Hydrogen Europe

INTRODUCTION

Participants in the Workshop

ETS-IF an ambitious pipeline of projects

In response to a request from the Commission, we have created an overview of projects in the "pipeline" classified by

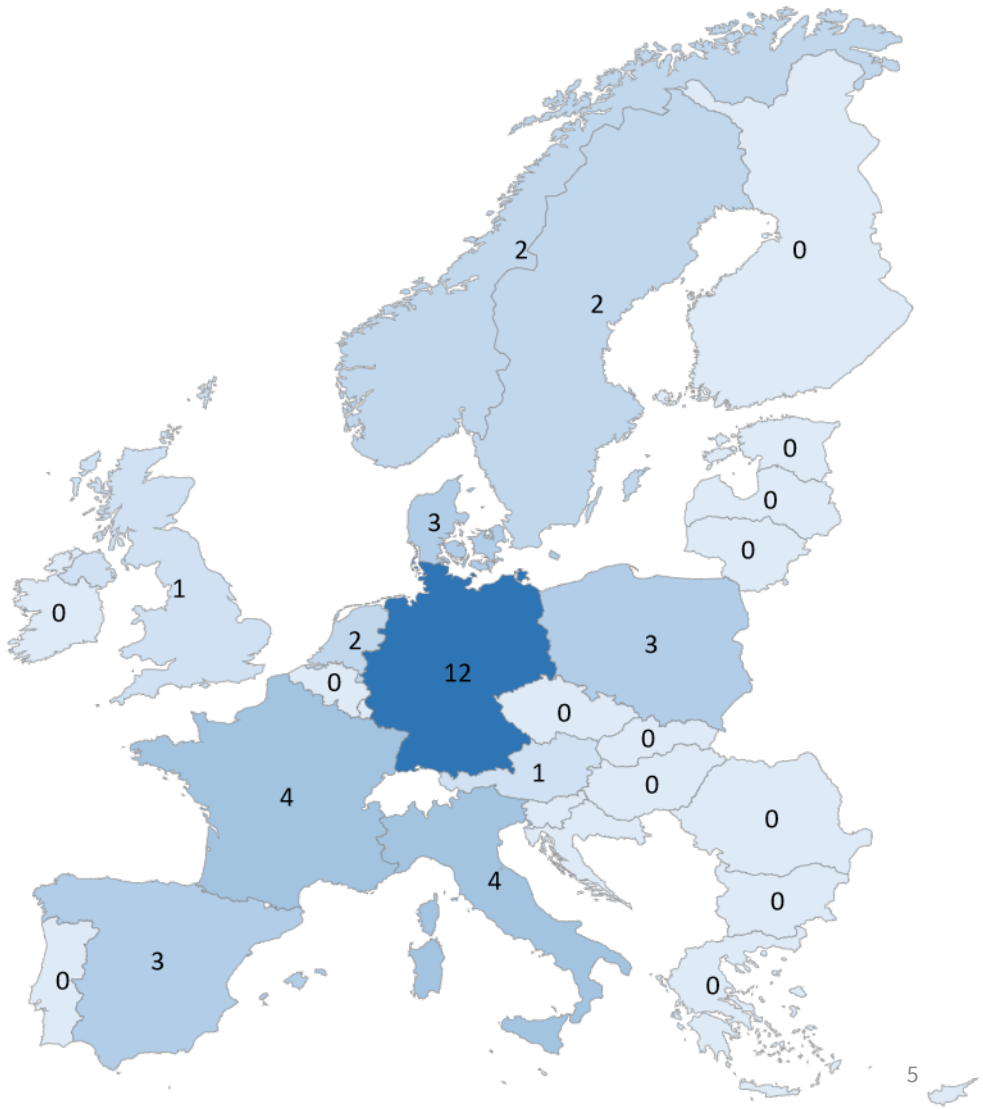
- (1) level of maturity,
- (2) priorities as expressed in the ETS Innovation funds decision and
- (3) country
- (4) indicative level of the project's budget

+ a short description of each project in separate annexes

At this stage we have a total of **38 projects** with a total budget of **EUR 3.2 – 4.4 Billion**

This includes **more than 20 mature and ambitious projects** that could be ready for the 2020 call, for a total amount of **EUR 2.5 – 3.2 Billion**

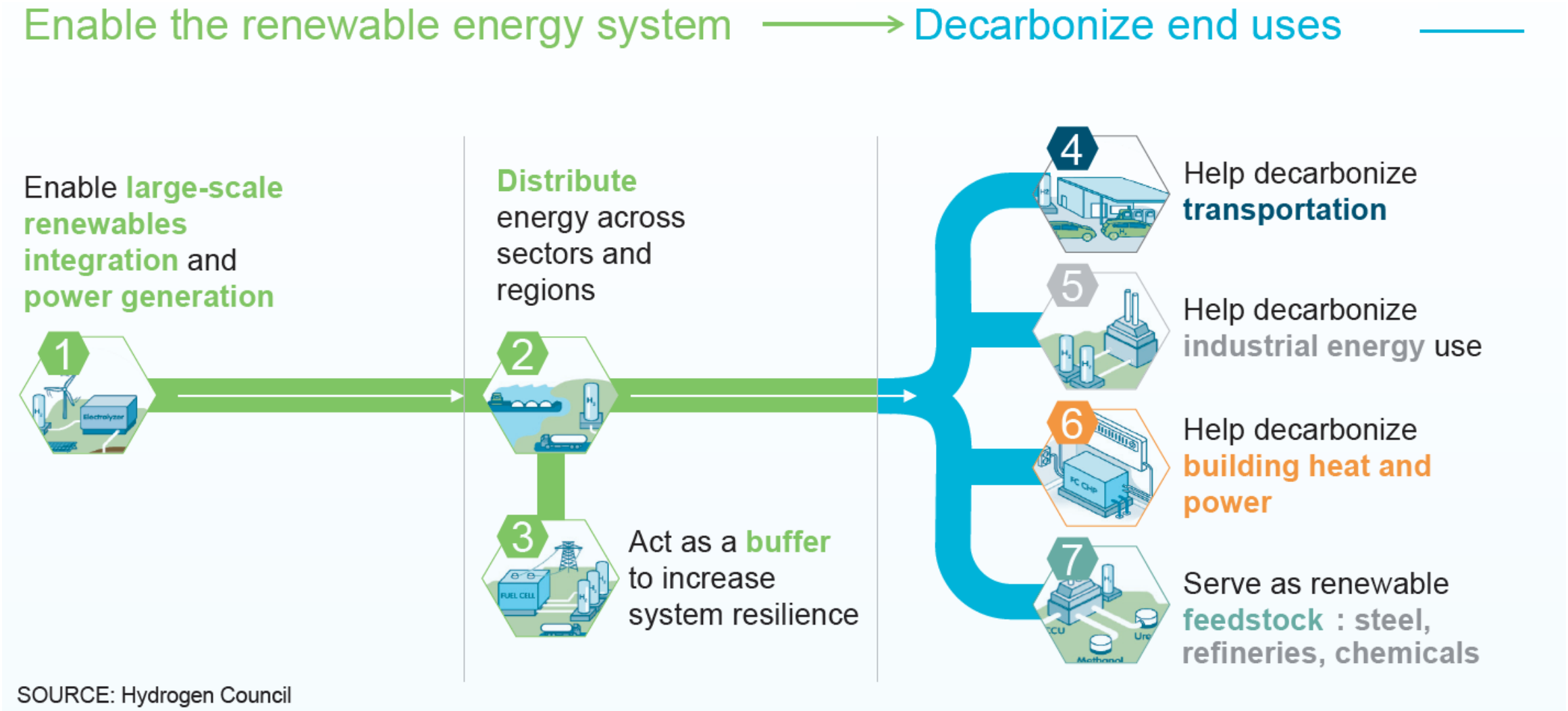
Location of the projects



Projects to be presented

Project name	Hydrogen	Application	Region
H2V NORMANDY, H2V 59	Green hydrogen	Industry Energy storage (gas grid)	France
H-Vision	Blue hydrogen	Industry Energy Transport (future)	Netherlands
Green Steel	Green Hydrogen	Steel manufacturing	Germany
H2Magnum	Blue hydrogen (link to H-Vision)	Power generation	Netherlands
GetH2	Green or blue hydrogen	Dedicated H2 infrastructure	Germany
Norsk e-Fuels Alpha	Green hydrogen	Power-to-X	Norway
Hybrid Steelmaking	Green or blue hydrogen	Steel manufacturing	Austria
LOHC Industry Transformation	Green or blue hydrogen	Dedicated H2 distribution infrastructure	Sweden, Norway Netherlands, Germany
HySynGas	Green or blue hydrogen	Power-to-SNG	Germany
Provision of H2 in NWE ports	Green hydrogen	Transport	North-Western-Europe

Other projects



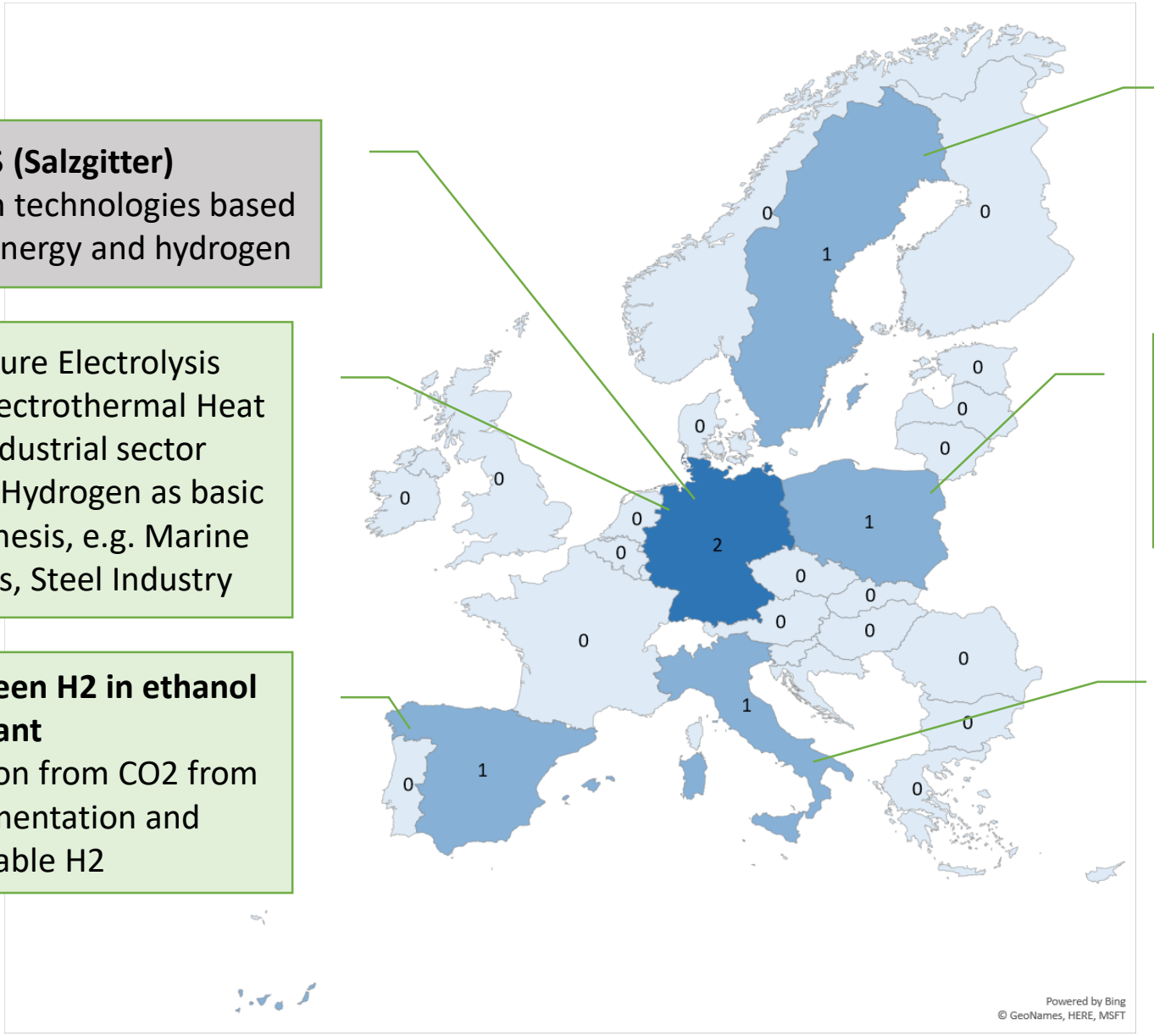
SOURCE: Hydrogen Council

Other projects | Industry

SALCOS (Salzgitter)
Direct reduction technologies based on renewable energy and hydrogen

High Temperature Electrolysis combined with Electrothermal Heat Storage for Industrial sector applications with Hydrogen as basic product for synthesis, e.g. Marine Fuels, Refineries, Steel Industry

Integration of green H2 in ethanol plant
Ethanol production from CO2 from alcoholic fermentation and renewable H2



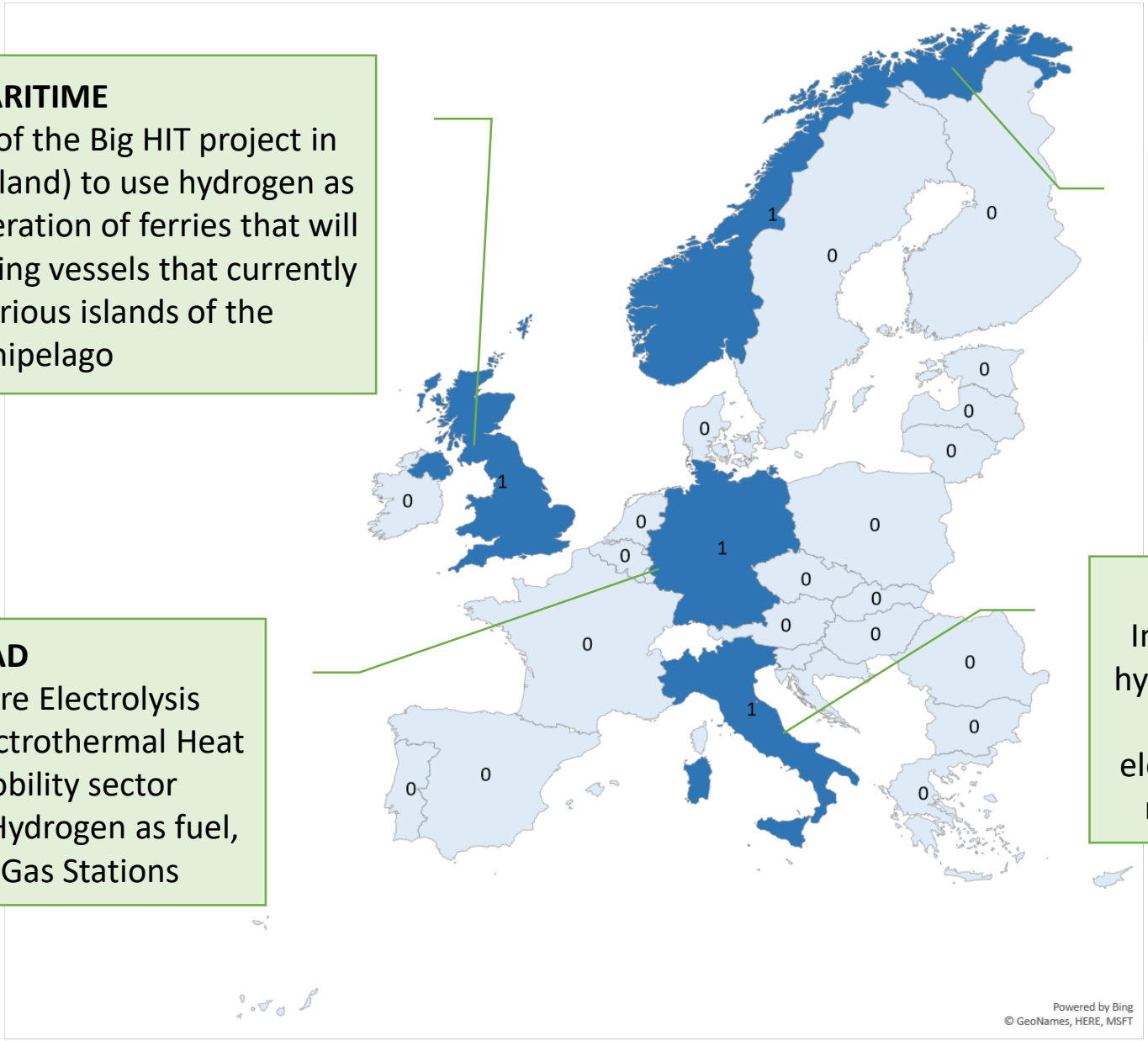
HYBRIT
(Equinor, Vattenfall, Gasunie)
Replacing coke with hydrogen for steel making processes

Refining processes
Renewable energy storage in the form of H2 in underground salt caverns with dedicated pipeline connection to a refinery

Steel production
Deep decarbonisation of:
(i) direct reduced iron processes (DRPs) via low carbon H2 and
(ii) smelting reduction process (SRPs) via H2 plasma.

Other projects | Mobility

MARITIME
Further expansion of the Big HIT project in Orkney Islands (Scotland) to use hydrogen as a fuel for a new generation of ferries that will replace the nine ageing vessels that currently connect the various islands of the archipelago



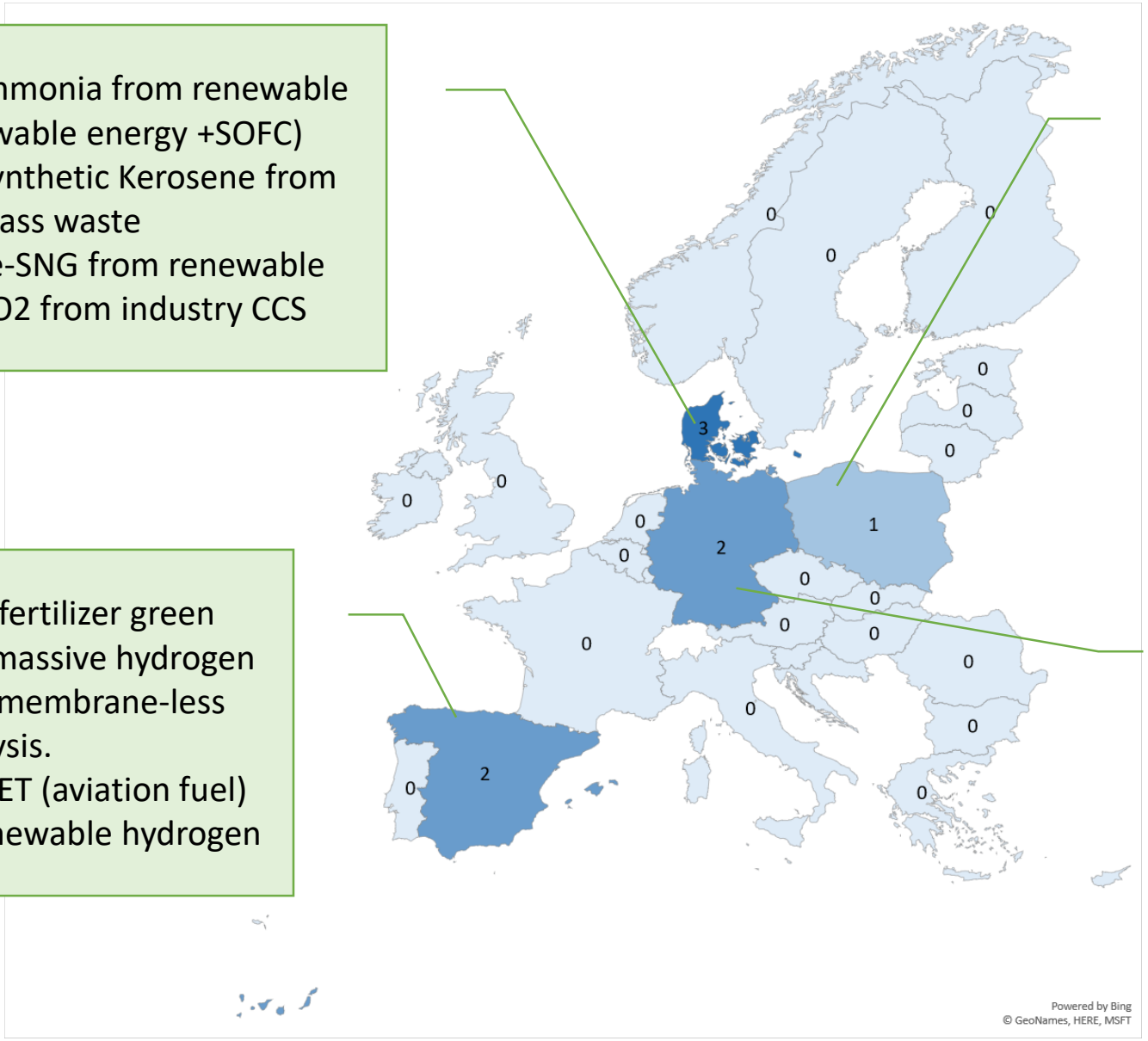
MARITIME
Hydrogen for zero emission maritime applications

ROAD
High Temperature Electrolysis combined with Electrothermal Heat Storage for mobility sector applications with Hydrogen as fuel, e.g. Hydrogen Gas Stations

RAIL
Integrating renewable power storage in hydrogen (through massive electrolysis or solar reforming) with train hubs for electrification of train transport in routes not serviced by overhead power lines

Other projects | Power-to-X

1. Production of ammonia from renewable hydrogen (renewable energy +SOFC)
2. Production of synthetic Kerosene from biomass waste
3. Production of e-SNG from renewable hydrogen and CO2 from industry CCS



Extract CO2 electrochemically from exhaust gases (industrial processes, coal fired power plants, CCGT cycles and other) while generating power, integrating it with hydrogen generated by excess electricity and excess heat for conversion into SNG/CNG.

1. Ammonium and fertilizer green production, based in massive hydrogen production with an membrane-less electrolysis.
2. Production of bio JET (aviation fuel) from biowaste and renewable hydrogen

1. Demonstration plant for PtL (Jet fuel) in Northern Germany
2. Green hydrogen used for selective hydrogenation of polycyclic aromatic hydrocarbons (PAH). Up to 30 million Nm3 of hydrogen demand with CO2 savings of 300,000 t/pa

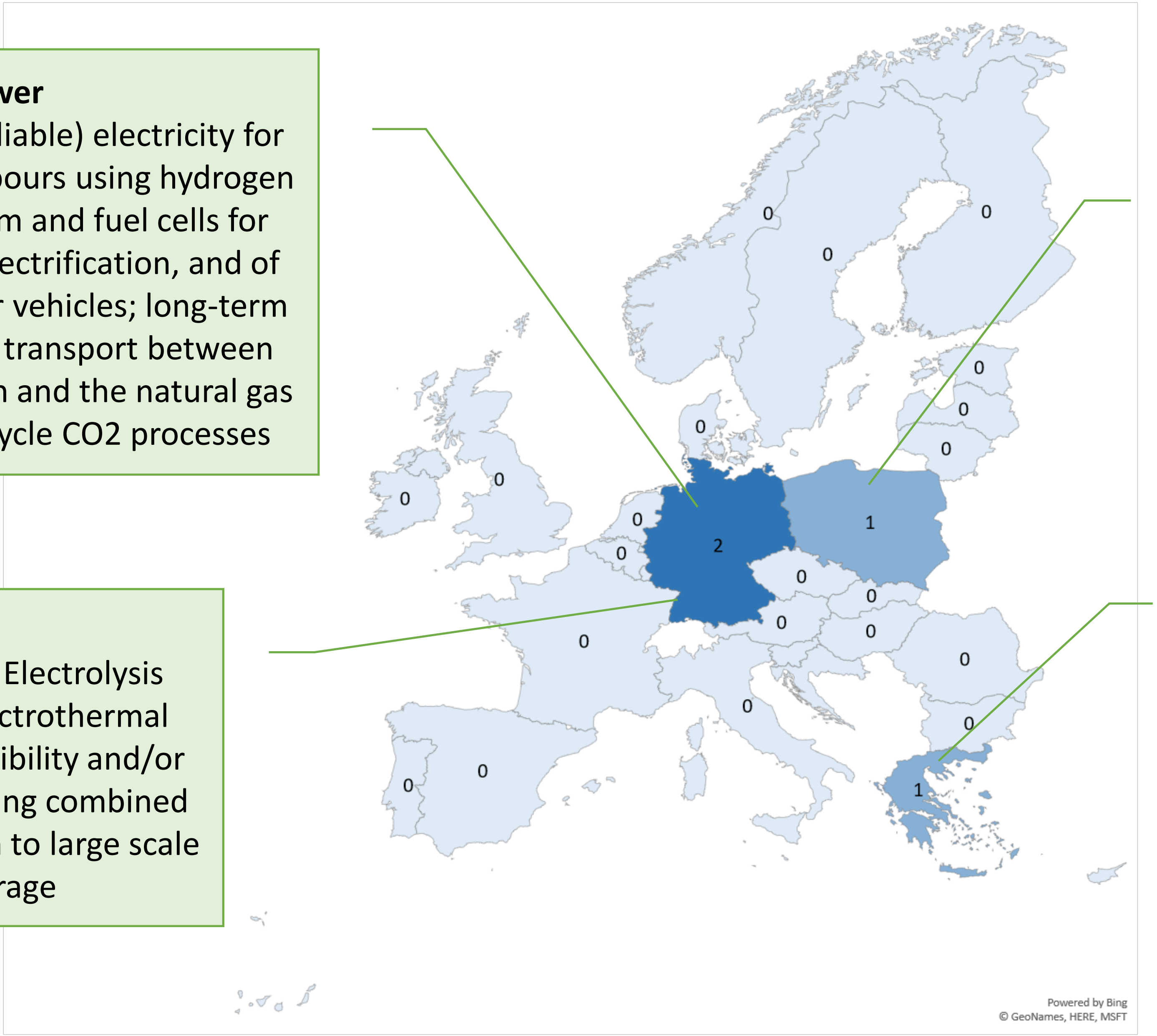
Other projects | Power generation

Power
provision of firm (reliable) electricity for ships moored in harbours using hydrogen as a storage medium and fuel cells for high-efficiency re-electrification, and of hydrogen to harbour vehicles; long-term storage and energy transport between sites via methanation and the natural gas grid, using closed-cycle CO2 processes

Power
Production of hydrogen by electrolysis from RES, H2 storage and electrical power generation by fuel cell to cover peak refinery electrical demand

Power
High Temperature Electrolysis combined with Electrothermal Heat Storage as flexibility and/or Retrofit option turning combined cycle power plants in to large scale energy storage

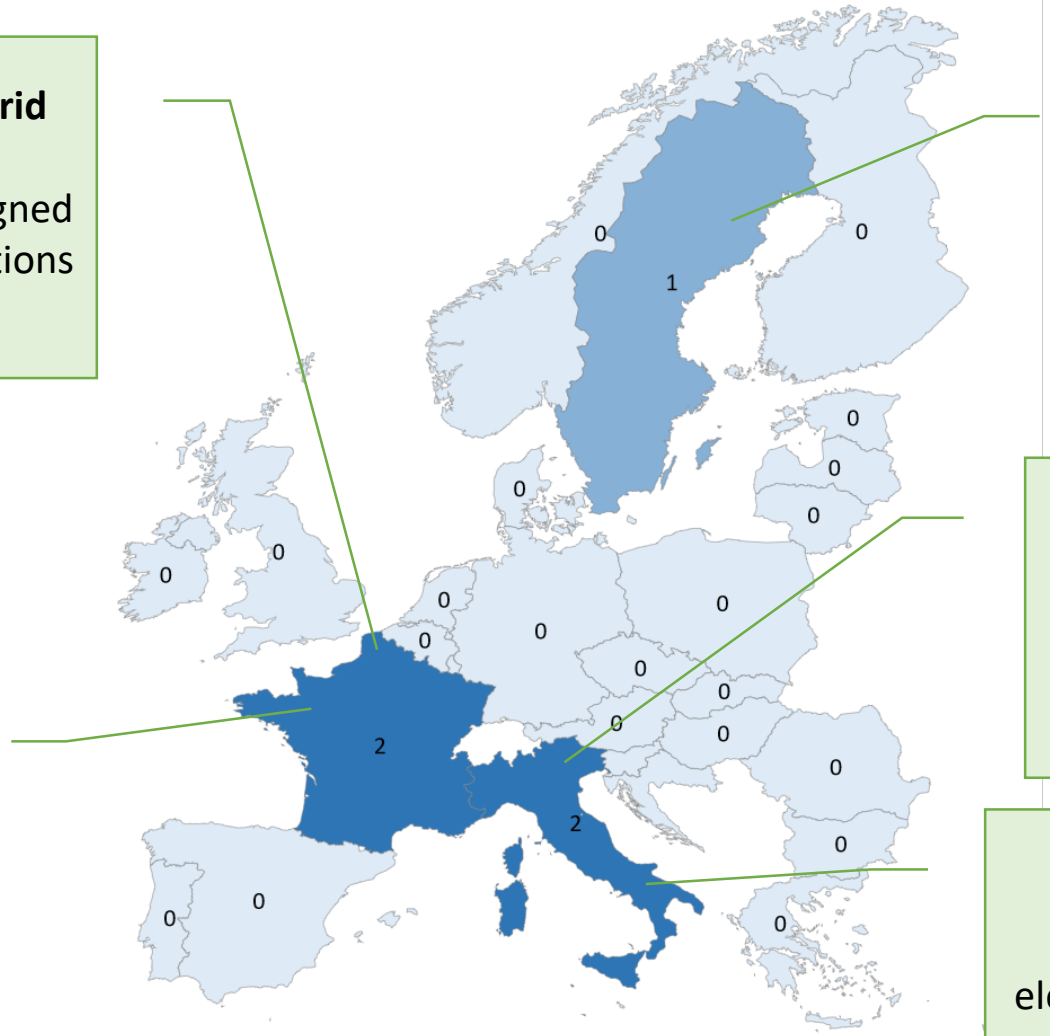
CHP
Regenerative fuel cell system operating with renewable electricity (closed water loop, cogeneration heat and power)



Other projects | Other

H2 storage and transport in the gas grid
Testing facilities reproducing gas transmission operating conditions designed for H2 and SNG for different concentrations of hydrogen and methane

Large scale H2 production
using off-shore wind electricity with capacities of more than 8500 tons of hydrogen production per year per site



H2 distribution
Harvesting hydrogen from RES in Sweden and transporting it by ship, rail and truck to hydrogen consumers in mobility and industry in mid-Europe.

Solar reforming
Following CoMETHy pilot proof-of-concept: a demo plant to be built in South EU, to produce hydrogen for Ammonia or Methanol production with reduced CO2 footprint

Hydrogen from waste
conversion of solid waste with reversible power-to-gas using electrochemical membranes for grid stabilization and renewable fuel production