



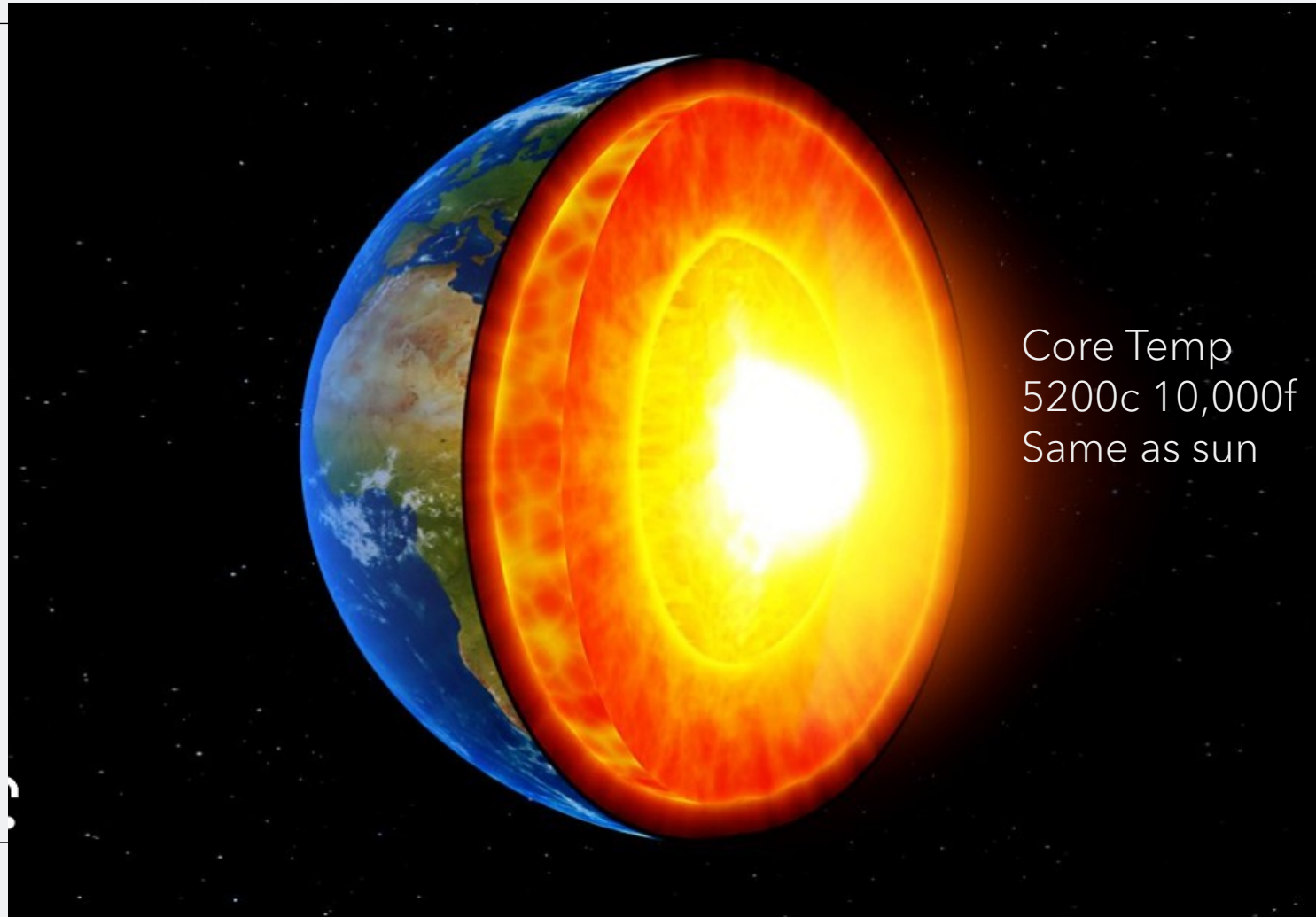
ALASKA GEOTHERMAL GREEN HYDROGEN

And Associated Industrial
Processes and Products

House Energy Committee
George Rauscher, Chairman
March 2, 2023

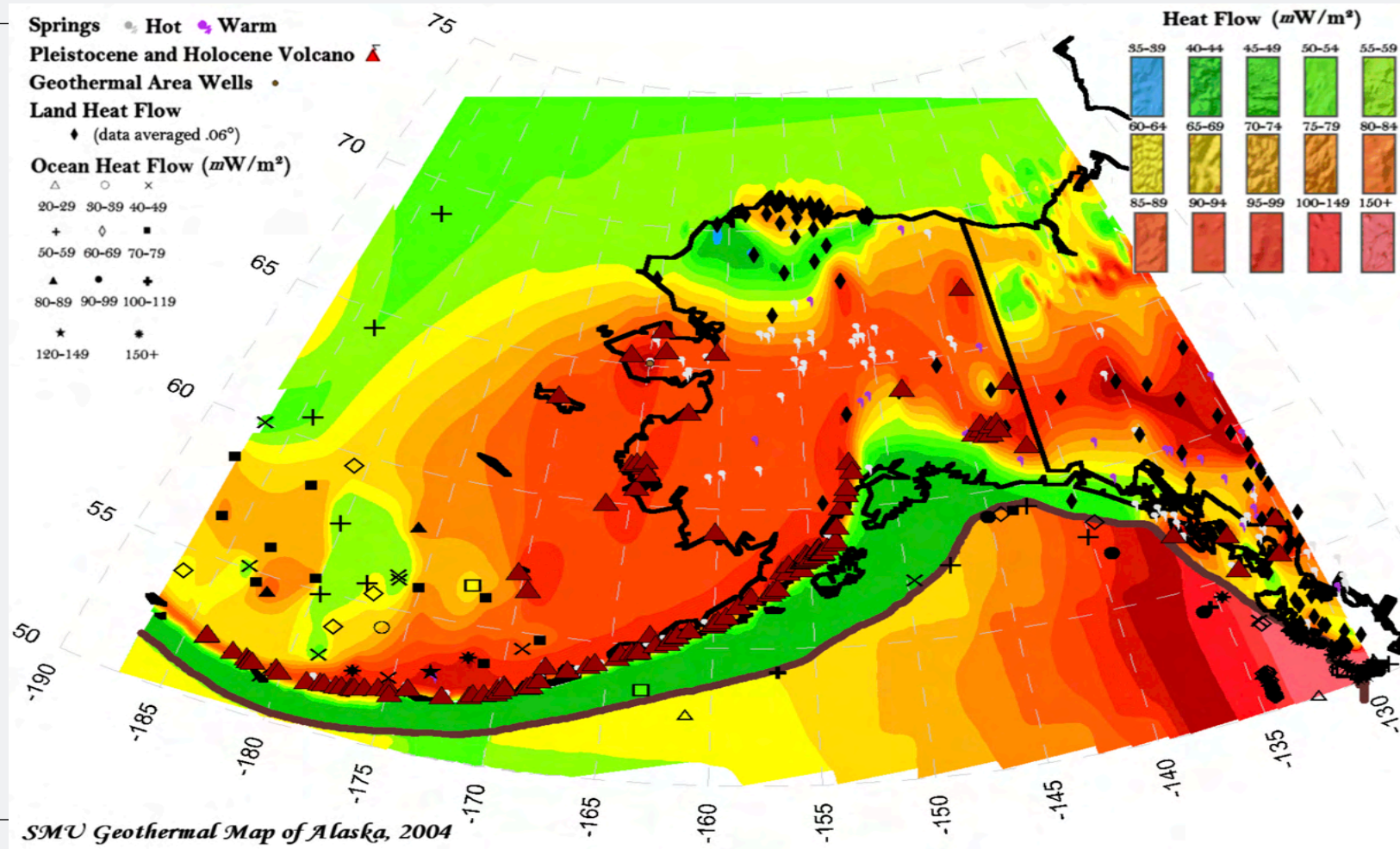
Paul Fuhs, CEO
Alaska Hydrogen Industries

EARTH'S SOLID CORE, MOLTEN IRON AND MANTLE

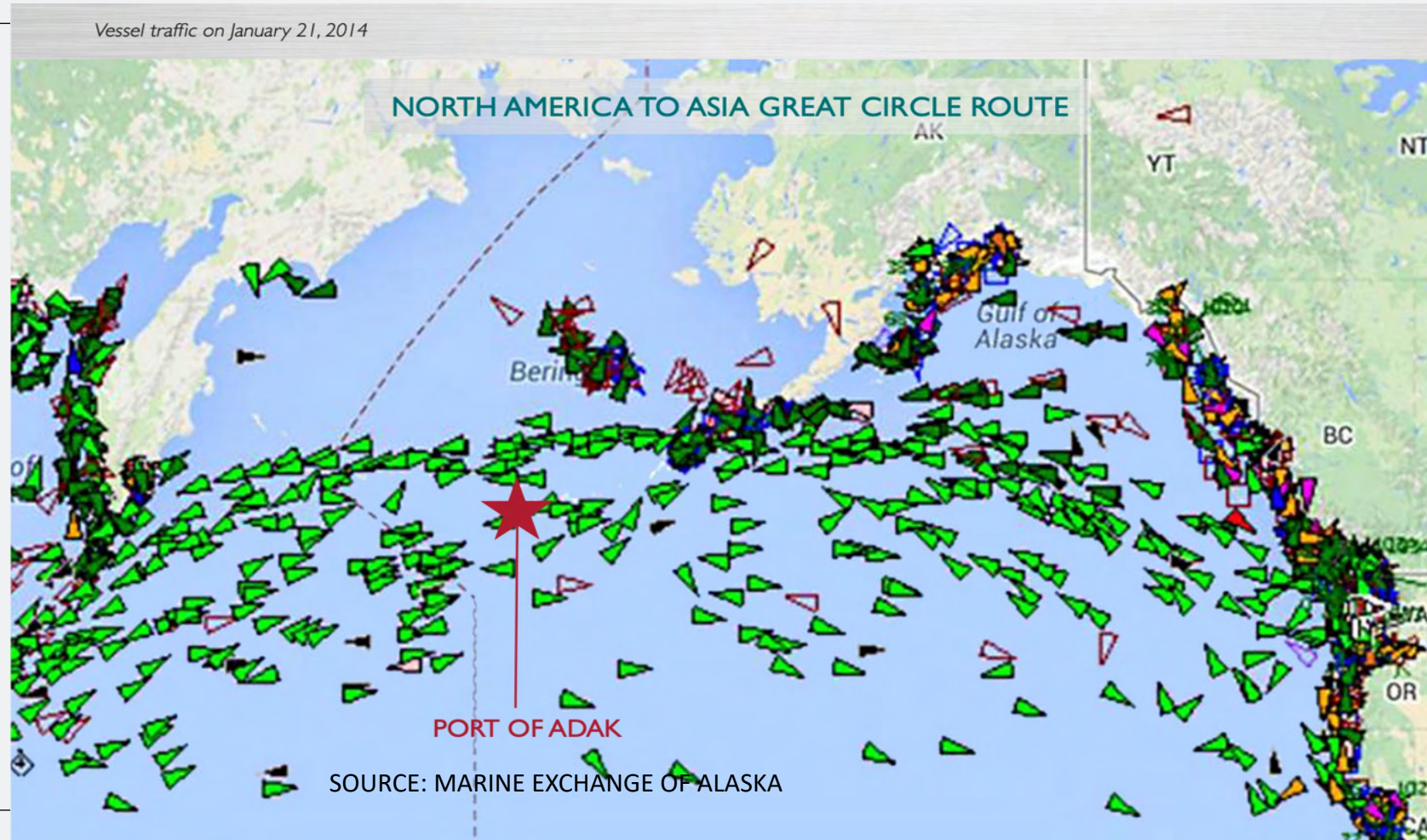


Geothermal sites Aleutian Islands

Stranded Energy



Alaska Strategic Marine Shipping Position

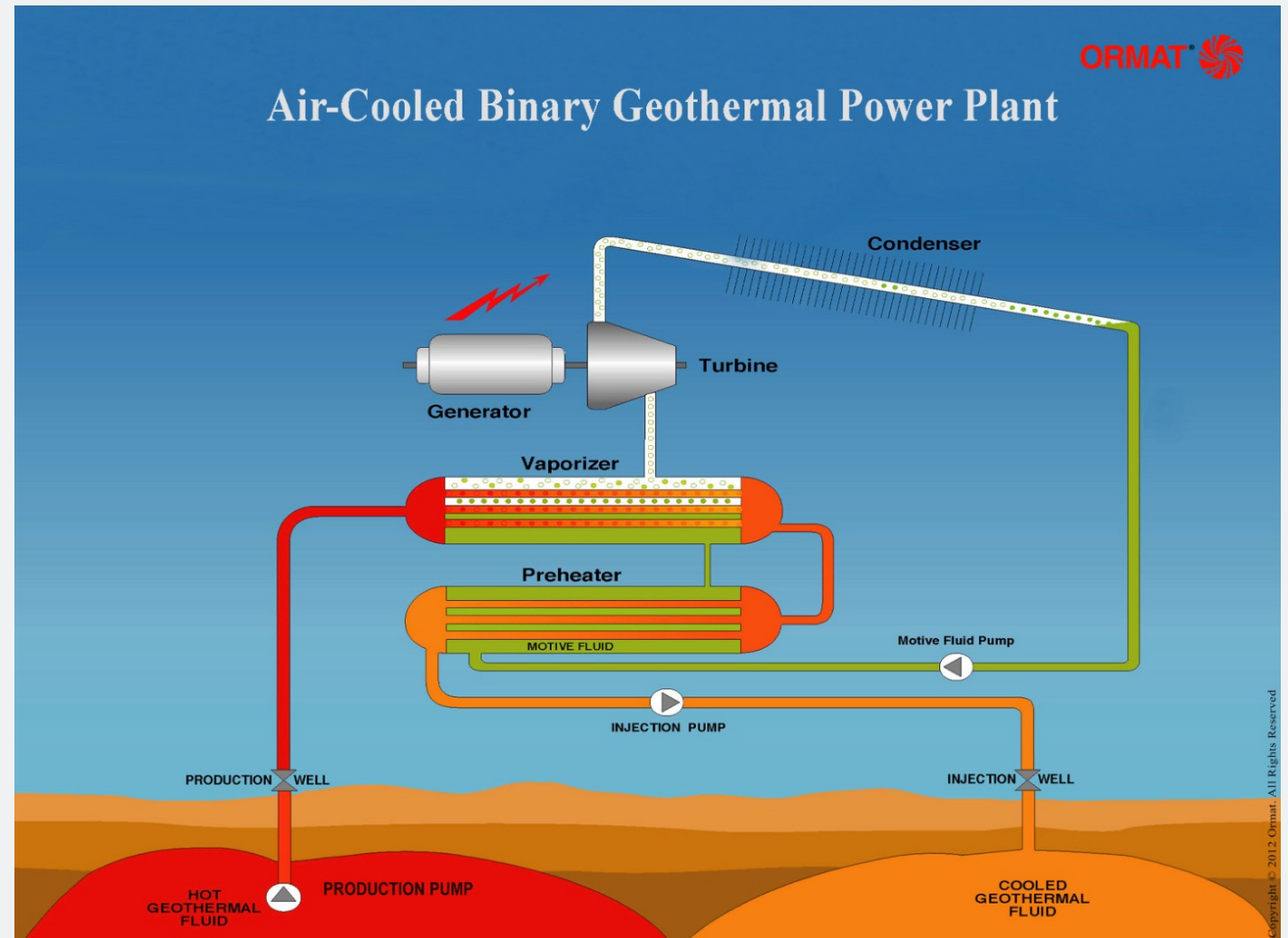


BINARY GEOTHERMAL PRODUCTION SYSTEM

Heat exchanger to production fluid

Geothermal fluids reinjected

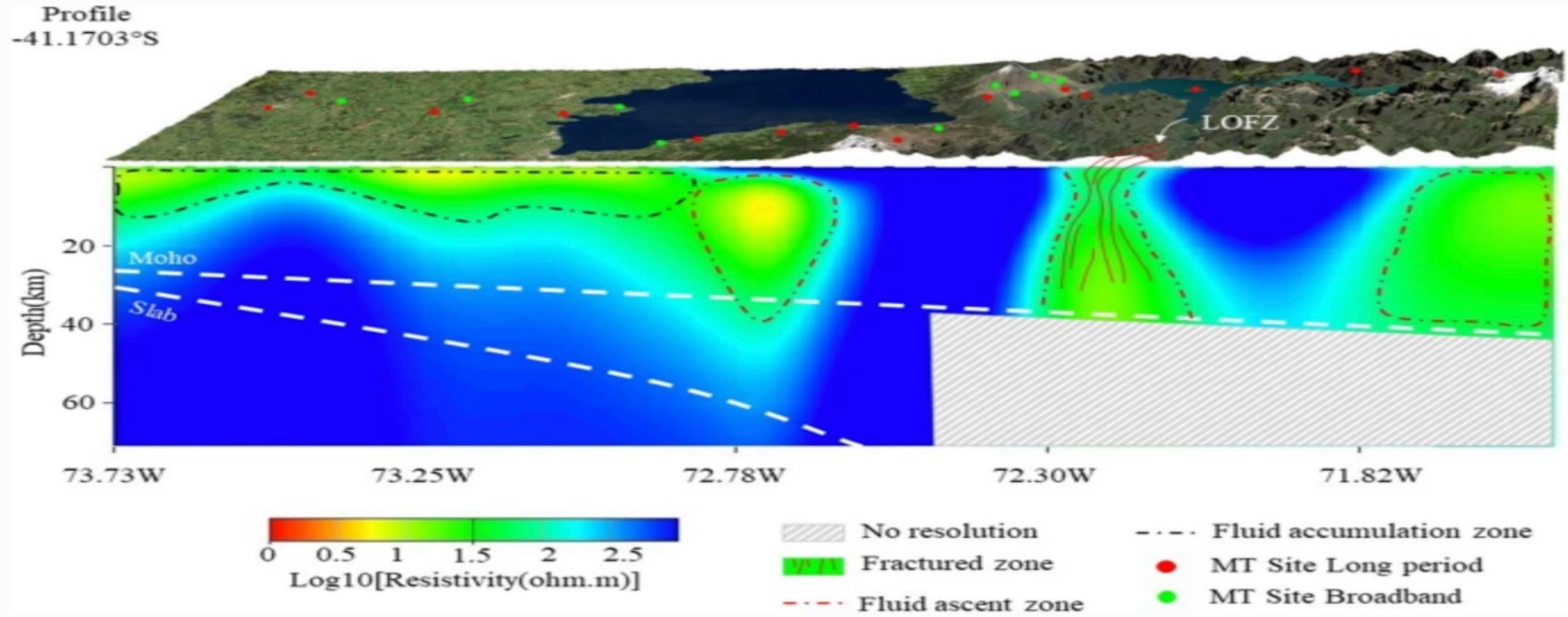
No harmful emissions or CO₂



Mammoth Geothermal Plant



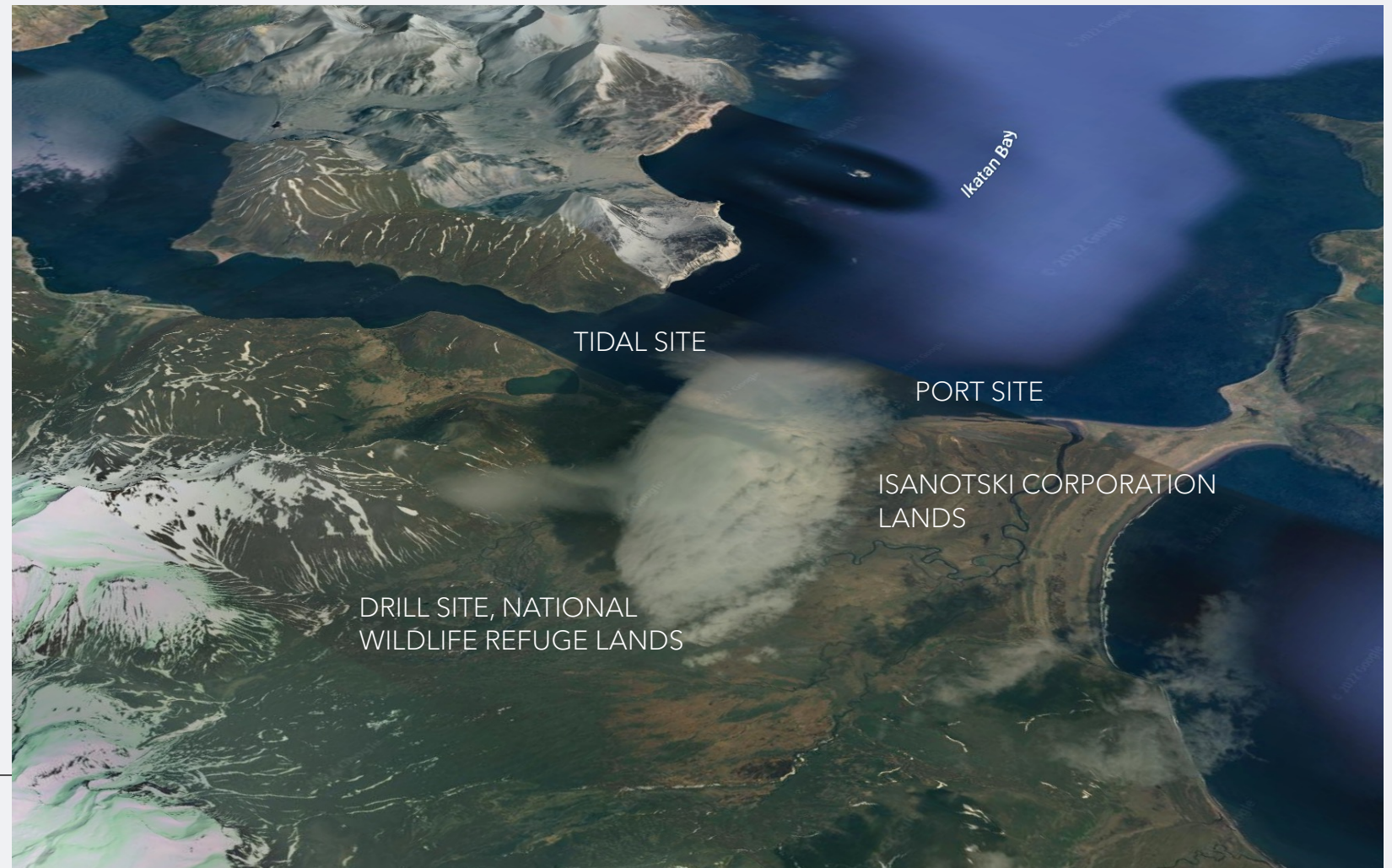
Magnetoelluric Geothermal Imaging



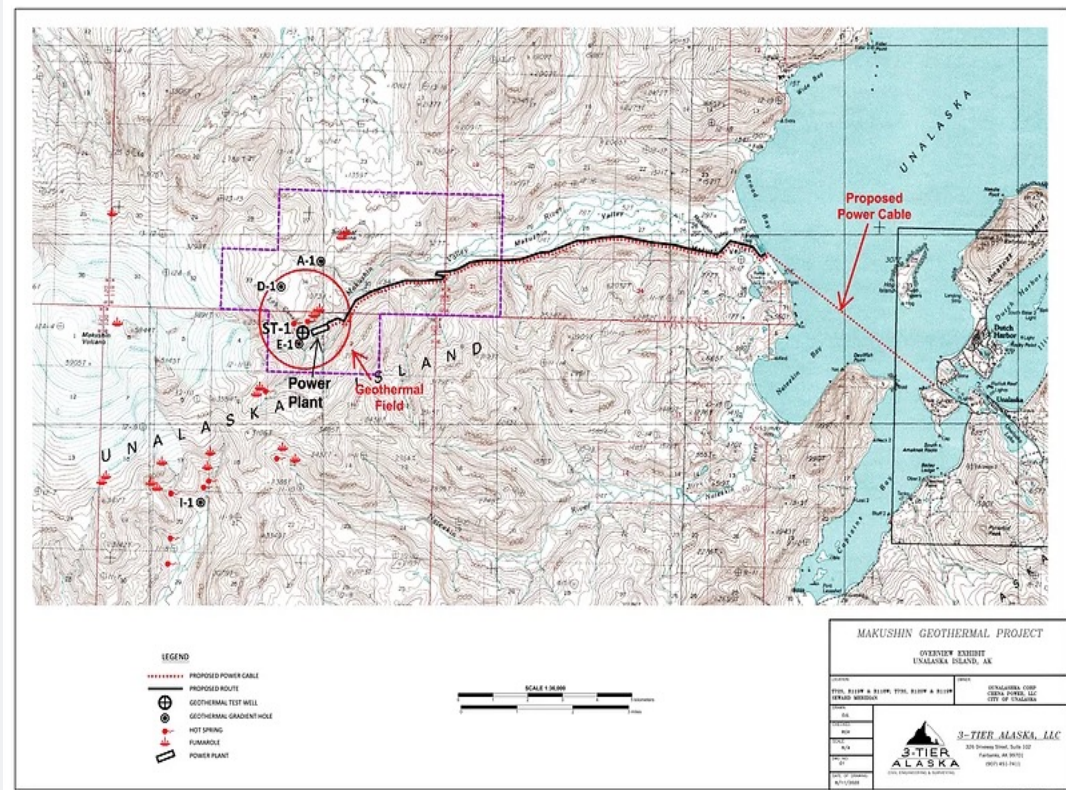
Hydrogen Hydrolyzer Plant Denmark



False Pass Geothermal/Tidal Site

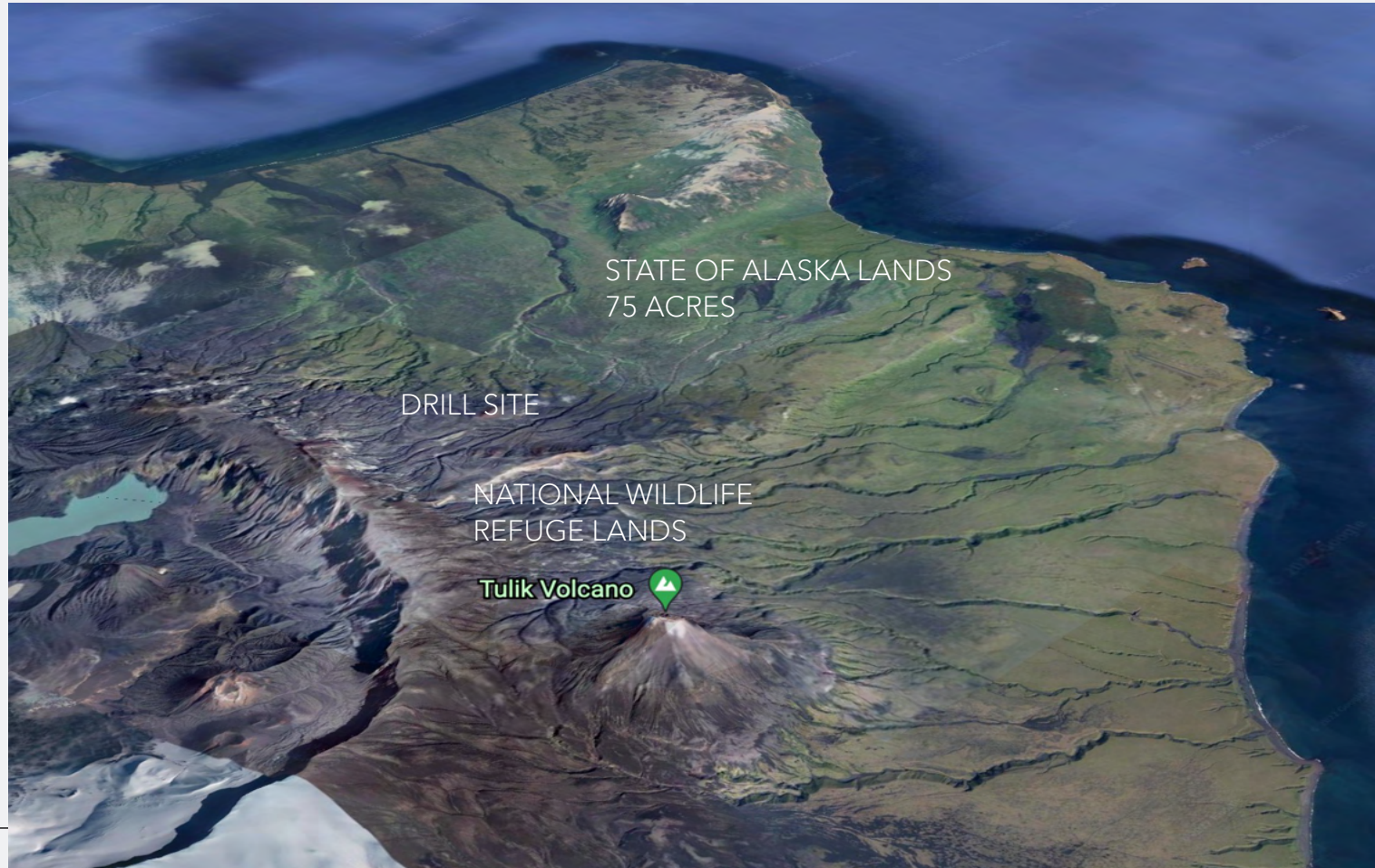


Makushin Geothermal Project Unalaska/Dutch Harbor



DOE TRIBAL FINANCING: 90%, 30 YEARS, 4.5% INTEREST UP TO \$2 BILLION

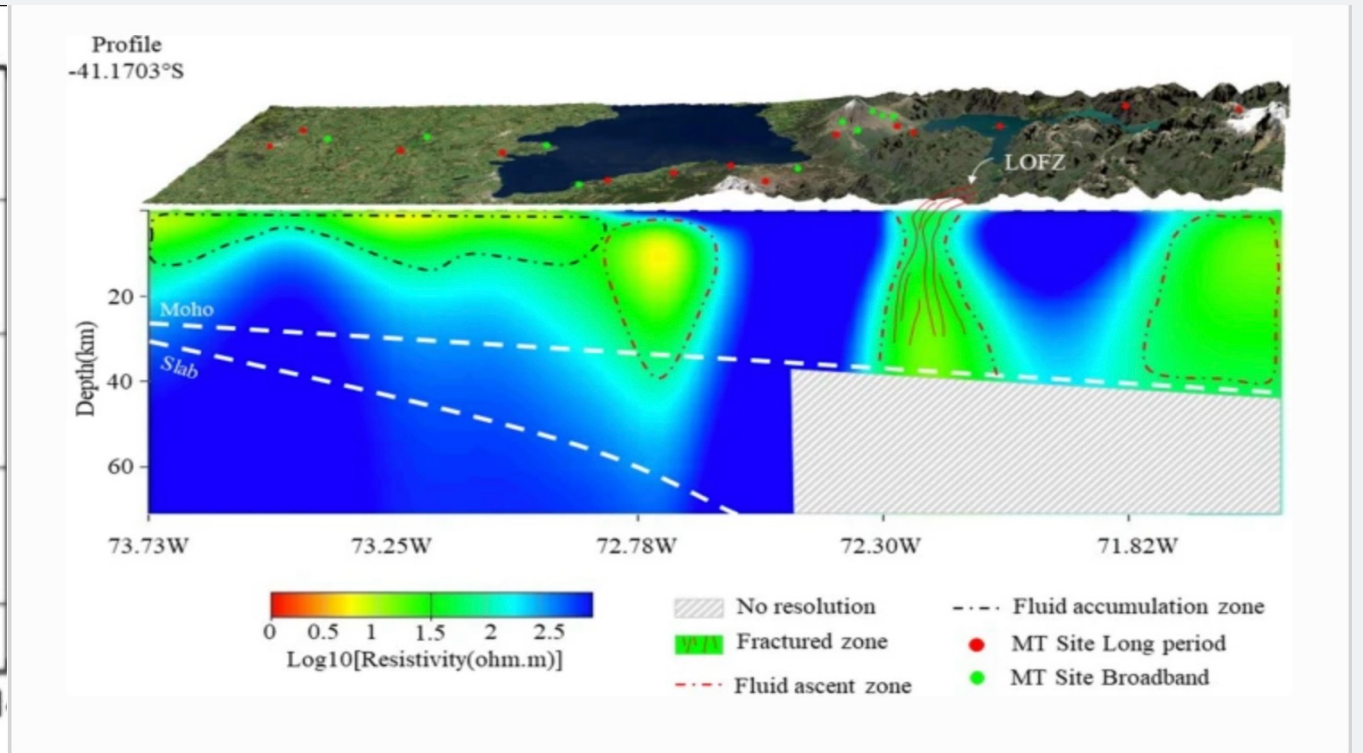
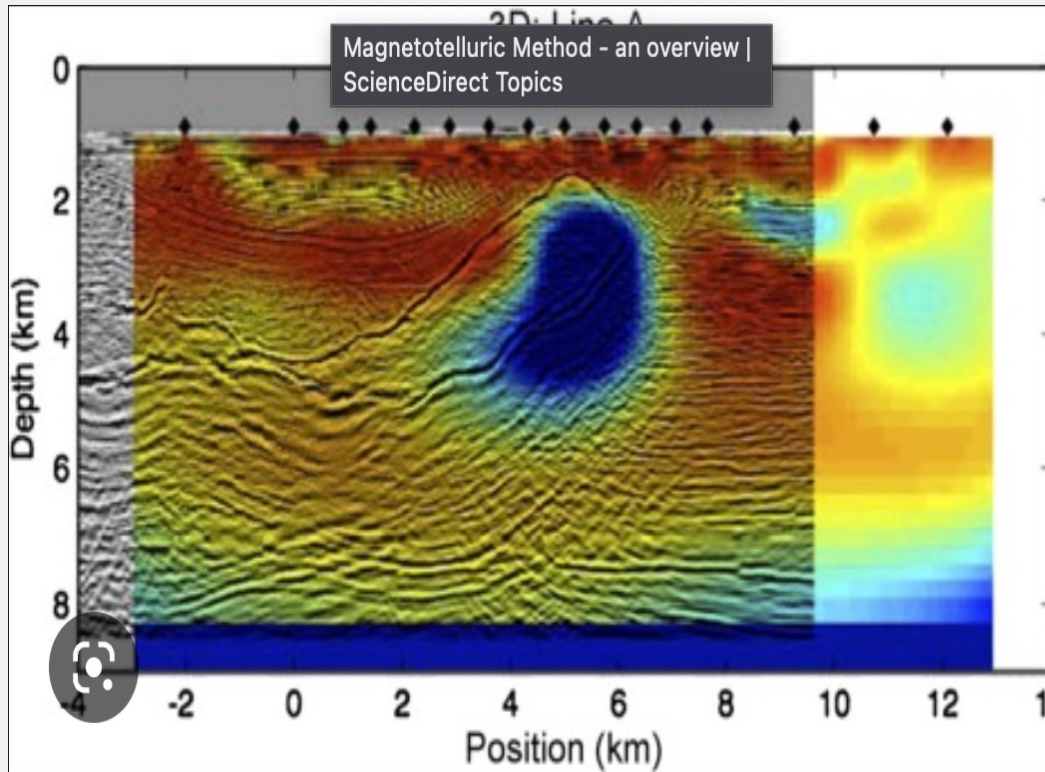
Fort Glenn/Unimak Island Geothermal/Tidal Site



Adak Geothermal Site



MAGNETOTELLURIC GEOTHERMAL IMAGING



DOE Hydrogen Programs, Tools

H₂ Matchmaker

A tool to assist hydrogen suppliers, users to identify collaborators, opportunities to expand regional hydrogen hubs.

Hydrogen Shot

The first Energy Earthshot, launched 6/7/2021 aims to reduce clean hydrogen costs by 80% to \$1 per 1 kilogram in 1 decade ("1 1 1").

\$47M in funding.

H₂ Twin Cities (part of the COP26, Climate Energy Ministerial)

To accelerate hydrogen deployments by pairing communities worldwide to collaborate at the city level.

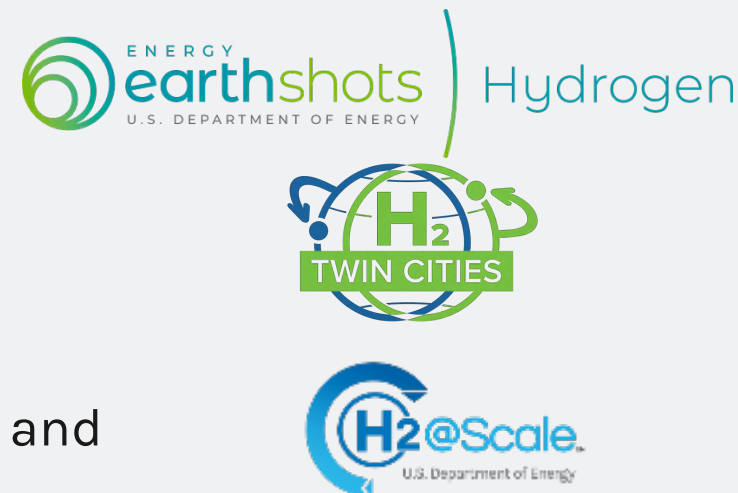
H₂@Scale

To advance affordable hydrogen production, transport, storage, and use for revenue opportunities in many sectors.

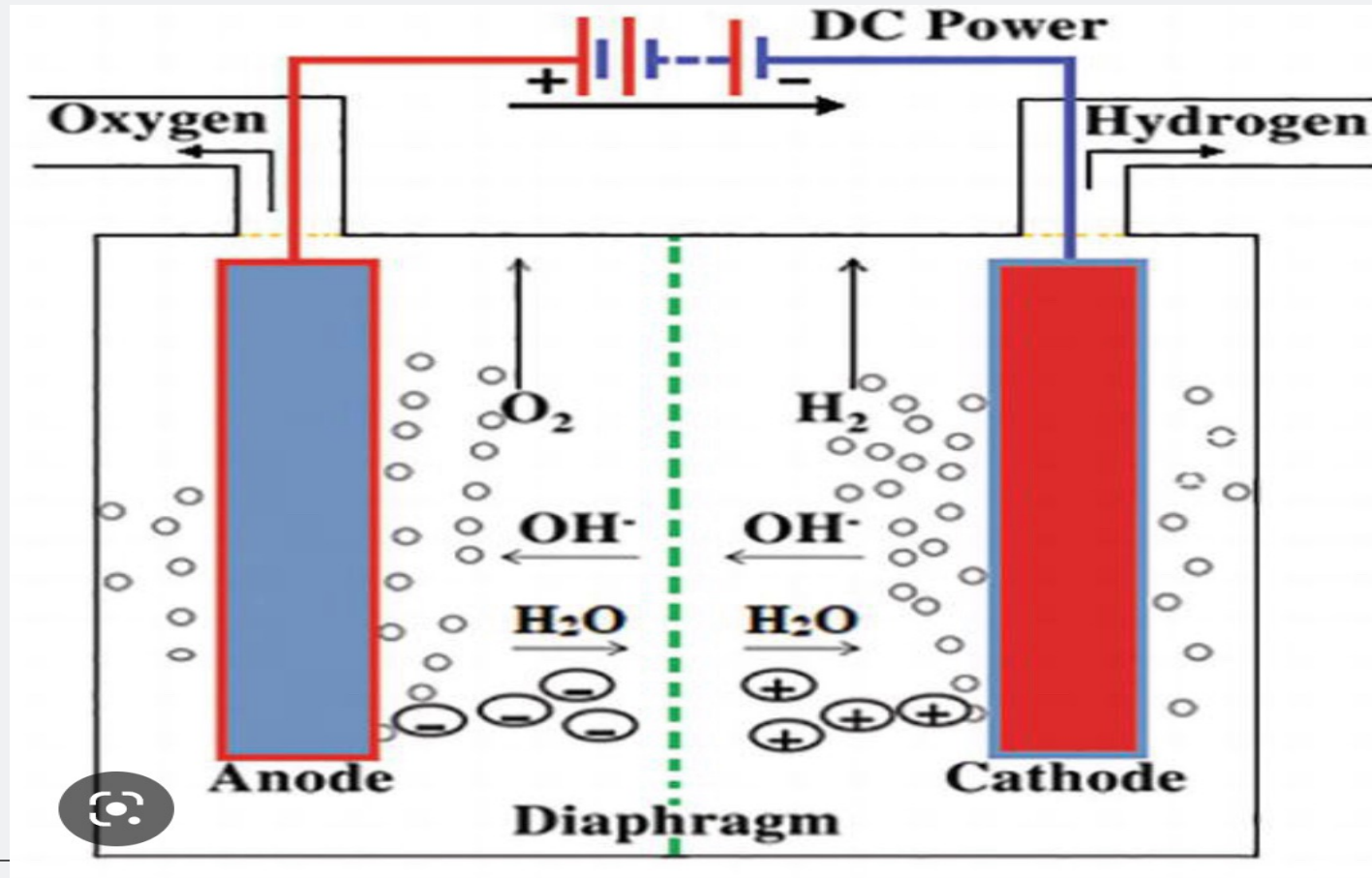
H₂Hubs

DOE received 79 concept papers, using \$150B of their capital + \$7B of DOE funding. DOE encouraged or discouraged full applications from applicants.

Alaska focus:
Alaska Hydrogen Energy Working Group – next virtual meeting is tomorrow!



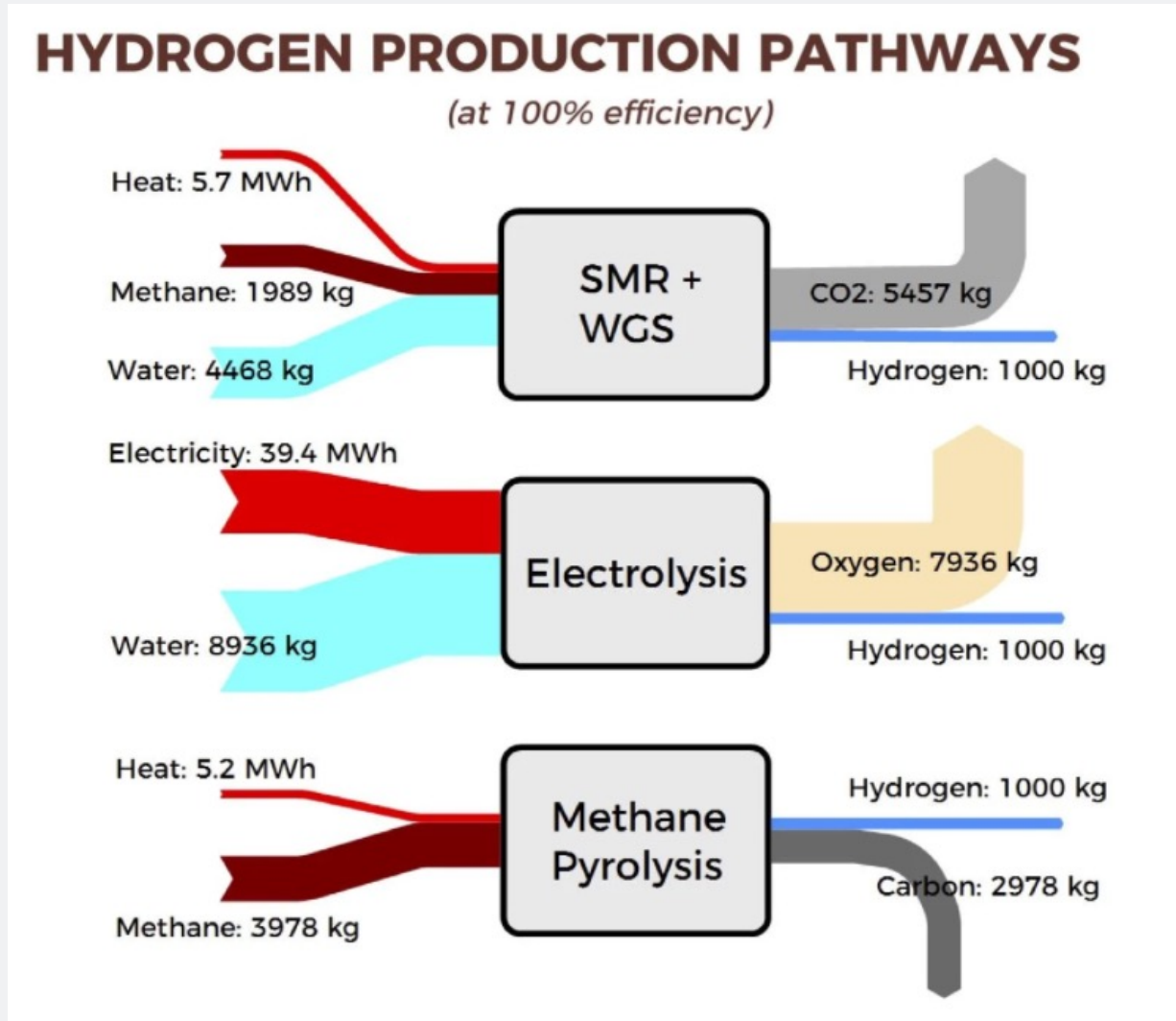
HYDROGEN ELECTROLYSIS PROCESS



TYPICAL HYDROGEN ELECTROLYZER PLANT DENMARK



Main Conversion Pathways



<https://www.greentechmedia.com/articles/read/c-zero-raises-11.5m-to-scale-up-turquoise-hydrogen-technology>

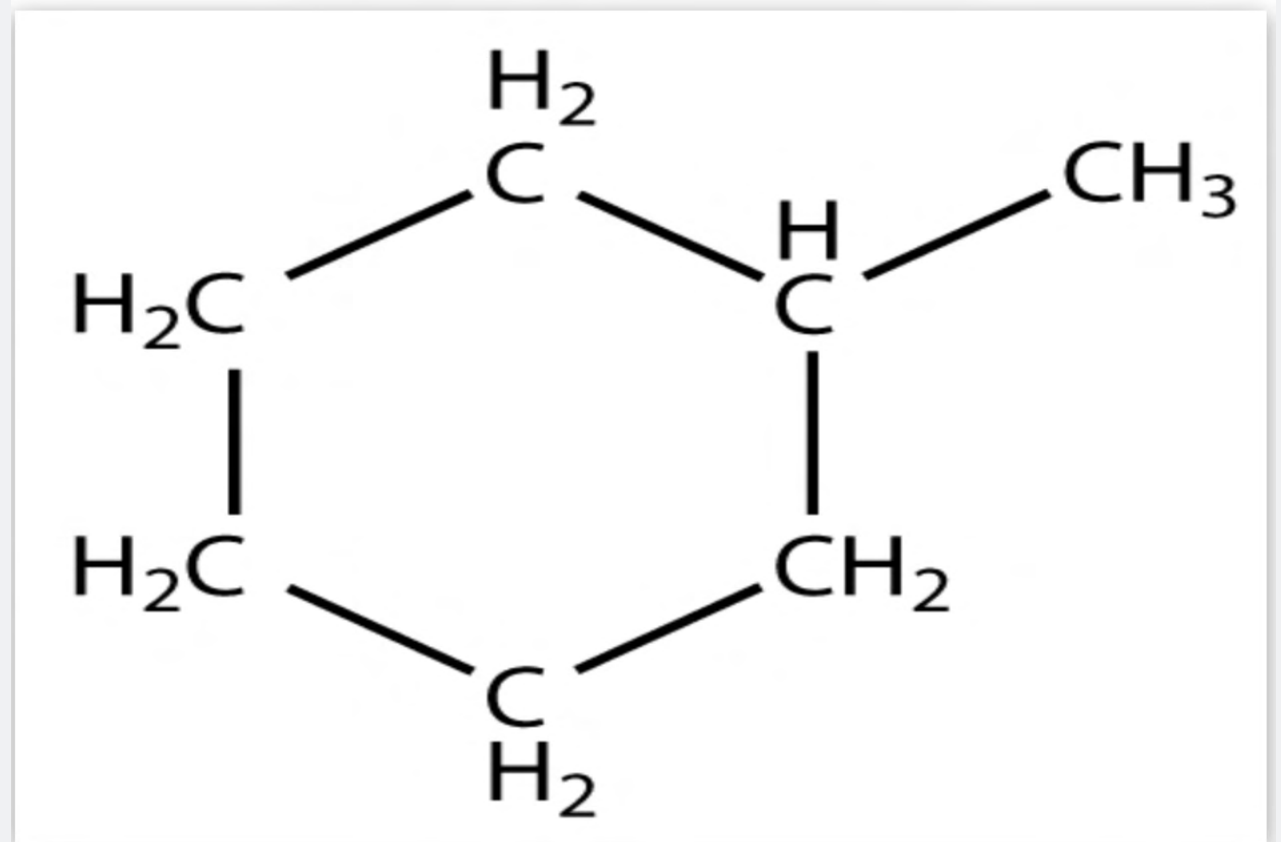
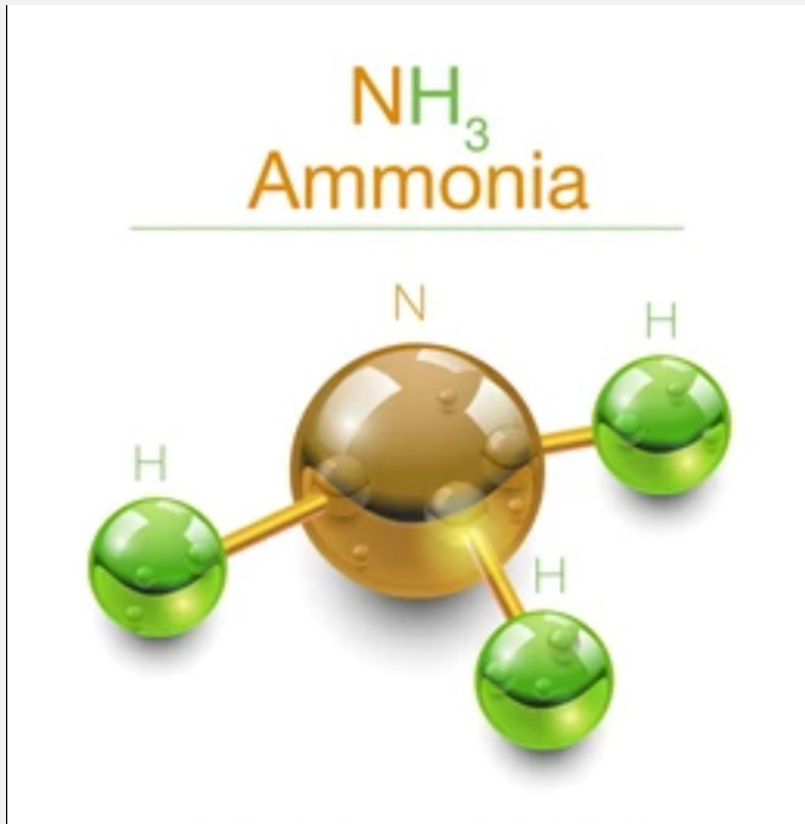
KOBE STEEL IRON ORE REDUCTION PLANT CHARLOTTESVILLE, SC



ELECTRIC ARC FURNACE RECYCLE STEEL + PURE Fe



HYDROGEN BASED FUELS: AMMONIA AND METHYLCYCLOHEXANE

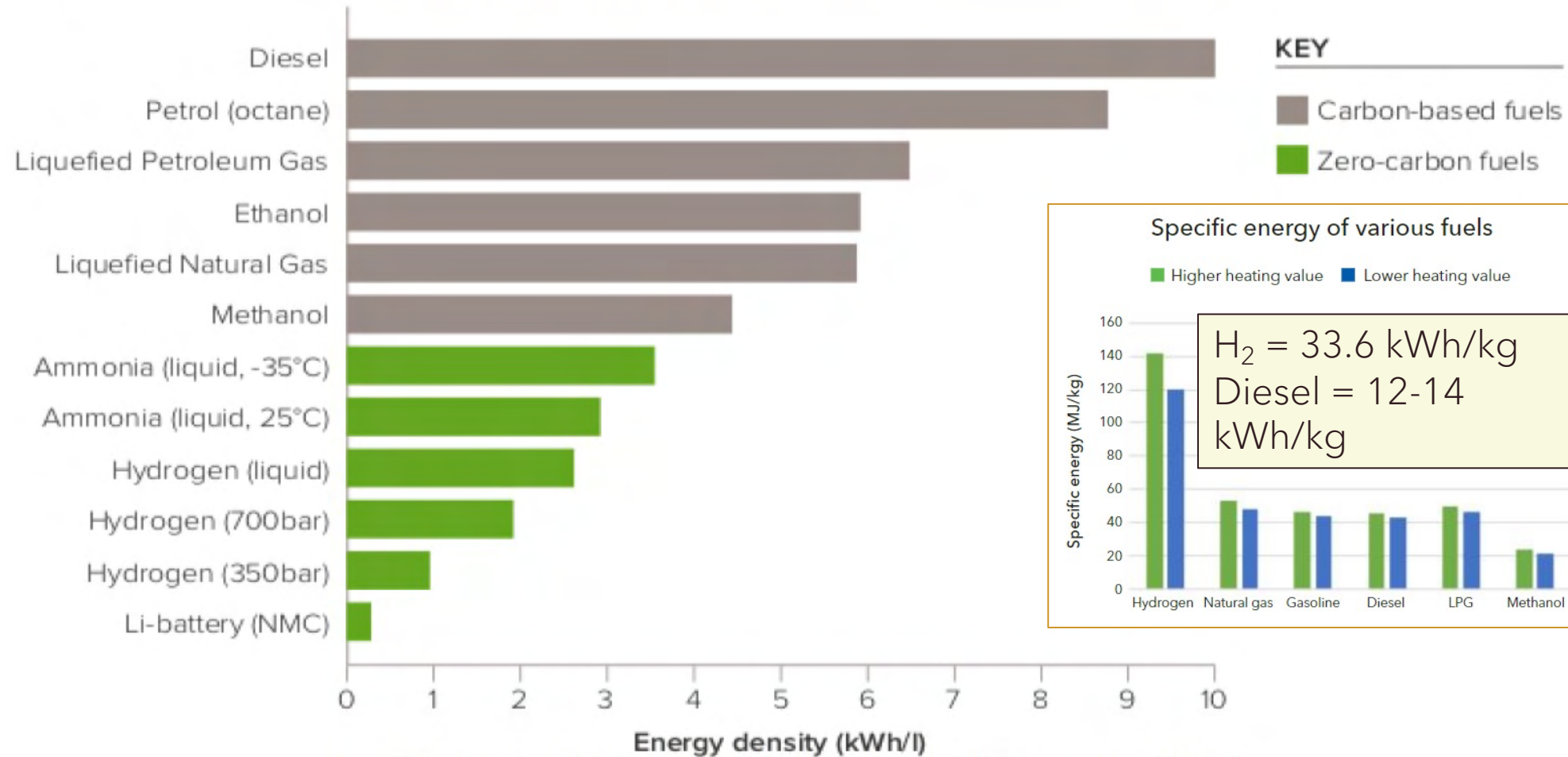


AMMONIA PRODUCTION PLANT SWEDEN



Density is Low Relative to Other Fuels, But Specific Energy is High

The volumetric energy density of a range of fuel options.

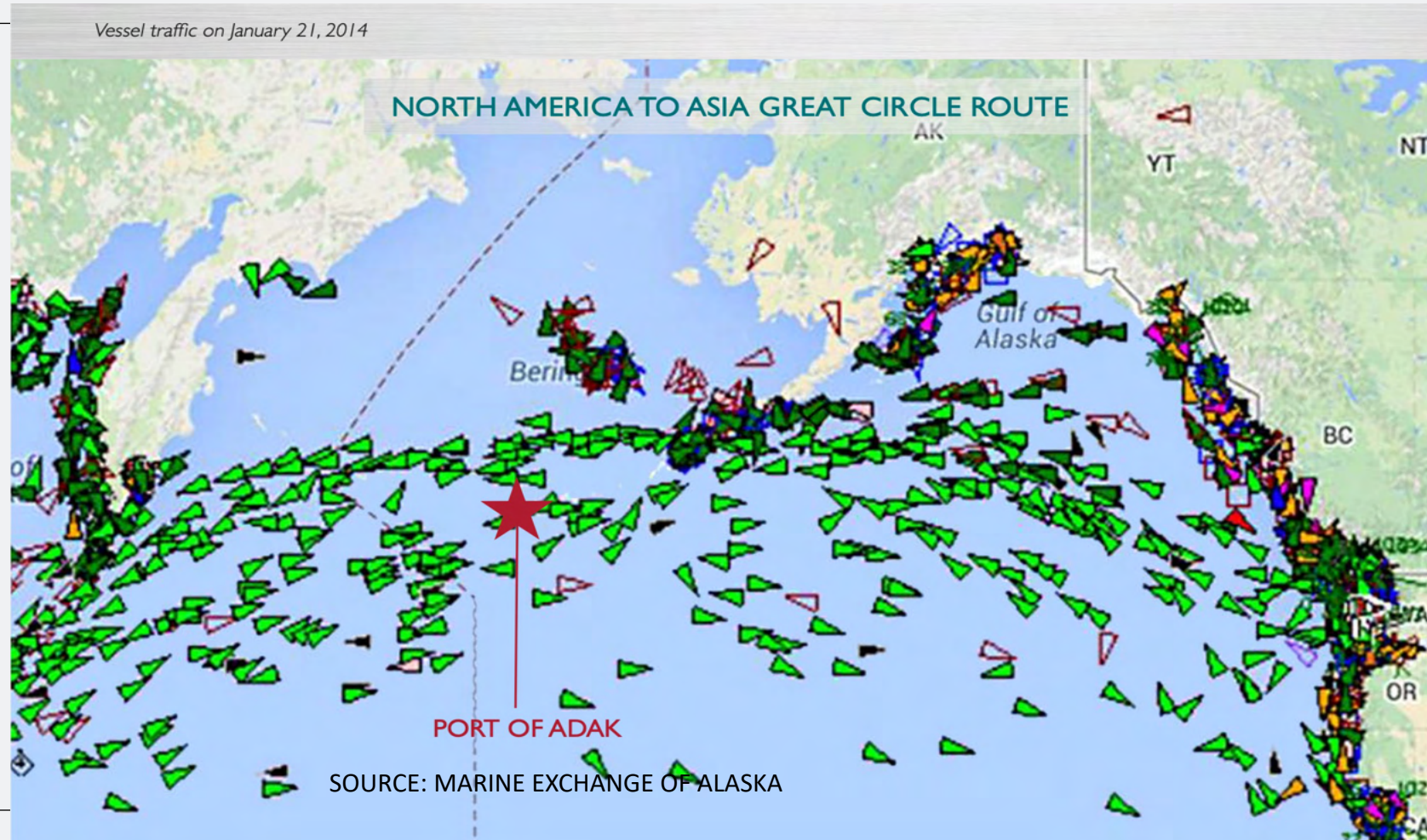


<https://royalsociety.org/-/media/policy/projects/green-ammonia/green-ammonia-policy-briefing.pdf>

<https://royalsociety.org/-/media/policy/projects/green-ammonia/green-ammonia-policy-briefing.pdf>

<https://www.dnvgl.com/publications/hydrogen-in-the-electricity-value-chain-141099>

Alaska Strategic Marine Shipping Position



IMO VESSEL FUEL TRANSITION



**GREEN SHIPPING
CORRIDORS:**
LEVERAGING SYNERGIES

LIQUID HYDROGEN CARRIER



MARKETS FOR ALASKAN HYDROGEN BASED PRODUCTS

- JAPANESE AUTO MANUFACTURERS ARE DEMANDING GREEN STEEL
 - JAPAN IS SEEKING SUPPLIES OF HYDROGEN BASED FUELS TO OFFSET FOSSIL FUEL IMPORTS
 - JAPAN IS SEEKING ALTERNATIVES TO NUCLEAR ENERGY FOLLOWING FUKUSHIMA DISASTER
 - MARINE SHIPPING OPERATORS ARE SEEKING TO REDUCE CARBON EMISSIONS
 - INTERNATIONAL MARITIME ORGANIZATION SETTING STANDARDS FOR REDUCED CARBON EMISSIONS
 - IMO PROHIBITING USE OF HEAVY FUEL OILS (HFO's) ON THE NORTHERN SEA ROUTE
-

ALASKA ENERGY POLICIES

- SUPPORT DEVELOPMENT OF RENEWABLE FUELS FOR LOCAL DISTRIBUTION AND EXPORT
 - PROVIDE FINANCIAL SUPPORT, ALONG WITH DOE, FOR GEOTHERMAL UPFRONT COSTS
 - CONTINUED SUPPORT FOR FOSSIL FUEL PRODUCTION
 - DEFEND AGAINST DISCRIMINATION TOW ARD ARCTIC PETROLEUM PRODUCTION
 - SUPPORT DEVELOPMENT OF MINERALS FOR ENERGY TRANSITION (ELECTRIC VEHICLE REQUIRES ON AVERAGE 193 POUNDS OF COPPER, 3% ORE RECOVERY RATE = 6 TONS COPPER ORE PER VEHICLE)
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CONTACT INFORMATION



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