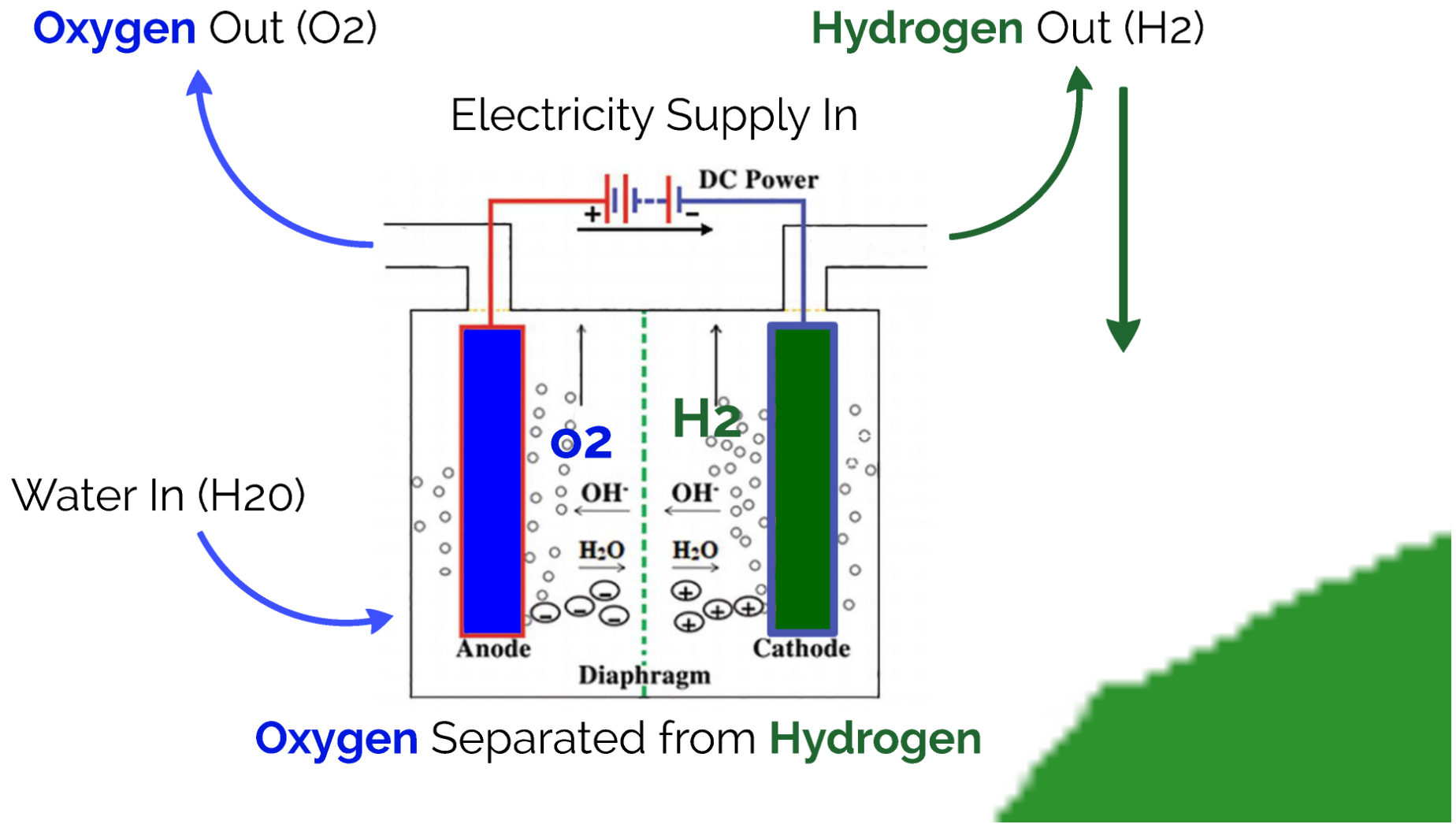
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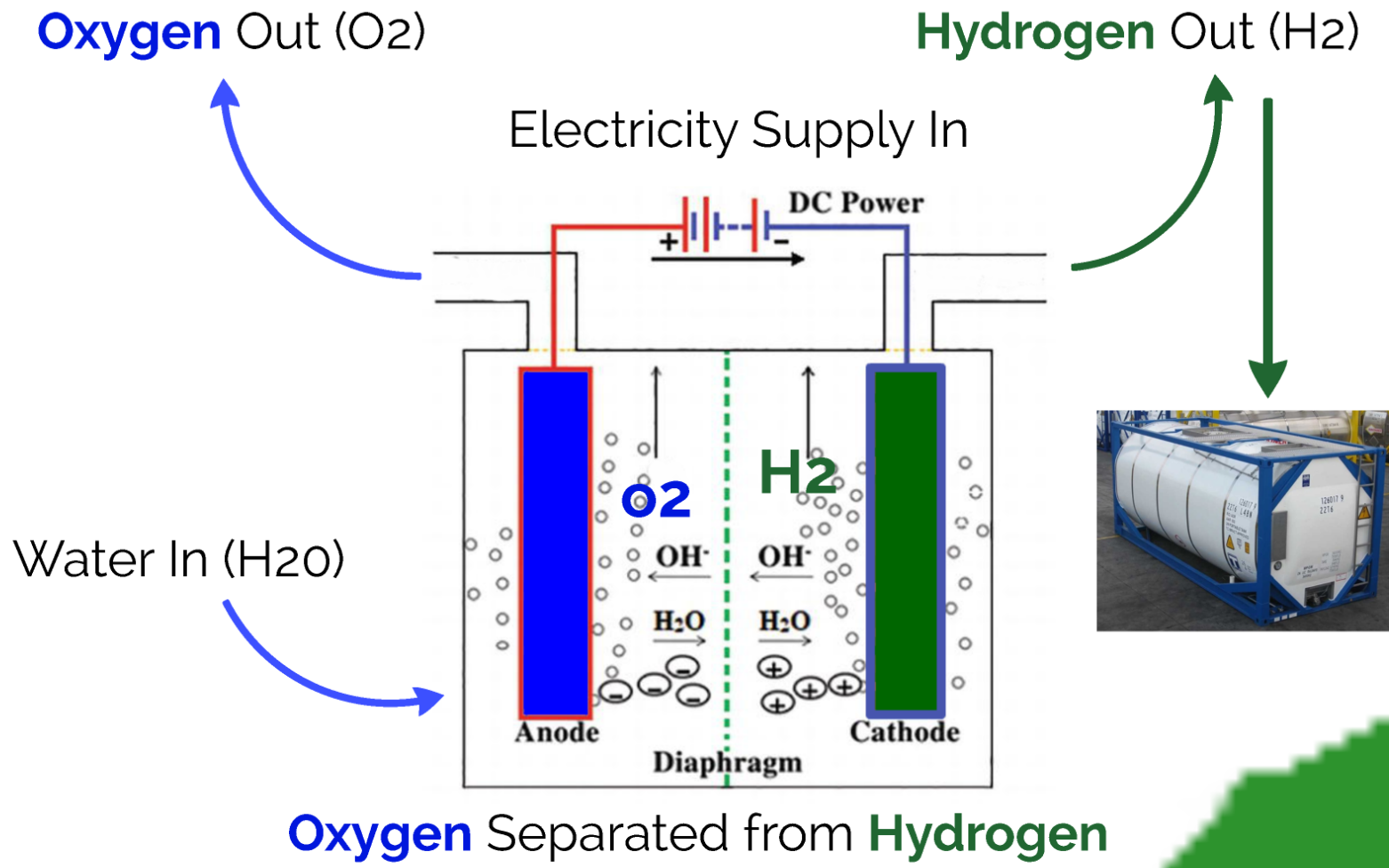












Water to Hydrogen to Power Options

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Constrained Electrical Generation to H₂

Water to Hydrogen to Power Options

Constrained Electrical Generation to H₂

When a generator cannot dispatch to the electricity grid (too much wind or sun on the grid)...

Water to Hydrogen to Power Options

Constrained Electrical Generation to H₂



When a generator cannot dispatch to the electricity grid (too much wind or sun on the grid)...

Water to Hydrogen to Power Options

Constrained Electrical Generation to H₂



...the excess electricity can be used on site to make hydrogen which can be used later.

When a generator cannot dispatch to the electricity grid (too much wind or sun on the grid)...

Water to Hydrogen to Power Options

Constrained Electrical Generation to H₂



...the excess electricity can be used on site to make hydrogen which can be used later.

When a generator cannot dispatch to the electricity grid (too much wind or sun on the grid)...

Energy is lost in the process (about 30% to make the H₂ and about 30% to turn the H₂ back into electricity). Best if you have a good use for it

Water to Hydrogen to Power Options

H₂ to
Heat

H₂ to
Heat



H₂ to Heat

If you need high temperatures
An on-demand heating source
If you want green energy
It has to be Hydrogen



H₂ to Heat

If you need high temperatures
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It has to be Hydrogen



It behaves like **LPG**, **LNG** and **NG** but:

H₂ to Heat

If you need high temperatures
An on-demand heating source
If you want green energy
It has to be Hydrogen



It behaves like **LPG**, **LNG** and **NG** but:

It's **NOT TOXIC**, It's **ZERO CO₂ Emission**, It
can be **produced locally** from **Green
Energy**:

H2 to Transport

H2 to Transport



H2 to Transport

Range: 500km



H2 to Transport

Range: 500km

Refill time: 7 mins



H₂ to Electricity

H₂ to Electricity

Hydrogen can be used for electricity storage.

H2 to Electricity

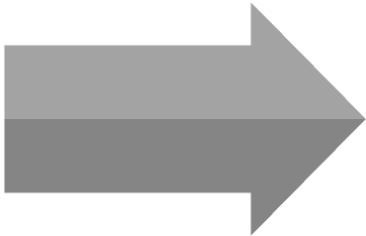
Hydrogen can be used for electricity storage.

Uses where there are grid constraints: Islands
Anywhere the grid is not strong or you don't want to have to upgrade it

H2 to Electricity

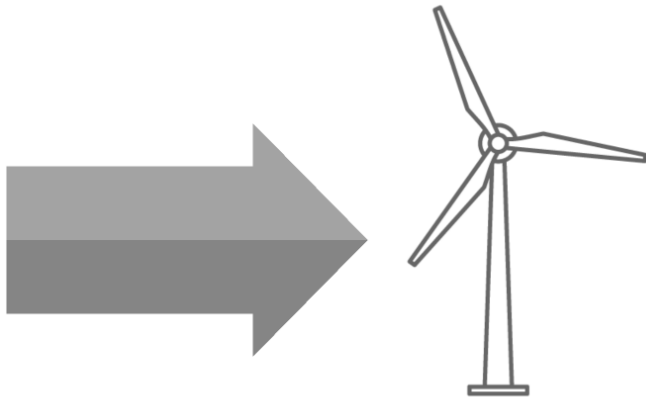
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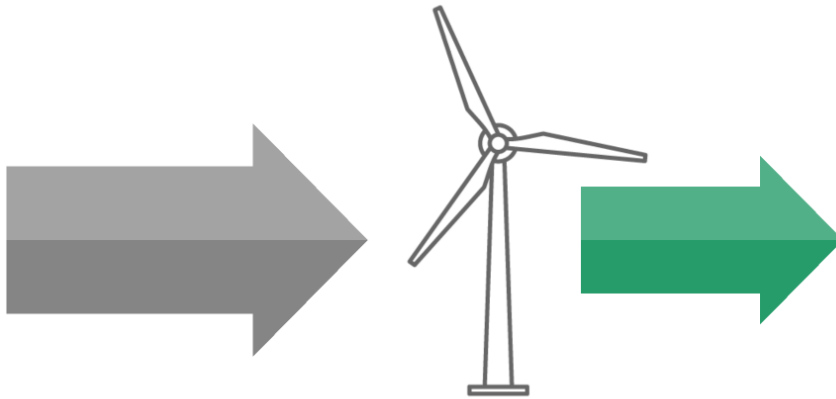


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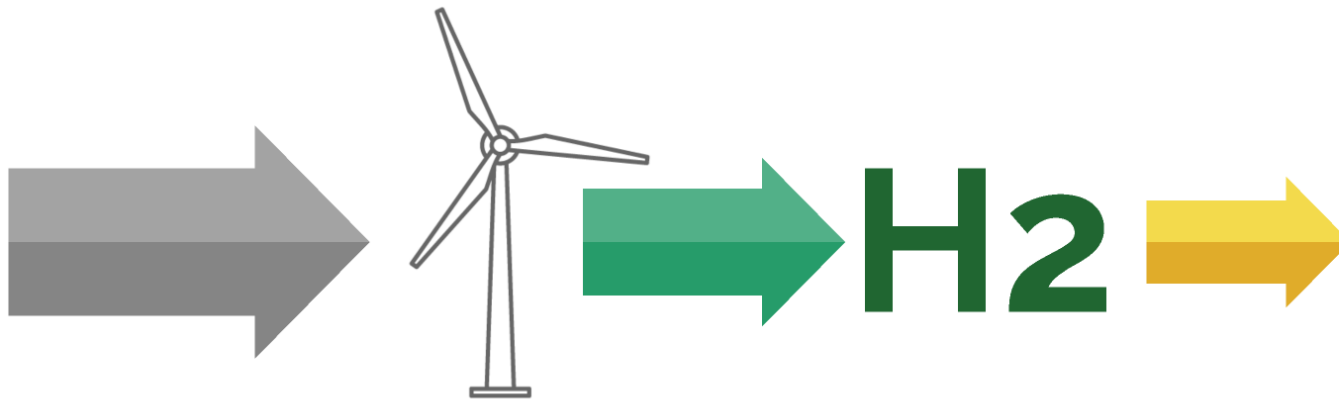
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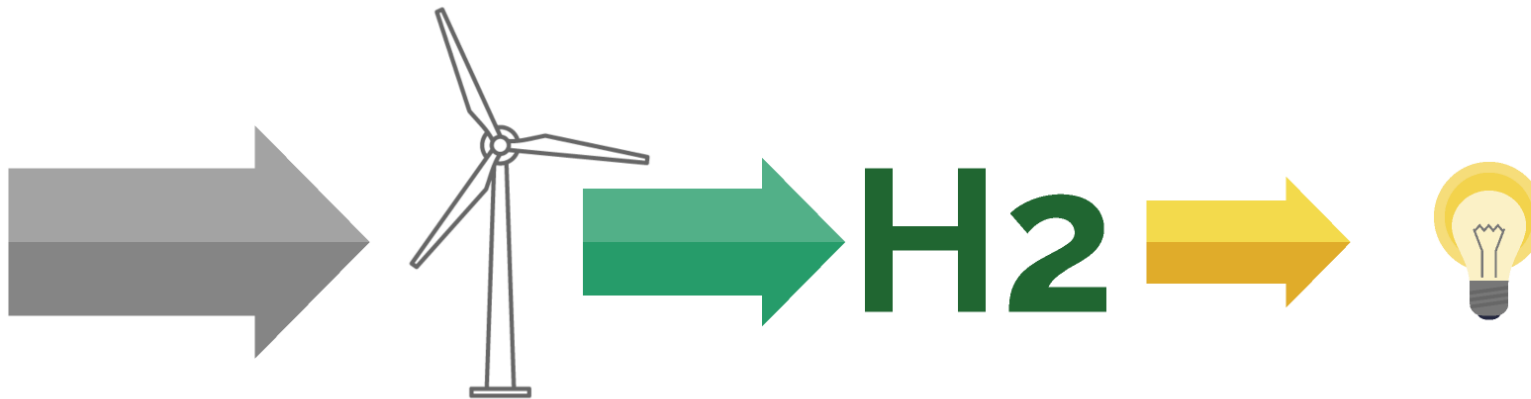
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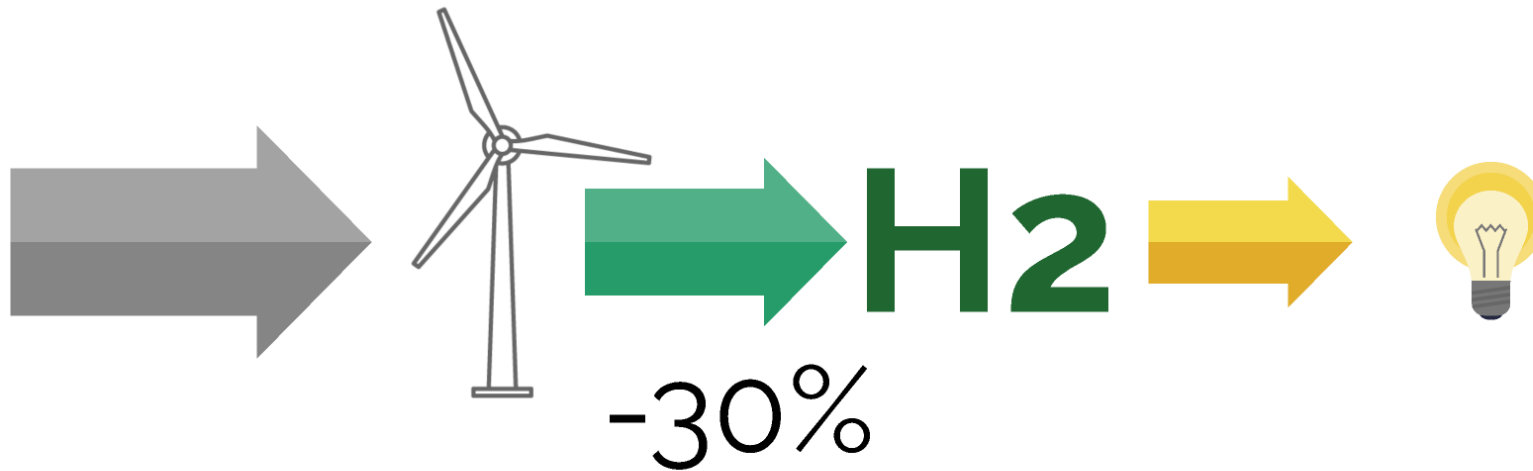
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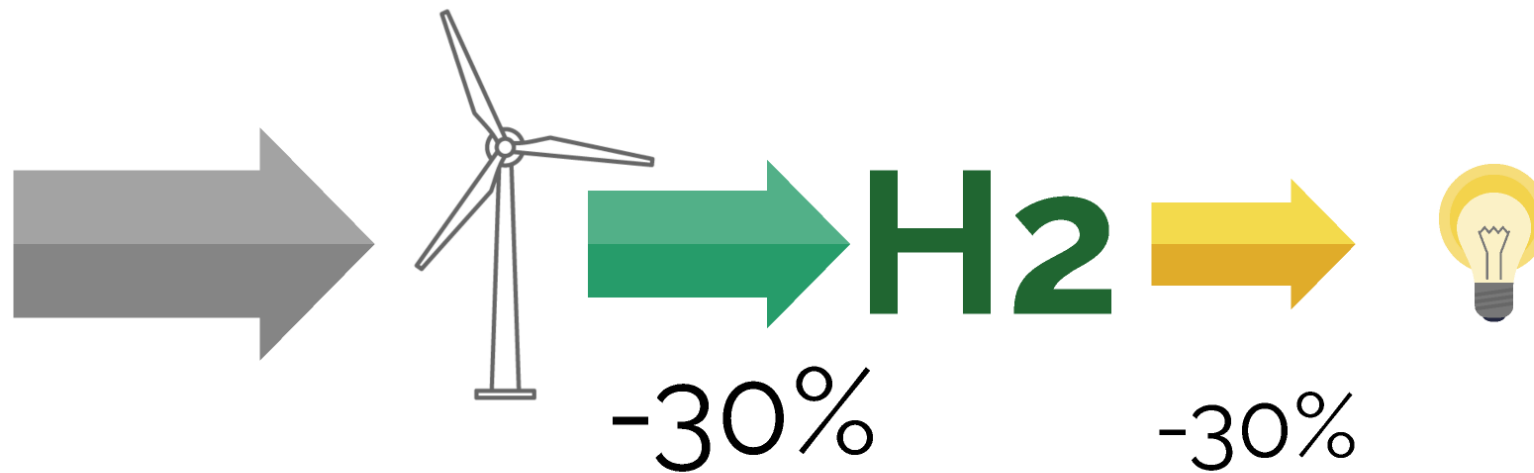
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Health





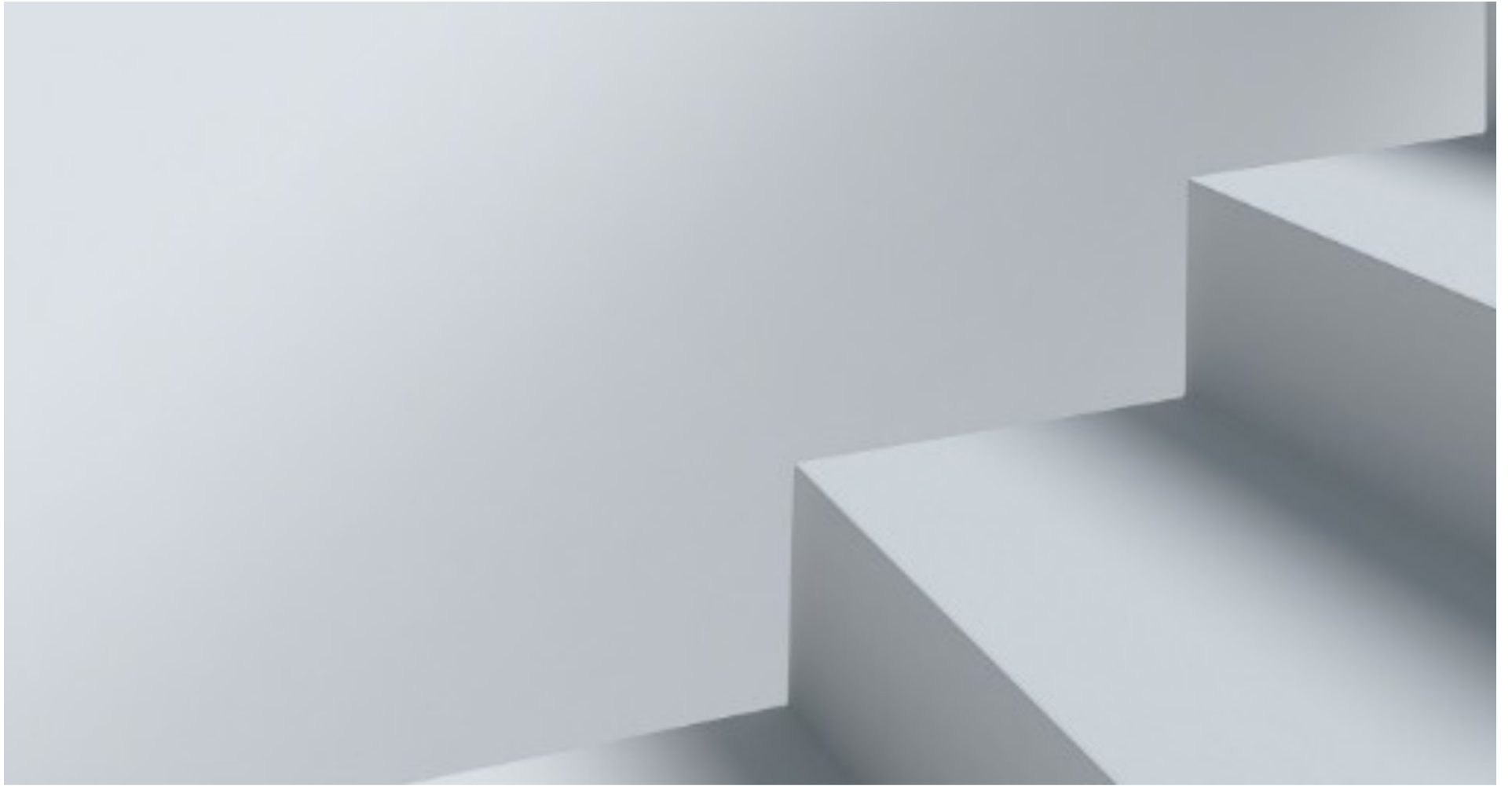
Hydrogen Opportunities



Hydrogen Opportunities

Valentia Island 2019-2022+








H₂ energy storage?



ergy storage?



H₂: heat to business?
energy storage?



heat to business?



H₂ large transport?

heat to business?

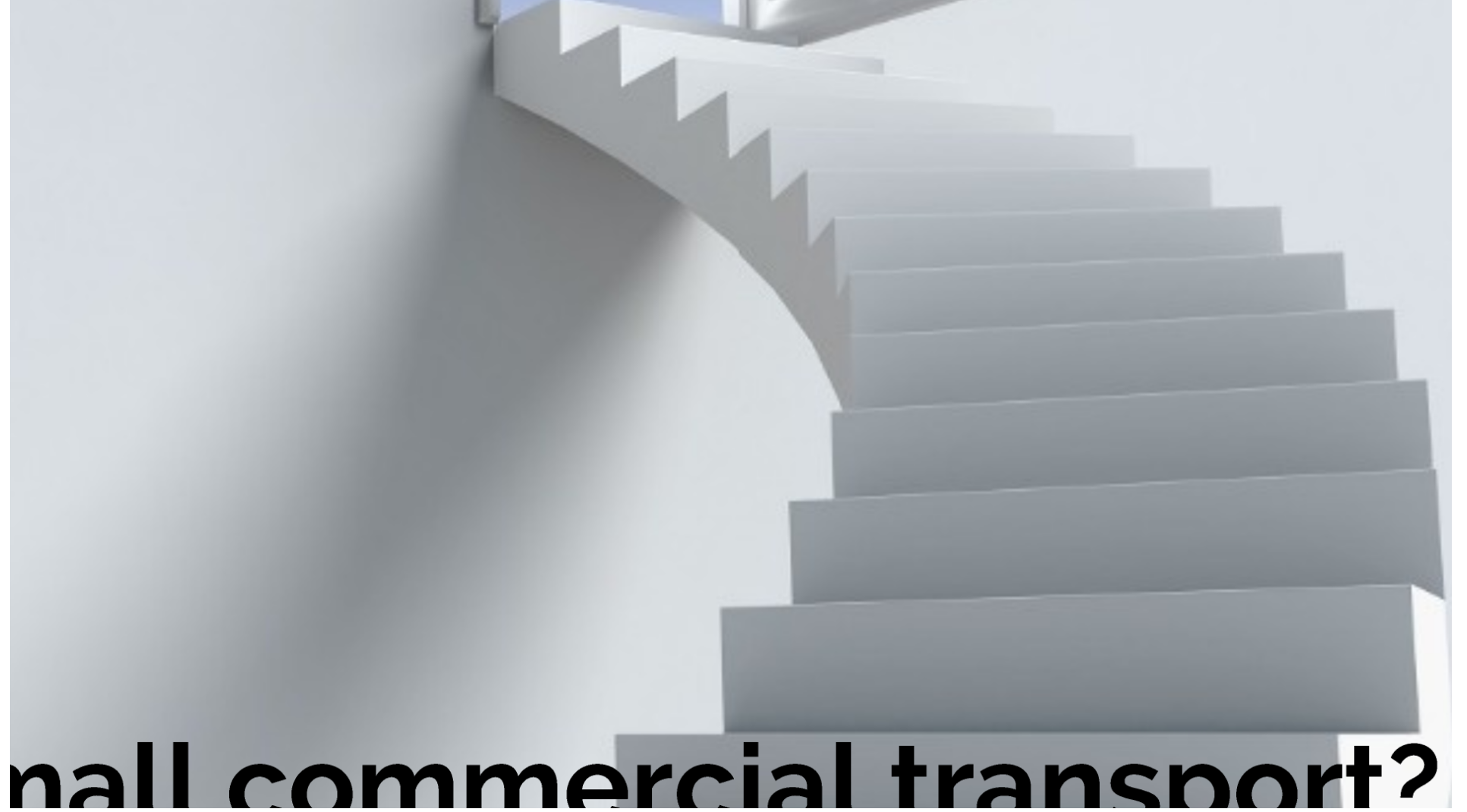


H₂ large transport?



H2 small commercial transport?

H2 large transport?





H₂ domestic transport?
Small commercial transport?



H₂ domestic heat?

H₂ domestic transport?

all commercial transport?





H2 research opportunities?



H2 research opportunities?



Opportunity 1: **H₂** to commercial heat

Opportunity 1: **H₂** to commercial heat

LPG replacement

Opportunity 1: **H₂** to commercial heat

LPG replacement

Energy Requirement

Opportunity 1: **H₂** to commercial heat

LPG replacement

Energy Requirement

Costs

LPG replacement

LPG replacement

Cable Station Plastics Factory

Uses imported LPG

Requires High Heat Boiler

130 degrees C+

Energy Requirement

Energy Requirement

Uses 532,524 kWh per year (@18.3 kWh/kg H₂)
=29,000 kg H₂/a

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Uses 532,524 kWh per year (@18.3 kWh/kg H₂)
=29,000 kg H₂/a

Potential CO₂ replacement

Minimum of **146.7 tonnes CO₂**

Energy Requirement

Uses 532,524 kWh per year (@18.3 kWh/kg H₂)
=29,000 kg H₂/a

Potential CO₂ replacement

Minimum of **146.7 tonnes CO₂**

=1,215,410 car km per year (@120.7 gCO₂/km)

Costs

Costs

Capital Costs

Electrolyser

Installation

Pipe Works/Civils

Boiler Conversion

Costs

Capital Costs

Electrolyser
Installation
Pipe Works/Civils
Boiler Conversion

O&M

Maintenance
Parts Replacement
Electricity Costs

Costs

Capital Costs

Electrolyser
Installation
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Boiler Conversion

O&M

Maintenance
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Electricity Costs

O&M

Maintenance = Training
Electricity Costs =
• Stage 1: PPA Partnership
• Stage 2: Community
Generation

Opportunity 2: H₂ Transport

Commercial Transport



Tour-Bus



Private Cars





Light Commercial Vehicles

Light Commercial Vehicles

Travelling above 200km but below 400km per day?

Light Commercial Vehicles

Travelling above 200km but below 400km per day?

Food business?

Light Commercial Vehicles

Travelling above 200km but below 400km per day?

Food business?

Green credentials?

Light Commercial Vehicles

Travelling above 200km but below 400km per day?

Food business?

Green credentials?

Locally produced and owned H2



Private Tourist Bus





There would be considerable commercial advantages in having the first H2 tourist bus in Valentia/Ireland

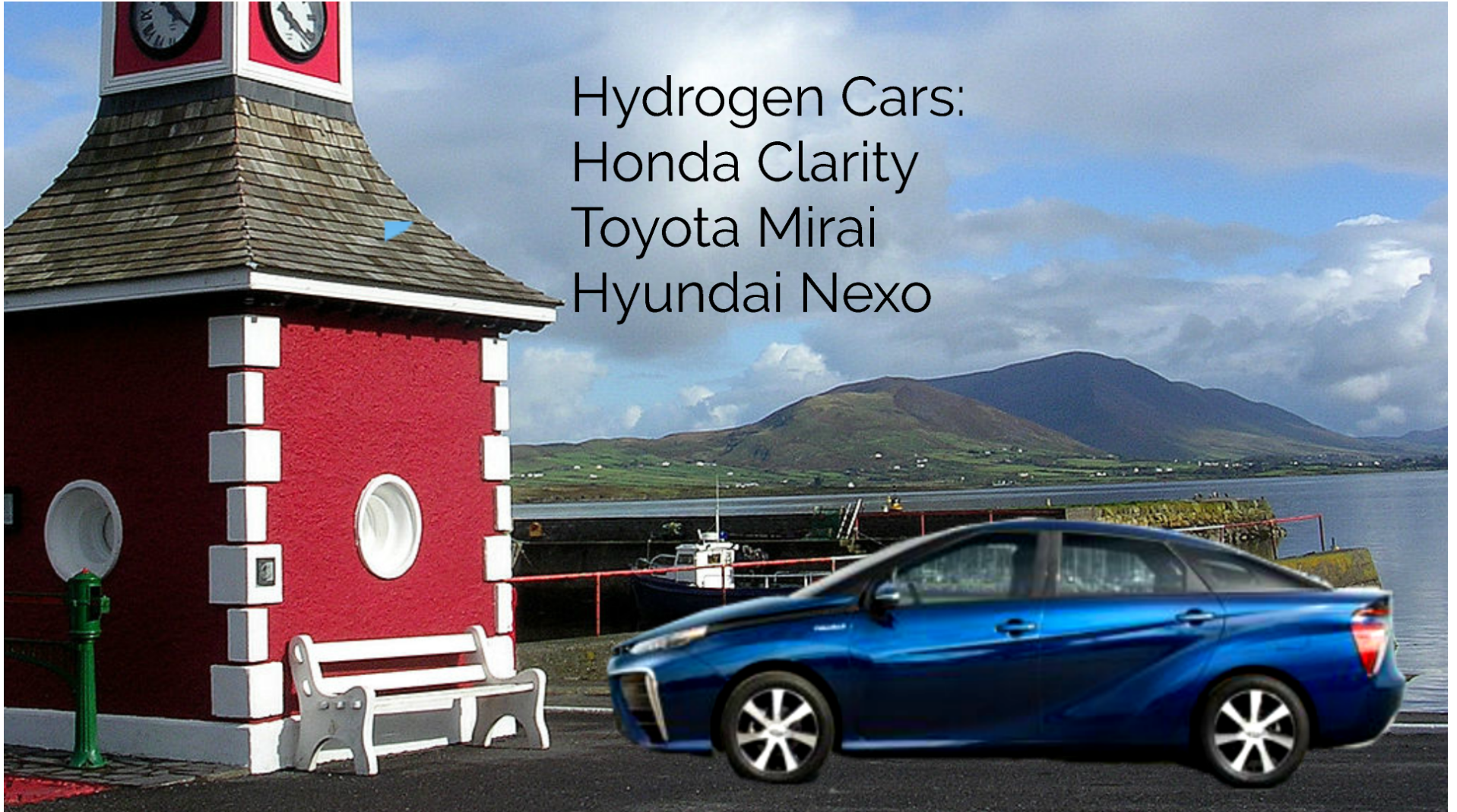


Both the Commercial vehicle(s) and the tourist bus(es) should be seen as an early extension of stage 1,

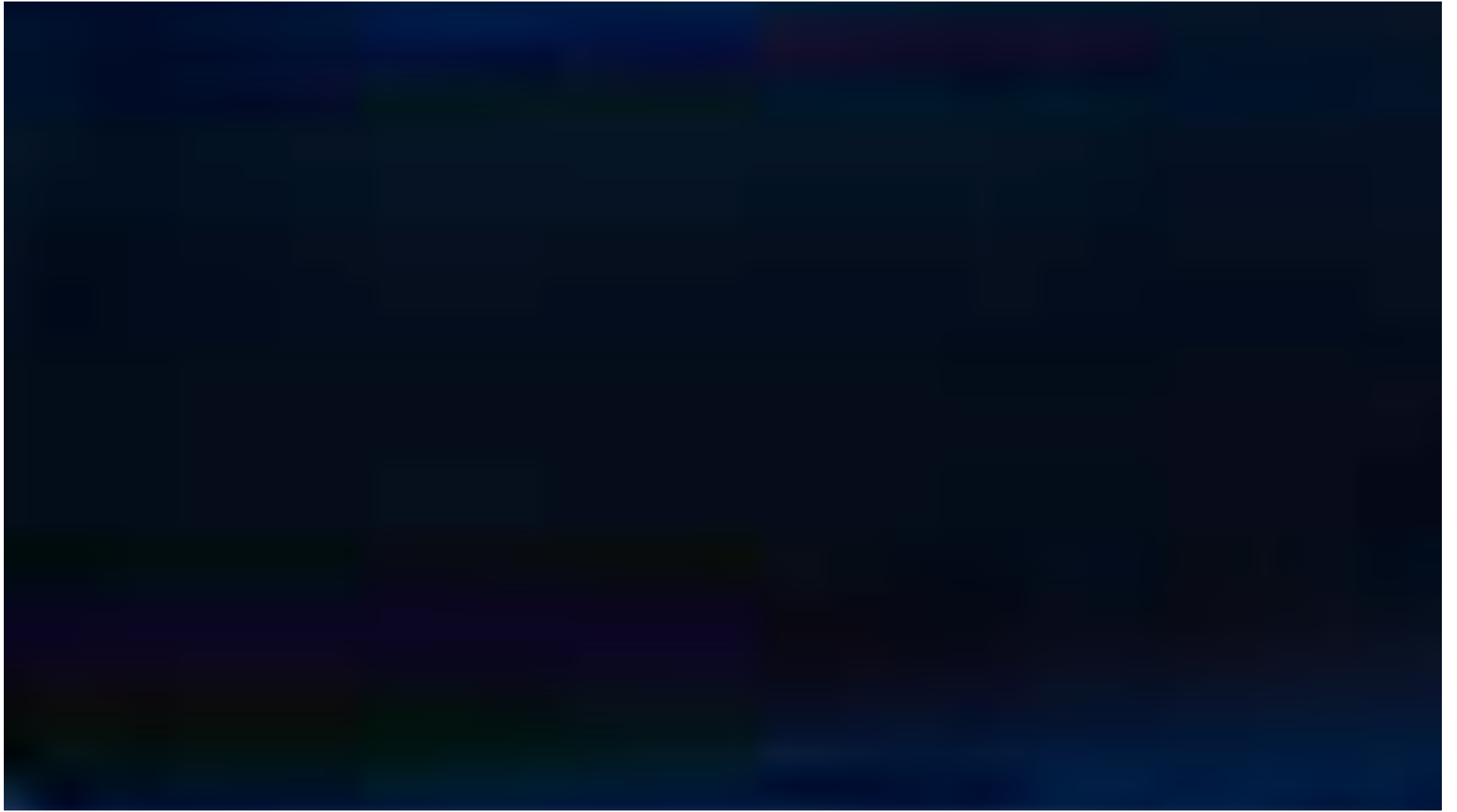
Their potential energy demand should be built-in to the Electrolyser system discussed in Stage 1

Transport applications will not materially change the costs of the electrolyser





Hydrogen Cars:
Honda Clarity
Toyota Mirai
Hyundai Nexa



Connected Island

Connected Island
Off island commute

Connected Island

Off island commute

Distances Tralee, Cork and Dublin beyond EV range

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Opportunities for Fuel Cell EVs with 500km+ range

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Stage 2: Demonstration vehicles

Requiring approximately 2-5kg H₂ per day

Connected Island

Off island commute

Distances Tralee, Cork and Dublin beyond EV range

Opportunities for Fuel Cell EVs with 500km+ range

Stage 2: Demonstration vehicles

Requiring approximately 2-5kg H₂ per day

Could be factored into sizing of Stage 1 Electrolyser



Domestic Heat

Domestic Heat
Stage 3 Opportunity

Domestic Heat

Stage 3 Opportunity

The replacement of Home Heating Oil by H₂

Domestic Heat

Stage 3 Opportunity

The replacement of Home Heating Oil by H2

Central heating	Households
No central heating	4
Oil	143
Natural Gas	6
Electricity	10
Coal (incl. Anthracite)	12
Peat (incl. turf)	53
Liquid Petroleum Gas (LPG)	7
Wood (incl. wood pellets)	3
Other	2
Not stated	3
Total	243

Domestic Heat

Stage 3 Opportunity

The replacement of Home Heating Oil by H2

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Energy Sources	Permanent Residents kWh	Permanent Residents Cost	Tonnes Co2
Heating Oil	1,900,929	€ 151,694	488.5
Tonnes H2 Required	58	-	0.0

Domestic Heat

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Build in two pilot homes into Stage 1

capacity 2 kgs/day

Investigate Funding Options in Stage 2



Research Opportunities



Research Opportunities

Existing Research Examples:

GENCOMM

SEAFUEL (Árainn, Madeira, Tenerife)

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Over 40

<https://www.fch.europa.eu/projects/h2020/energy>



Over 220

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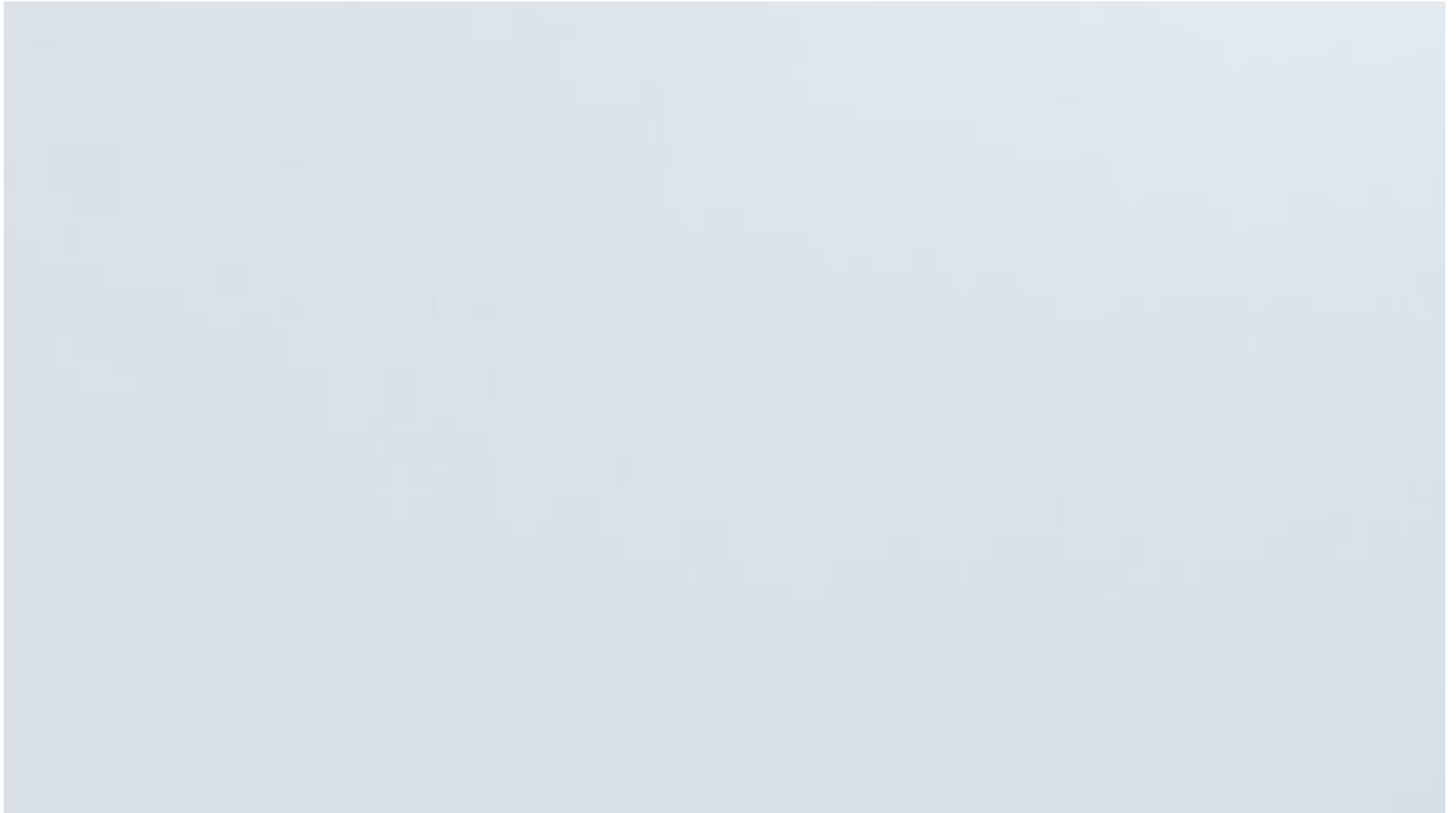
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Skills and people retention

Valentia can **own** and **direct** the research partnership



Next Steps

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Community Feedback and discussion of
opportunity selection - May 2019

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Completion of feasibility - Sept 2019

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Completion of feasibility - Sept 2019

Step 1 - Sept 2019-Dec 2021

Funding and Research Applications June 2019 - June 2020

Design and installation - June 2020-June 2021

H2 production and Use - June 2021-Dec 2021

Factory, Cable Station, Commercial Heat
Investigate using H2 to reduce emissions on maritime vessels

investigate using H₂ to reduce emissions on maritime vessels

investigate using H₂ to reduce emissions on maritime vessels

Step 2

Funding and Research Applications June 2020 - June 2021

Design and installation fueling station - June 2021-June 2022

H₂ Distribution to transport- June 2022 onwards

Light Commercial, Bus, Passenger cars (2-3)

investigate using H₂ to reduce emissions on maritime vessels

Step 2

Funding and Research Applications June 2020 - June 2021

Design and installation fueling station - June 2021-June 2022

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Step 3

Maritime, Home Heating

Evaluation of Steps 1 and 2 towards roll-out

Valentia Island: Carbon to H2-zero-emissions

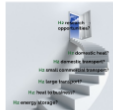
Replacement of Fossil Fuels by H2

Valentia Island Co. Kerry

Geography & Transport



Hydrogen Opportunities Valentia Island 2019-2022*



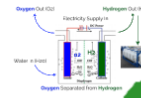
H2 to Transport



Range: 500km
Refill time: 7 mins



Water to Hydrogen to Power Options



CSD 2016
Population: 657
Occupied Houses: 256 (39%)
Temp. Abs: 21.15 (°C)
Unoccupied holiday homes: 302 (46%)
Unoccupied houses: 85 (13%)

Valentia Island Development Company
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Email: info@valentiaidland.com

