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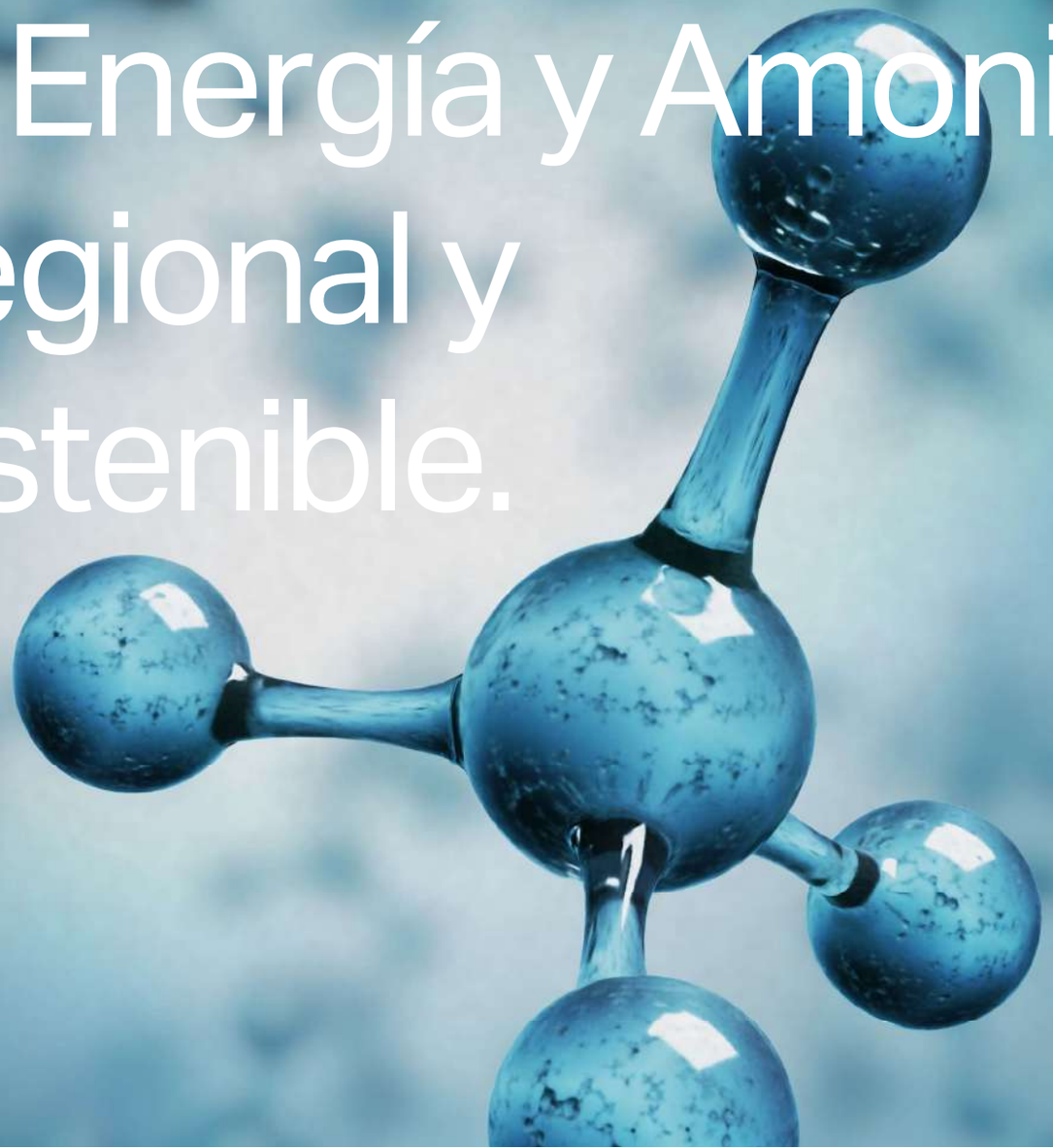
# Hidrógeno, Energía y Amoniaco. Realidad Regional y Legado Sostenible.



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Delivering a better world

# POR QUÉ AECOM?

## ESTADÍSTICAS

EN TODO EL **MUNDO**

**6**
Continentes

**50,000**
Empleados

**150 +**
Países

**US$13.1B**
Ingresos en 2022

**NYSE**
ACM

**#189**
Fortune 500 (2021)

**2022**
La Empresa más admirada del mundo por Fortune

## #ENR2022

TOP 500

1 Construcción en General
1 Mercados Internacionales
1 Transporte
2 Top Firmas de Diseño
2 Residuos Peligrosos
3 Alcantarillado y Residuos
3 Agua
8 Energía

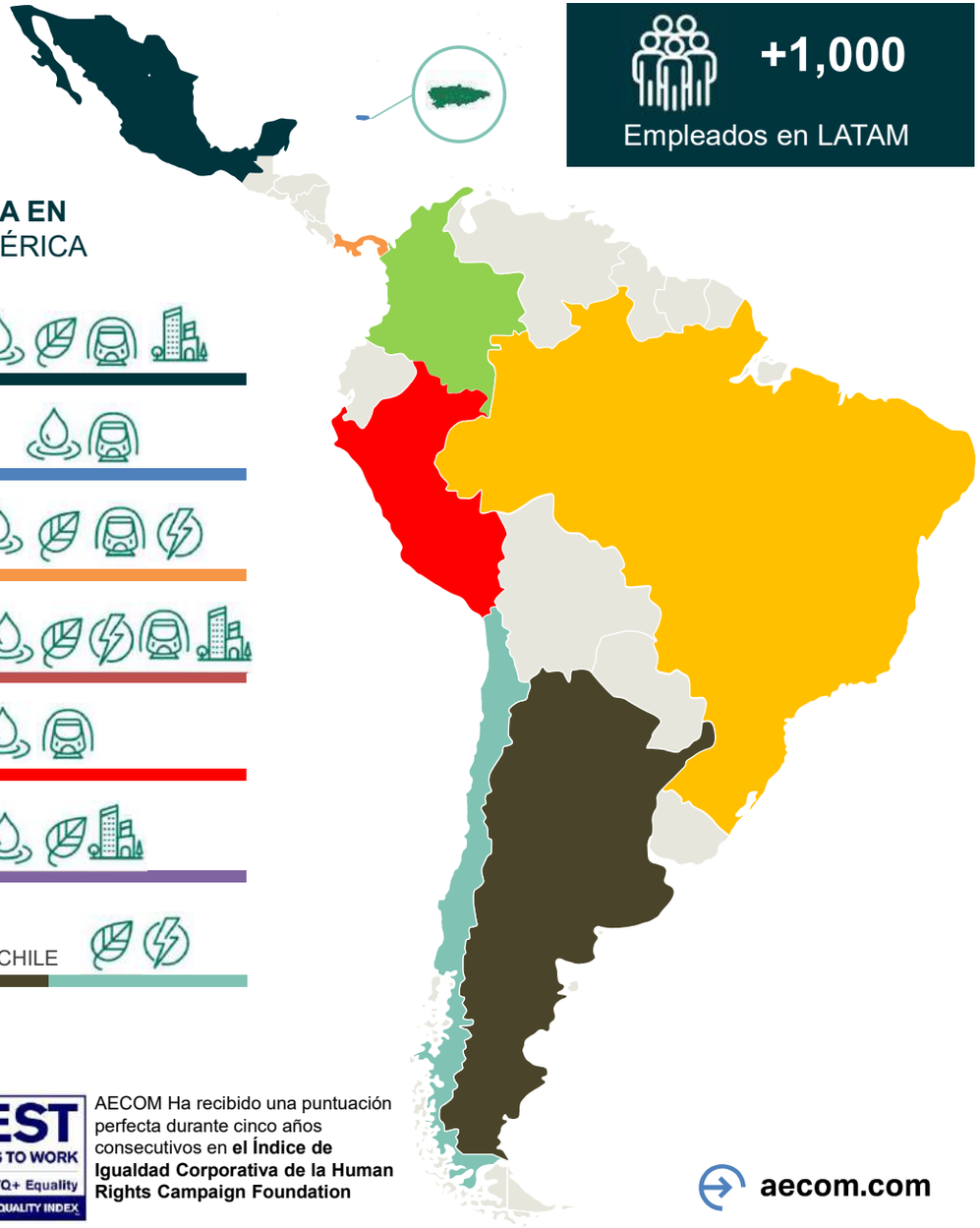
## CENTROS DE DISEÑO

- AGUA
- MEDIO AMBIENTE
- PPM
- ENERGÍA
- TRANSPORTE

**+1,000**
Empleados en LATAM

**PRESENCIA EN** LATINOAMÉRICA

- MÉXICO
- PUERTO RICO
- PANAMÁ
- COLOMBIA
- PERÚ
- BRASIL
- ARGENTINA Y CHILE



FORTUNE THE WORLD'S MOST ADMIRED COMPANIES® 2022

DALLAS (2 de febrero de 2022) - AECOM (NYSE:ACM), la consultora de infraestructuras de confianza en el mundo, ha anunciado hoy que ha conseguido por segundo año consecutivo el **número 1 en la lista de las empresas más admiradas del mundo de su sector, elaborada por la revista Fortune**. Este es el octavo año consecutivo que la empresa ha sido reconocida en la lista

2022 WORLD'S MOST ETHICAL COMPANIES® WWW.ETHISPHERE.COM
2021 WORLD'S MOST ETHICAL COMPANIES® WWW.ETHISPHERE.COM

Estamos orgullosos de ocupar el primer puesto en la lista de las empresas más admiradas del mundo de la revista Fortune por segundo año consecutivo.

BEST PLACES TO WORK 2022 for LGBTQ+ Equality 100% CORPORATE EQUALITY INDEX

AECOM Ha recibido una puntuación perfecta durante cinco años consecutivos en **el Índice de Igualdad Corporativa de la Human Rights Campaign Foundation**

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# Proyectos en Colombia

AECOM en Colombia cuenta con una oficina hace más de 15 años, desarrollados a través de sus líneas de negocio:

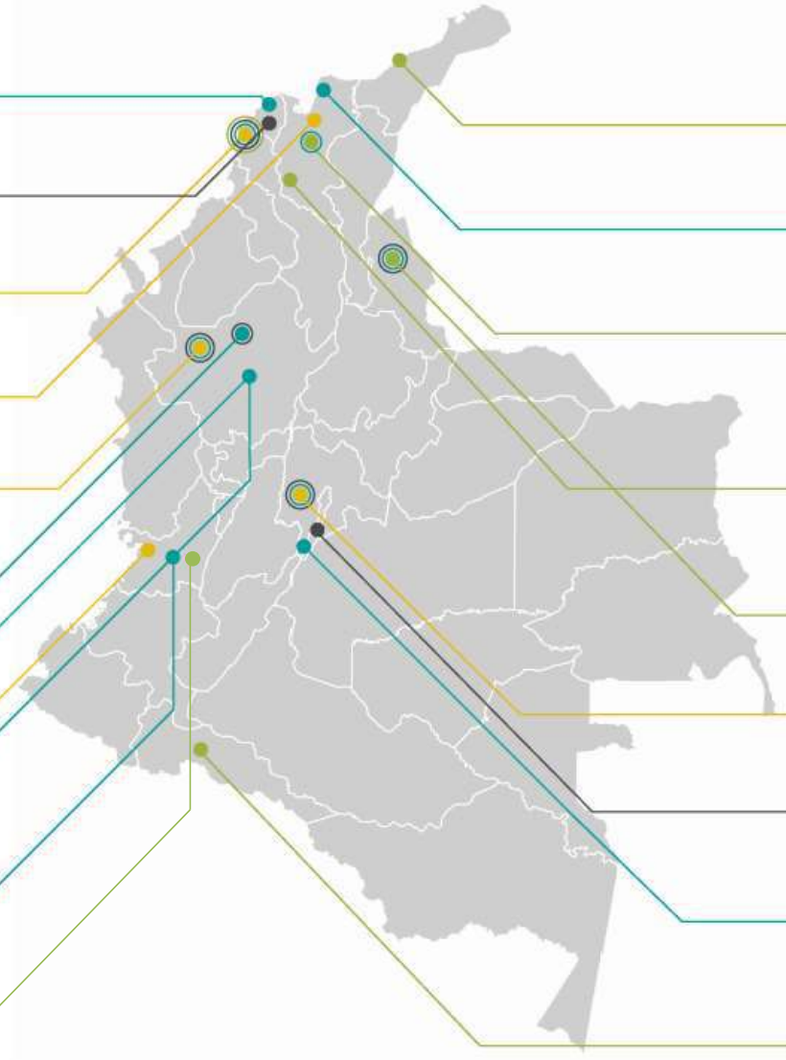
- AGUA
- MEDIO AMBIENTE
- ENERGÍA
- TRANSPORTE
- PPM

Trabajamos por construir un **Mundo Mejor**:

- Liderando con **ESG** y entregando Legados Sostenibles.
- Buscando soluciones basadas en la naturaleza (**NBS**)
- Proporcionando **soluciones digitales (DIGITAL)**, para conectar un futuro mejor.
- Buscando a través de nuestras soluciones mejorar el medio ambiente **y reducir el coste de la infraestructura** a lo largo de su ciclo de Vida.
- Dando prioridad a la **seguridad, la resiliencia y la sostenibilidad**.

**+300** Empleados en COLOMBIA

Oficina establecida desde el **2004**



- Master Plan Río Magdalena, Puerta de Oro Barranquilla, Atlántico
- Gerencia de Proyecto Arena del Río Barranquilla, Atlántico
- Aeropuerto de Cartagena Cartagena, Bolivar
- Supervisión Concesión Férrea del Atlántico Magdalena
- Autopista al Mar 2 Antioquia
- Diseño urbanístico y arquitectónico de casas rurales e instalaciones comunales para el reasentamiento de la población del proyecto minero de Gramalote, Antioquia
- Plan de Acción Climática Medellín, Antioquia
- Estructuración de la Red Férrea del Pacífico, tramo Buga-Buenaventura
- 100 Ciudades Resilientes Medellín y Cali
- Escuelas Resilientes Cali
- Designado Técnico y Administrativo durante la construcción de una PTARI y una PTAI Cali
- **USAID** Colombia Programa de tierras y desarrollo rural en todo el país
- **USAID** Colombia Programa Nacional de Políticas Públicas (CPPP)
- Servicios medioambientales, sociales y de seguridad industrial para perforaciones de exploración offshore en el Caribe Colombiano
- Estudios Ambientales y evaluación para proyectos de generación eólica offshore
- **USAID** PARA-Agua Cuenca del Guatapurí
- Evaluación de impacto ambiental y social del proyecto de perforación de una instalación de exploración de petróleo y gas offshore en Guajira
- Gerencia Integral para el proyecto de reasentamiento del área urbana de Gramalote, Norte de Santander
- Regiotram de Occidente Bogotá y Cundinamarca
- Torres Atrio Bogotá
- Plan de Acción Climática de Bogotá Bogotá
- Estudios Medioambientales para licenciamiento de un proyecto de hidrocarburos en Putumayo

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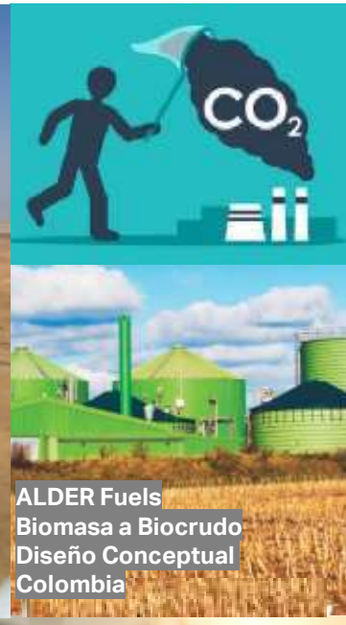
# Energía LatAm

## SERVICIOS Y ÁREAS DE NEGOCIO

**Pre-factibilidad, Diseños, FEED, Ingeniería del Dueño, Project Management, Asesoría Técnica.**

- Proyectos Eólicos (*onshore y offshore*)
- Proyectos de Hidrógeno verde y su cadena de valor (amoniaco, metanol, urea)
- Líneas y SE HVDC
- *Net Zero*, Bajas emisiones y Captura de Carbono
- *Energy Storage - BESS*
- Servicios Digitales: Redes y Microrredes Inteligentes
- Movilidad Sostenible
- *Power to X*
- Biomasa, *Bio fuels, SAF*
- *Waste to Energy Technologies*
- Eficiencia Energética



# The Future of Energy — AECOM's Market Perspective

**Sustainable, Secure, Available and Efficient**

### Energy Transition

Decarbonisation professional and project delivery services to support clients with the strategy and implementation of transitioning from fossil fuelled infrastructure to more sustainable alternatives.

### Renewables & Sustainability

Enabling the development of new Wind, Solar and other Green Energy projects through a combination of siting, generation, grid connectivity solutions and supporting infrastructure.

### Energy Delivery

Core Power services to provide solutions for Grid modernization including new utility services and interconnectors to enable clients to access Energy reliably and sustainably from point of generation to point of use.

### Decentralised Energy

Strategic Green Energy consultancy and solutions to serve the growing local generation, micro- grid, decentralised storage and Energy management markets.

The rapidly growing integrated hydrogen market is the space to build our legacies for generational sustainability.

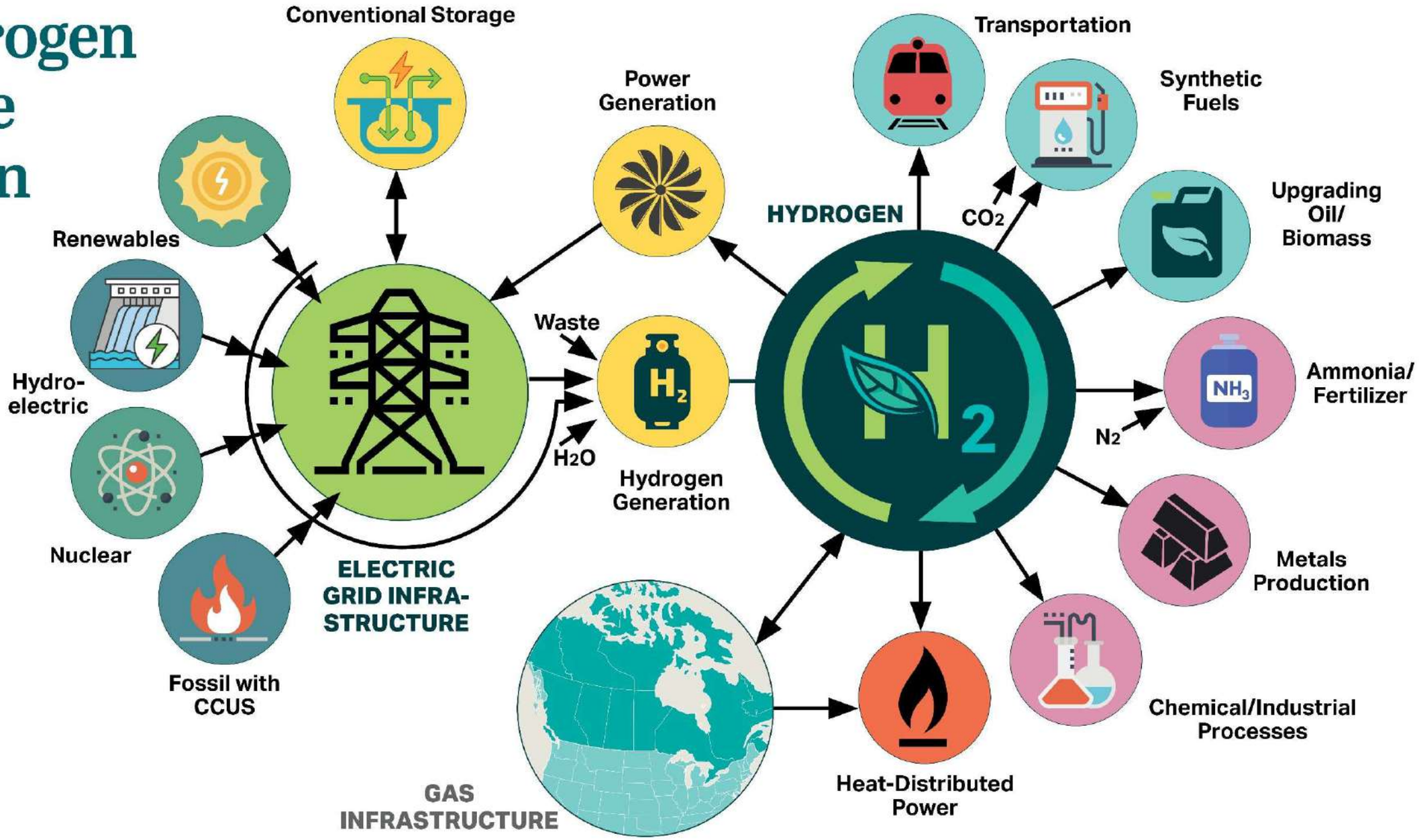
To enable hydrogen as a service, we leverage our combined Energy competencies to advise clients on:

- ✓ how to decarbonize portfolios
- ✓ transition to sustainable alternatives
- ✓ delivering energy solutions meeting your customers needs
- ✓ innovations emerging in a decentralized dynamic ecosystem.

*We envision a world where infrastructure creates opportunity for everyone*

Source: AECOM UK

# Hydrogen Value Chain



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# Complete Hydrogen Solutions

Hydrogen is highly versatile as either an energy carrier or feedstock and can serve a variety of downstream applications and processes.

**Identify**
- Idea generation
- Business Case

**Assess**
- Studies and assessments, critical issue
- Alternatives evaluation

**Select**
- Select Best Alternative

**Develop**
- Regulations & standardization
- Master, city & network planning
- Design
- Strategy generation
- Feasibility studies
- Due Diligence
- Permitting

**Execute**
- HHSEQ
- Engineering
- Procurement
- EPCM/PMCM
- Construction Oversight/EOR
- Integrated Solutions
- Compliance, monitoring

**Operate**
- Startup
- Commissioning
- Maintenance
- Compliance, monitoring

# Owner Engineer, Project Management

| Define Phase | Design Phase | Procurement | Construction | Commissioning | Operations |
|---|---|---|---|---|---|
| **Project Definition** | **Design Execution** | **Procurement** | **Construction Oversight** | **Handover** | |
| • Master planning<br>• Technology selection<br>• Conceptual design<br>• Estimating<br>• High-level initial schedule<br>• Computer modelling<br>• Feasibility studies<br>• Permitting analysis<br>• Scope definition<br>• Risk analysis<br>• IT PM systems<br>• Technical due diligence<br>• Stakeholder mapping<br>• Strategic advisory | • Detailed design and engineering<br>• Cost control<br>• Planning and scheduling<br>• Constructability / value engineering<br>• Risk review and mitigation<br>• Safety planning<br>• Project delivery strategy and logistics<br>• Value engineering<br>• Permitting | • Real Estate support<br>• Supply chain due diligence<br>• Sourcing strategy<br>• Contract management<br>• Contract terms and conditions<br>• Contract management<br>• Manage tender process<br>• Commercial and technical analysis of proposals<br>• Supplier verification and shop inspections | • Construction oversight<br>• Change management<br>• Quality control<br>• Construction programme implementation and monitoring<br>• Contractor(s) management<br>• Field engineering<br>• Safety management<br>• Site management and logistics<br>• Cost control<br>• Audits | • Commissioning and testing<br>• Engineering support<br>• Systems check out<br>• Technical training<br>• Final accounts<br>• As-built drawings<br>• Handover & close-out plan<br>• Snagging<br>• Handover documentation<br>• Lessons learned | |

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# AECOM experience

Active in over 500 green Hydrogen projects globally

Delivering a better world

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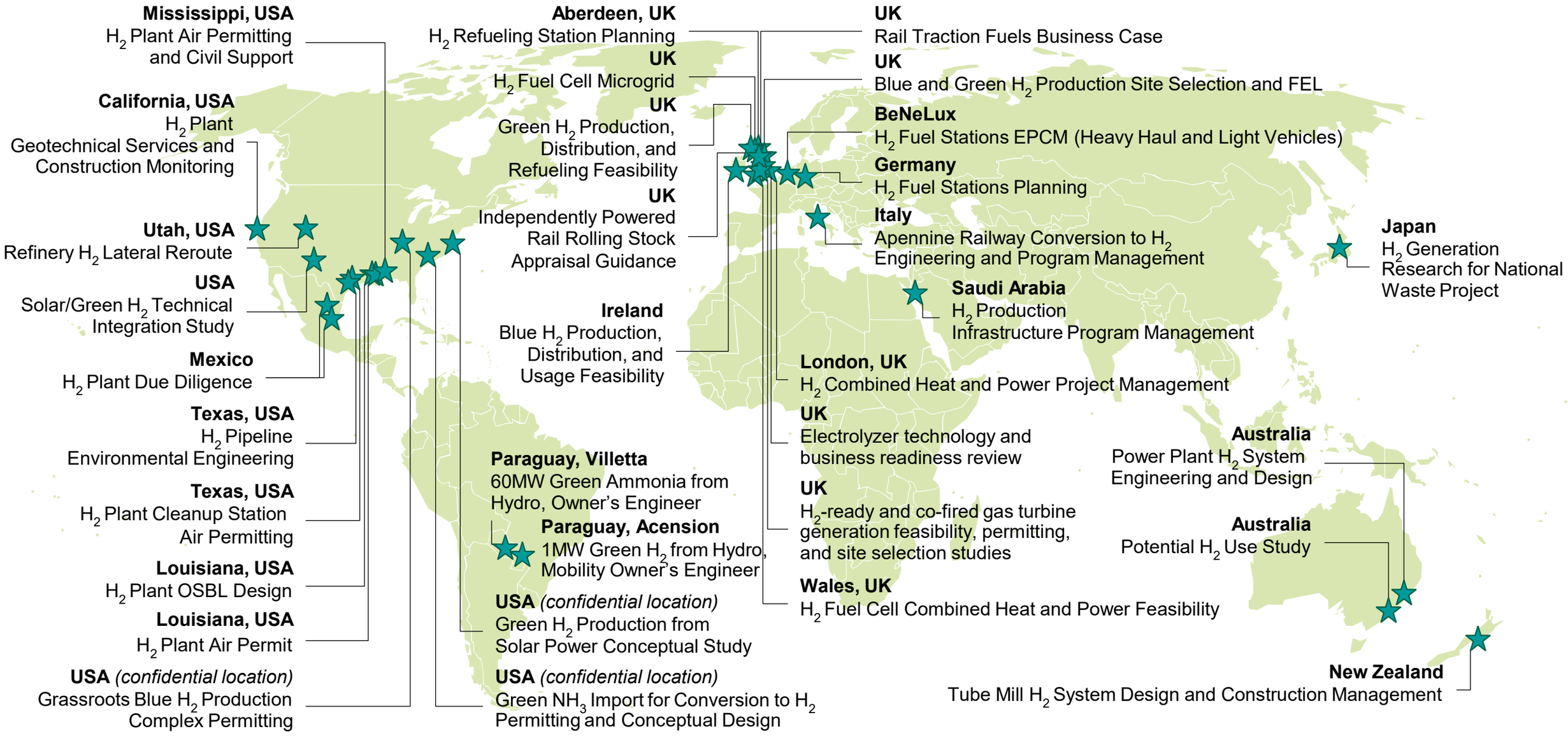
# AECOM's Hydrogen Projects Across the Globe

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# Assessment of BOEM's Role in Reviewing Hydrogen Production as a Complement to Offshore Wind

AECOM's deep regulatory and energy experience is assisting BOEM in identifying permitting and regulatory changes needed to advance Hydrogen as a complementary transport mechanism for offshore wind energy.

**Client**
BOEM

**Location**
US Outer Continental Shelf (OCS)

**Years**
2021-present

## Project Overview

The hydrogen molecule ($H_2$) is an emerging energy vector that can be used as a clean-burning fuel and can be produced from both conventional and renewable energy sources. Green hydrogen produced from renewable energy creates an opportunity to transport, store, and use carbon-free energy in industrial, transportation and other sectors traditionally powered by liquid and gaseous hydrocarbon fuels.

Offshore wind (OSW) power on the Outer Continental Shelf (OCS) is a significant renewable resource that can support utility-scale green hydrogen production in the United States (US), with active development development and permitting underway. US federal policy supports continued expansion of OSW in support of the transition toward renewables and reduction of greenhouse gas (GHG) emissions while enhancing national energy security. $H_2$ production, storage, and distribution technologies are rapidly evolving, and regulatory frameworks for managing relevant aspects of $H_2$ production from offshore wind energy ($H_2$-OSW) will need to anticipate emerging $H_2$-OSW implementations throughout US coastal waters. While hydrogen production technology has already evolved to a point where it can be sited complement to offshore wind projects, research and development to improve safety, efficiency, and commercial readiness of such coupling are still in early stages.

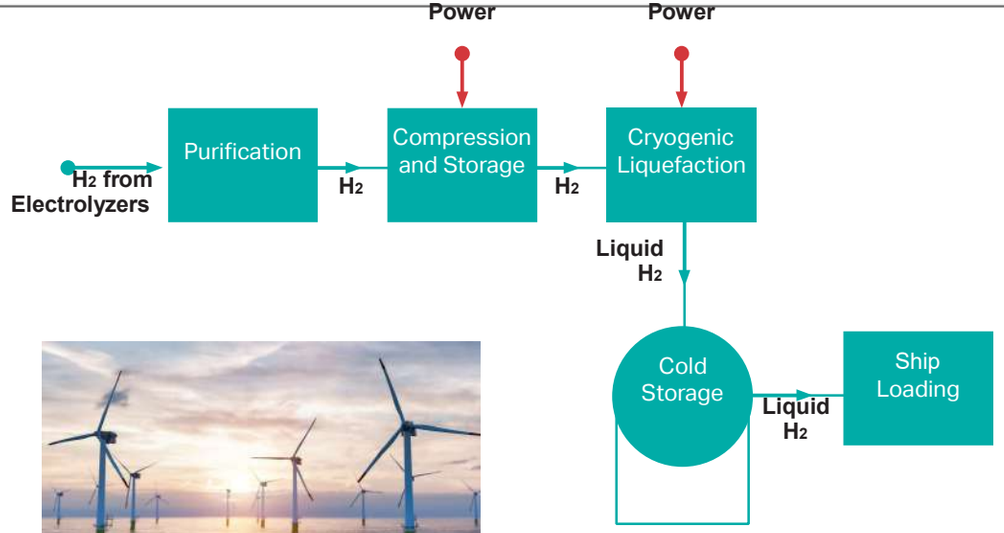
## Client Benefits

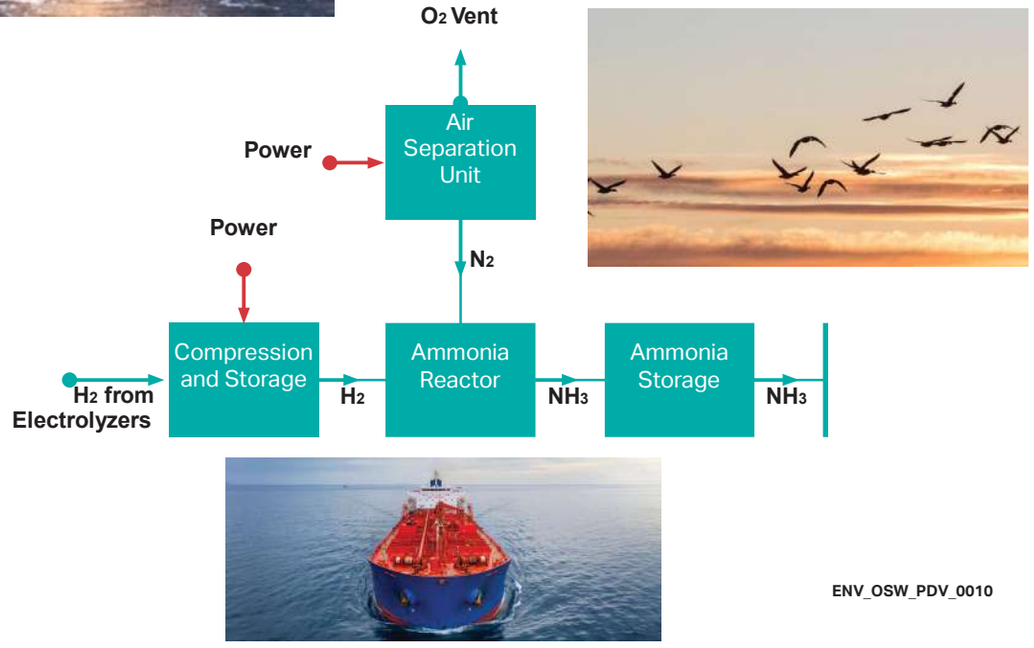
AECOM's experience provided the right fit and perspective to thoroughly engage this analysis of an emerging energy sector

- Extensive offshore technical and permitting support
- Broad and diverse client base across energy sectors
- Longstanding support of BOEM and other federal agencies / familiarity with priorities and process
- Coordinated team approach synthesizing regulatory expertise with technical research and development capabilities for both offshore wind and hydrogen

## Work Performed

AECOM's scope of work is to provide BOEM with the necessary background, analysis, and recommendations to update existing regulatory guidance for offshore development on the OCS, and to identify existing gaps in technical review expertise required for administering hydrogen production as a complement to offshore wind energy ($H_2$-OSW) permitting and for safety enforcement under BSEE. The hydrogen molecule ($H_2$) is an emerging energy vector that can be used as a clean burning fuel, which can be produced from OSW energy as a fully green fuel. A robust $H_2$ energy sector is a United States (US) federal priority supporting national energy security and resilience, contributing to climate and environmental policy goals.





# Mobility Program Delivery

## Client
Supermajor Oil & Gas Client

## Location
Global

## Years
2017-present

## Project Overview
AECOM have supported the client in the design, permitting, procurement, project, construction and facilities management of their global mobility portfolio for over six years. In our role as engineering delivery partner we have led the conversion of their portfolio to adapt to the varying requirements of a full range of low and zero carbon fuels including LNG, Biofuels, Hydrogen and Electric Vehicle Charging.

## Work Performed
We support the client across Europe, the Americas, Asia and Africa and have led both the development of engineering standards as well as value improvement initiatives to substantially reduce the cost of Future Fuelling as well as the delivery schedule whilst integrating safety requirements. In execution we have saved over $300M of installation cost realising a return of investment of over 20% on deployed capital.

Across a portfolio of thousands of stations we manage the diverse requirements of stakeholders including permitting authorities, retailers, landlords, utilities and operators to ensure uptime availability of a full range of fuelling solutions adapting to the everchanging infrastructure requirements.

# Future of Hydrogen Industrial Conversion Feasibility Studies

This study has generated evidence to highlight considerations necessary for industrial consumers to prepare for a future switch to grid hydrogen as a cost-effective and safe alternative to natural gas as a means of decarbonisation.

**Client**
Department for Business, Energy & Industrial Strategy

**Location**
United Kingdom

**Years**
2022

## Project Overview

AECOM carried out a UK government-funded project to survey seven industrial sites seeking to switch from natural gas to hydrogen as a means of decarbonisation. The project's aim was to understand the barriers to implementation, evaluate impact on design safety cases and hazardous area zoning, develop a concept design and estimate the capital cost for the preferred solution for seven sites and report finding in a summary report for public dissemination.

## Client Benefits

This study:

- Helped the local site owners understand barriers to implementation for hydrogen conversion, impact on design, safety and hazardous area zoning, and develop estimated costs.
- Helped the government understand barriers to implementation for future hydrogen conversion, the current availability of hydrogen capable equipment and areas for policy and funding development.
- Helped in the development of safety guidance and appreciation of the potential impacts due to hydrogen switching.
- Helped develop case studies and a knowledge base which will be shared with the wider stakeholder community through publication.

## Work Performed

AECOM was commissioned by The Department for Business, Energy and Industrial Strategy to deliver seven hydrogen conversion feasibility studies for industrial sites that had been selected by BEIS to provide an initial site-level perspective on what are likely to be the key issues, factors and impacts should the National Grid be converted to hydrogen in the future.

The main deliverables were site-specific hydrogen feasibility studies for the industrial sites along with a brief case study that could be published as part of the overall summary report identifying the most significant factors likely to affect safety, feasibility and cost of an industrial site switching to hydrogen that will likely be the key factors in any decision of whether a site switches to hydrogen or not.

AECOM carried out the following activities:

**PRE-SITE INSPECTION ACTIVITIES.** Detailed requests for information were prepared along with inspection check lists to ensure that site visits were productive. Safe Work Plans were prepared ahead of the site visit and information provided was reviewed prior to the visits.

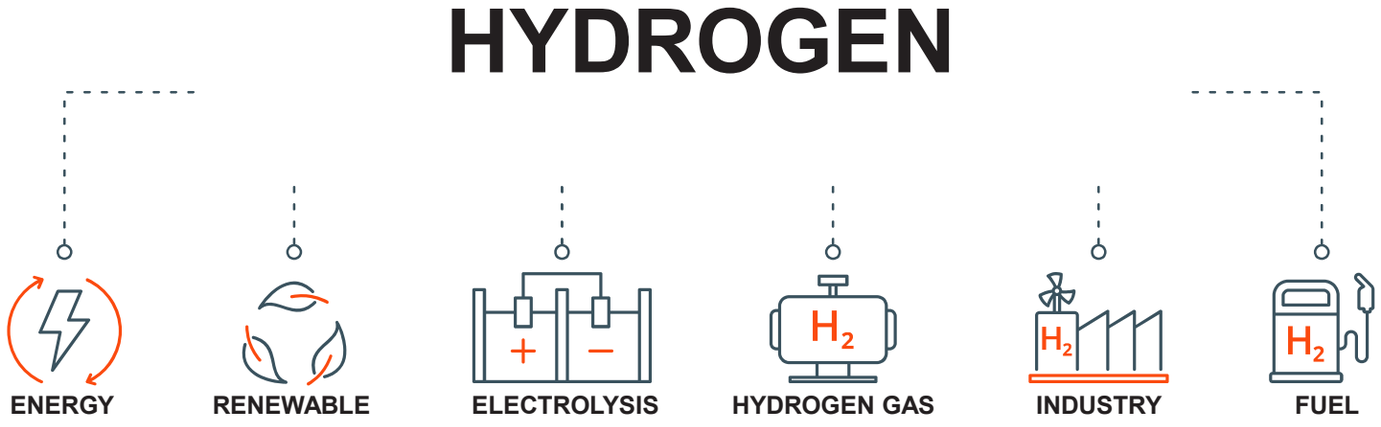
**SITE INSPECTIONS.** The site inspections included safety inductions, interviews with relevant staff members, site walkovers and review of information unavailable prior to site inspection.

**TECHNICAL ASSESSMENT.** The technical assessment considered the conversion feasibility and other viable alternatives, based on engineering considerations including understanding the existing energy use profile, availability of end use equipment and suitability of the existing infrastructure. Techno-economic assessments were conducted to establish comparative emissions between decarbonisation options, the associated CAPEX and OPEX and hence a levelized cost of carbon abatement comparison.

**ENVIRONMENTAL ASSESSMENT.** Alongside the technical assessment, the study considered the planning and environmental requirements to allow hydrogen conversion on an industrial site.

**SAFETY ASSESSMENT.** Safety assessments were carried out for each site to identify potential barriers both technical or economic. These included the following elements:

- HAZID including discussion of potential risks and mitigation
- DSEAR assessment to identify hazardous and non-hazardous areas
- Fire and explosion modelling to inform a high level consequence assessment



# Louisiana Low Carbon Fuels Carbon Capture and Storage

AECOM's experienced permitting team and comprehensive technical capabilities helped the client navigate permitting needs for air quality, sensitive wetland habitats, significant cultural resources, and support community engagement.

**Client**
Air Products Blue Energy, LLC

**Location**
Louisiana, USA

**Years**
2021-2023

## Project Overview

AECOM was contracted by Air Products to provide environmental review and supporting technical studies and permitting assistance for a proposed low carbon fuels carbon capture and storage project in Ascension Parish in southern Louisiana along the Mississippi River.

## Client Benefits

- AECOM provided a comprehensive permitting plan and managed development of critical permitting data needs to accelerate permitting.
- Our team conducted cultural resources studies that included locating and preserving a mid-19th century cemetery.
- AECOM led the evaluation of alternatives to support USACE and Coastal Use Permit applications and demonstrate resource impact avoidance and minimization kept the local community informed of plans and project progress.

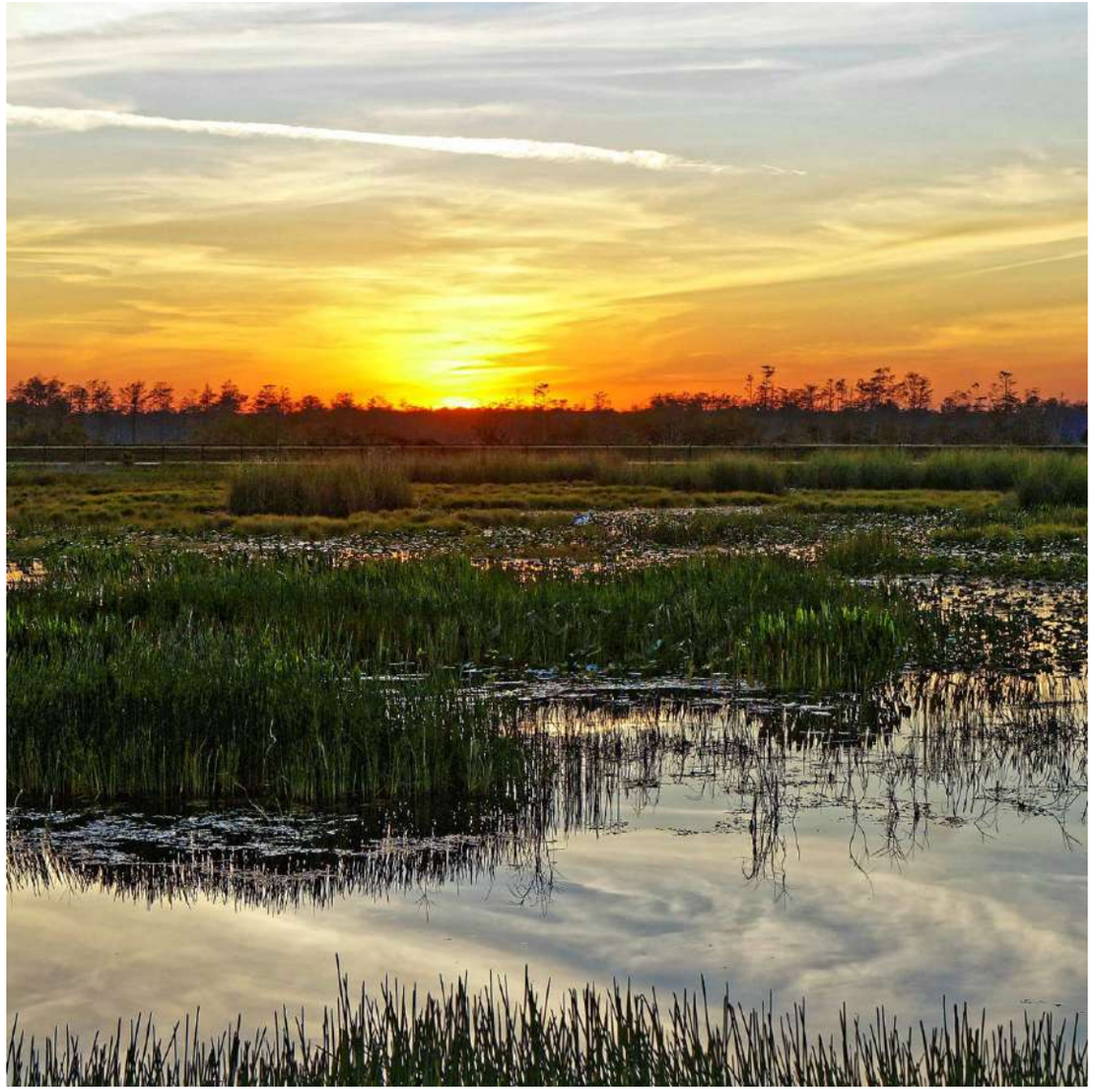
## Work Performed

The new facility will include hydrogen plants combined with $CO_2$ capture and storage.

Agency coordination, including USACE, Ascension Parish, Louisiana DNR, Office of Coastal Management, and Maurepas Swamp Wildlife Management Area.

Provided assessment/permitting for facility/dock areas including:

- Air emissions and air quality permitting
- Waters of the US assessment and wetlands delineation
- $CO_2$ pipeline environmental studies and alternatives analysis
- Stratigraphic test well studies and permitting
- Federally threatened and endangered species habitat assessment
- Cultural resources assessment and field studies
- Coastal Use Permit application and agency coordination
- Compensatory mitigation planning
- Section 408 permitting
- Seismic study permitting for sequestration site
- Scenic rivers permit
- Louisiana NPDES permit
- Parish permit coordination
- Public Trust Doctrine analysis
- Environmental Justice analysis
- Facility intake sampling and analysis
- Pipeline route analysis and options



# Engineering and Design for Green Hydrogen Production Facility

AECOM's design and engineering work on this project is helping to advance the availability of green hydrogen, which is experiencing rapid demand for its outstanding sustainability and versatility.

**Client**
Plug Power

**Location**
New York, USA

**Years**
2022-present

## Project Overview

Plug Power, a domestic leader in green hydrogen, has announced they plan to design and construct 500 TPD of green hydrogen production facilities in the US in the next 3-5 years. Project Gateway is one of the first units and it will be used as a template for future facilities. AECOM is serving as the engineer of record for the completion of the detailed engineering for this new facility.

## About Green Hydrogen

In the green hydrogen production process, electrolyzers break down deionized (DI) water from a combined reverse osmosis/DI water treatment process into hydrogen and oxygen. The bulk oxygen is vented and the wet hydrogen gas from the electrolyzer is de-oxygenated, cooled, and dried. Hydrogen gas is sent to the hydrogen liquefier units where it is pre-cooled with refrigerated nitrogen. The N2 re-liquefaction system is integrated within N2 refrigeration, N2 expander compressors, and pre-cooling perlite cold box system. The pre-cooled hydrogen undergoes ortho-para conversion to minimize boil-off in the liquid product. Hydrogen gas is liquefied using a hydrogen gas compression/expansion refrigeration loop. Hydrogen is also used as a refrigerant in a closed loop within the vacuum insulated cold box exchanger to achieve desired temperature for hydrogen liquefaction. Liquid hydrogen is moved to storage for transportation. Hydrogen flash gas is captured and recycled to minimize loss.

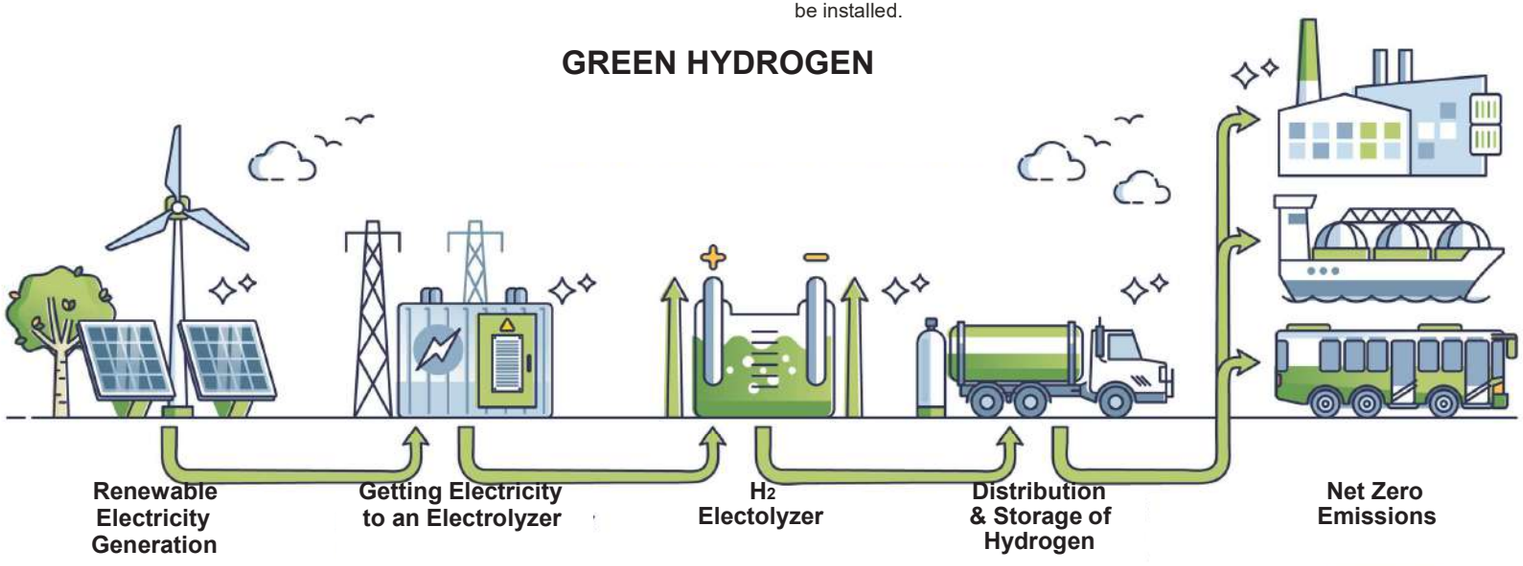
## Client Benefits

- **100% SUSTAINABLE:** green hydrogen does not emit polluting gases either during combustion or during production.
- **STORABLE:** hydrogen is easy to store, which allows it to be used subsequently for other purposes and at times other than immediately after its production.
- **VERSATILE:** green hydrogen can be transformed into electricity or synthetic gas and used for commercial, industrial or mobility purposes.
- **DEMAND:** the demand for domestic green hydrogen is forecasted to quickly outpace production capacity.

## Work Performed

AECOM is serving as the engineer of record for the completion of the detailed engineering for this new facility. Project Gateway will be a new, grassroots green hydrogen production facility in Alabama, New York. This new facility will include electrolysis, liquefaction, water treatment, storage/loadout, and all utilities for a 45 TPD facility. AECOM's scope includes design of the production trains comprised of mini substations, electrolyzer system, rectifiers, electrolyzer arrays, H2 deoxo-dryer unit, cryoabsorber unit, liquefaction system, and compressed N2 systems.

From this project, AECOM is getting firsthand design experience for commercial scale green hydrogen production from electrolysis. This project employs Plug Power-owned technologies (Frame electrolyzers and Joule liquefaction) which are being implemented in green hydrogen production facilities around the world. In the US, this is one of the first commercial applications to be installed.



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# Levenmouth 2MW microgrid

**United Kingdom**

Bright Green Hydrogen engaged AECOM to develop their 2MW microgrid facility at Levenmouth, by integrating new solar and wind power and developing a 'private wire' network for the entire site.

The project required a new multiple G59 Grid interface design, switch board and cabling design. The Front-End Engineering Design (FEED) featured energy storage provided by electrolysers and hydrogen for fuel cells, reconfiguration of switch board designs to ensure power flow balance, utility negotiations to ensure compliance and agreement with the DNO, grid interface design at multiple points with high speed transition switching, and extensive PV installation with full system studies design including station earthling and protection.

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# Development of concept of hydrogen for multi sector purposes

**United Kingdom**

The study is an outline feasibility assessment of an innovative, grid-connected, fuel cell based Combined Heat and Power (CHP) network developing a concept for potential opportunities in Wales for Smart Living, a Welsh Government Initiative. Use of hydrogen and biofuels are considered as potential fuels for the system, the use of opportunities from wind/solar farms and possible Anaerobic Digestion (AD) plants which are assessed. Proposals consider the impact of grid limitations, and potential means of energy storage and surplus of generation utilisation such as hydrogen production. Additionally, EV chargers are also considered as part of the scheme to utilise the electricity generation from a Combined Heat and Power system. From the completed analysis, introduction of hydrogen into the mix would facilitate capacity to generate and supply green hydrogen to a proposed fuel cell-based CHP network. Electrolysis has been assumed to be the hydrogen generation method and recommendations made to investigate further hydrogen transport and storage scenarios in future development of the concept.

# Kittybrewster Hydrogen Refuelling Station

**Aberdeen, United Kingdom**

AECOM was appointed by British Oxygen Company to undertake landscape, structural and planning services for the creation of a Hydrogen Refueling facility located in Aberdeen City; the first such facility in Scotland and the largest in the UK. The site is used for both hydrogen production and refueling, with initial priority for the refueling of 10 Van Hool buses.

The Project, which has backing from Europe, the UK Government and the Scottish Government, as well as a broad range of private sector partners, is the most high-profile of a range of projects designed to create a hydrogen economy in the city. Building on Aberdeen's world-wide reputation in the energy industry, the Aberdeen Hydrogen Bus Project will enable the development and deployment of hydrogen infrastructure. This work will open the way for new and innovative hydrogen technology projects and accelerate the commercial use of hydrogen as a fuel, offering green transport solutions and promoting Aberdeen as a 'Smart City'.

# Potential hydrogen use study, confidential client

**Australia**

Confidential Australian study into the potential uses for hydrogen in the Australian energy system, that covered hydrogen for grid scale storage, injection into existing natural gas infrastructure, export for use in fuel cells and for hydrogen fueled vehicles. The study presented case studies and lessons learnt for different hydrogen energy technologies, together with a high-level assessment of characteristics, potential risks, viability and pathways to construction.

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# Scottish Transport Appraisal Guidance (STAG) of independently powered rail rolling stock

**United Kingdom**

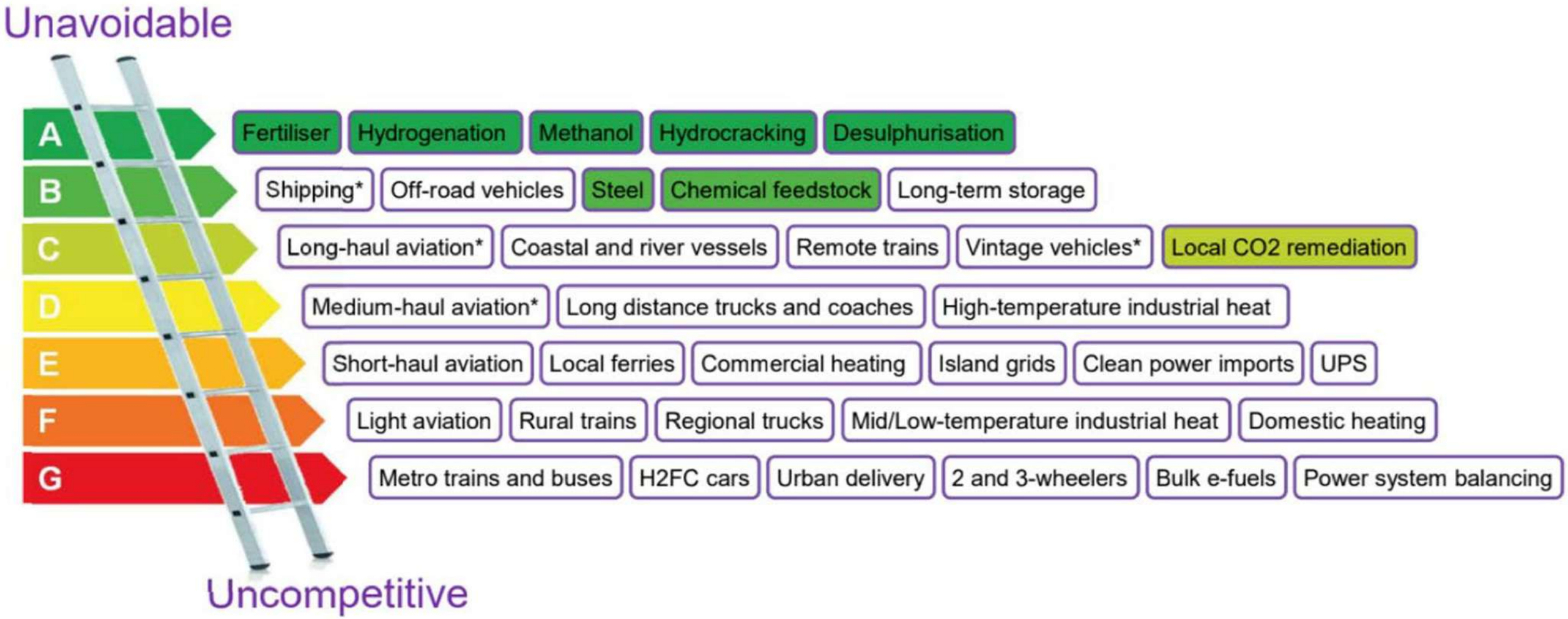
AECOM provided strategy advisory services, where hydrogen trains where considered as option, to evaluate alternative zero carbon rail traction choices for the Scottish rail network.

# Case Study

ATOME Paraguay Green Ammonia Projects

ATOME will be the largest UK based green hydrogen and ammonia producer by 2025

# Chemical and Process Industries




** Via ammonia or e-fuel rather than H2 gas or liquid*

*Source: Liebreich Associates (concept credit: Adrian Hiel/Energy Cities)*

# **AMMONIA** - A food safety strategy

- Today, approximately 95% of all production is fossil fuel based [1]
- Second-most produced chemical globally, with an annual production volume of over 180 million tonnes each year
- 80% of global ammonia production is used in fertiliser and 20% for industrial products
- Easier to store and transport than hydrogen, an existing and tradeable commodity
- Ammonia could become a US$12 trillion market, according to some estimates [1]
- Green ammonia market is expected to grow at a rate of around 85% between 2023 and 2032 [2]

**ENERGY CRISIS**

Prices of ammonia, natural gas and carbon have significantly increased sinceDecember2021

**RECORD PRICES**

Nitrogen fertilizer ammonia hit highs of over US$1600/MT in 2022 an all-time record. Since then, ammonia prices remained nearUS$1,000

**FOOD INSECURITY**

Europe lost half of its ammonia capacity and 33% of its nitrogen fertilizer operations. Further supply chain risk as Russian and Ukraine globally export 28% of all nitrogen and phosphorous fertilizers.

Sources; 1. weforum.org 2. Future Market Insights - 202[illegible]0220 ATOME Investor Presentation v8

# Owner's Engineer for 120 MWe Villeta Green Ammonia Project

AECOM's work enabled ATOME to procure a Front-End Engineering Design for a world-leading green ammonia project, enabling ATOME to become first-mover in the space and lead global development of this renewable fertilizer and transport fuel.

**Client**
ATOME Energy PLC

**Location**
Paraguay

**Years**
2022-present

**Proud winner of the 2022 Climate Change Business Journal Award for Project Merit: Green Hydrogen**

## Project Overview

Ammonia is an important chemical with many uses including fertilizer and as a potential transport fuel of the future. It is produced on massive scales globally, and is one of the top-ranking chemicals manufactured in volume. Traditionally, ammonia has primarily been produced through steam reforming of natural gas into hydrogen and subsequent reaction with nitrogen separated from air in the Haber-Bosch process. This method produces significant quantities of greenhouse gas and contributes significantly to the environmental footprint of most agriculture globally.

A novel approach to ammonia manufacture uses hydrogen generated through electrolysis of water using renewable electricity. This method eliminates use of fossil fuel and carbon dioxide emissions and the resulting ammonia is referred to as "green ammonia". The technology is limited at present due to availability of excess renewable electricity and the cost of the produced ammonia being greater than that produced conventionally, but this is expected to change as the world moves away from fossil fuels.

AECOM is working with the client to develop a 120 MWe green ammonia facility, drawing power which is 97% carbon free from an existing major hydropower facility in Paraguay to provide ammonia to meet local fertiliser demand. AECOM is acting as ATOME's Owners Engineer, shaping the technical and contractual solution for this ambitious commercial project which will produce its first ammonia in late 2025.

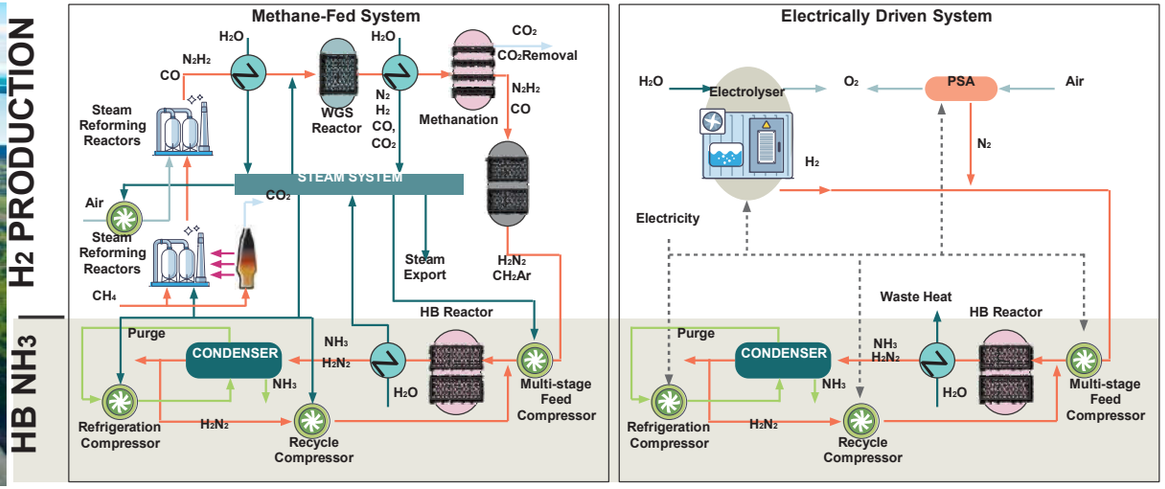
- 120 MWe green ammonia facility will begin producing in 2025 to meet local fertilizer demand
- Production output of 88,000 tonnes per year

## Client Benefits

- The facility will offset circa 88,000 tonnes per annum of fossil-produced ammonia currently being imported into Paraguay for agriculture.
- Later project stages may allow for green hydrogen to be exported as a product as well as ammonia as a transport fuel, creating environmental benefits by providing a low carbon fuel and thermal energy source.
- Client preference to utilise local labour for construction of the plant will provide community benefit through the creation of jobs.
- The existing relationships AECOM holds with electrolyser vendors from previous projects presented a client benefit by accelerating engagement with suppliers.
- AECOM's ability to produce a technology agnostic preliminary design allowed for engagement with a wider variety of suppliers in later stages of the project which can lead to a more suitable and cost-effective final design.
- Design decisions were continuously challenged by AECOM against the hierarchy for carbon reduction potential (Build Nothing, Build Less, Build Clever, Build Efficiently) to ensure that the plant's environmental impact is kept to an absolute minimum.
- AECOM's identification of plant areas suitable for pre-investment presented client benefits by planning ahead and therefore minimizing costs and simplifying expansion at later project stages.

## Work Performed

AECOM developed a concept design for the facility and undertook pre-qualification of FEED contractors and technology suppliers, prepared a tender pack and distributed this to the shortlisted FEED suppliers, carried out tender evaluation and developed contract technical schedules and supported with all aspects of the procurement process.



# Villeta Ammonia Project

- **Project Outline**
- Electrolytic Hydrogen generation using renewable energy from Itaipu hydroelectric dam.
- Ammonia synthesis using Habor Bosch process
- Phase 1 power purchase agreement of 120MW signed.
- Phase 2 to take project to 400+MW by 2027.
- **Optimal Site Location**
- Near to several agricultural ammonia off takers
- Adjacent to electrical sub station
- Close proximity to water source

- **Current Status**
- Land purchased & power purchase agreement signed
- FEED study awarded Q4 2022.
- Financial Investment Decision 2023.
- Operational 2025.

# Hydrogen Production | How it comes together...

AECOM

Technical Advisory to assure understanding of legislative operating / design requirements

Environmental / Engineering Professional Design Service

Owners Engineer / Delivery Partner to assure delivery of Project to agreed specifications

Stakeholder Engagement / Management

Concept Design

Process safety integration

Enabling infrastructure

Clear translation of project objectives to FID and basis of design

Agnostic appraisal of supply chain to deliver safely, cost effectively and sustainably including Scoping Tender documentation

Supply chain competence assurance and training

Post consent manage-ment

| Feasibility | Pre-FEED | FEED | Procurement & Construction | OPERATION |
|---|---|---|---|---|

| Planning, Consenting & Analysis | Land Agreements | Site Assessment / Construction | Compliance Assurance |
|---|---|---|---|

Informed appraisal of environmental impacts, potential mitigations and compliance requirements

Environmental surveys / baseline assessment

Confident negotiation / management of permitting / compliance requirements

Inform FEED require-ments / specification

BAT Appraisal Mitigation: Air / Water / Land / Waste

Confirmed management of stakeholder requirements

Construction Environmental Management Planning & assurance

Compliant Construction and Operational Monitoring

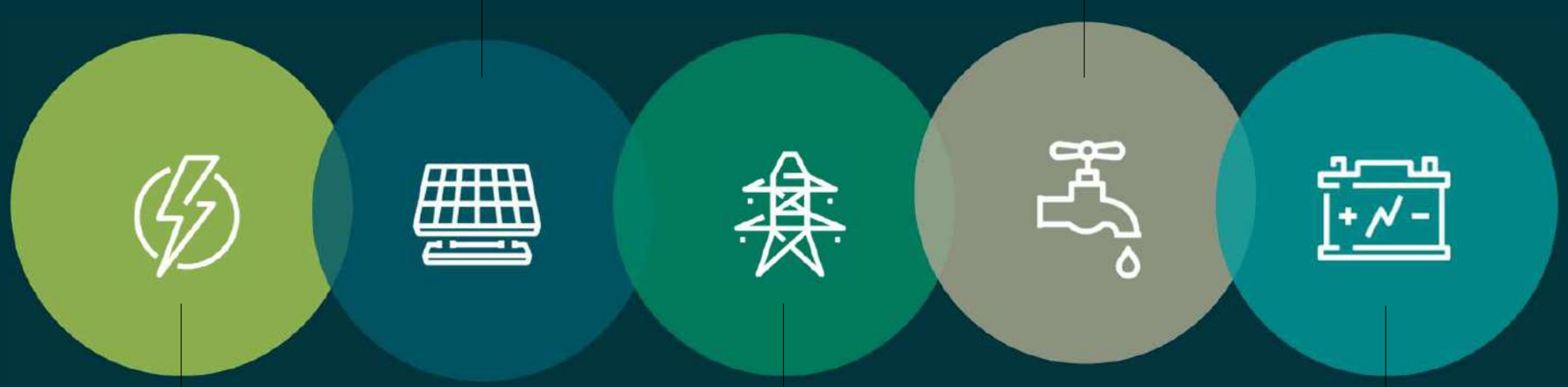
Reliable delivery of first hydrogen to market to meet business plan

# Site Considerations

*The "usual" factors for resource projects apply – high quality resource, high utilisation configuration, proximity to existing infrastructure and markets*

**Renewable resource**
Access to high quality renewable resource, suitable topography

**Water Supply**
Sufficient access to high quality water to minimise processing requirements

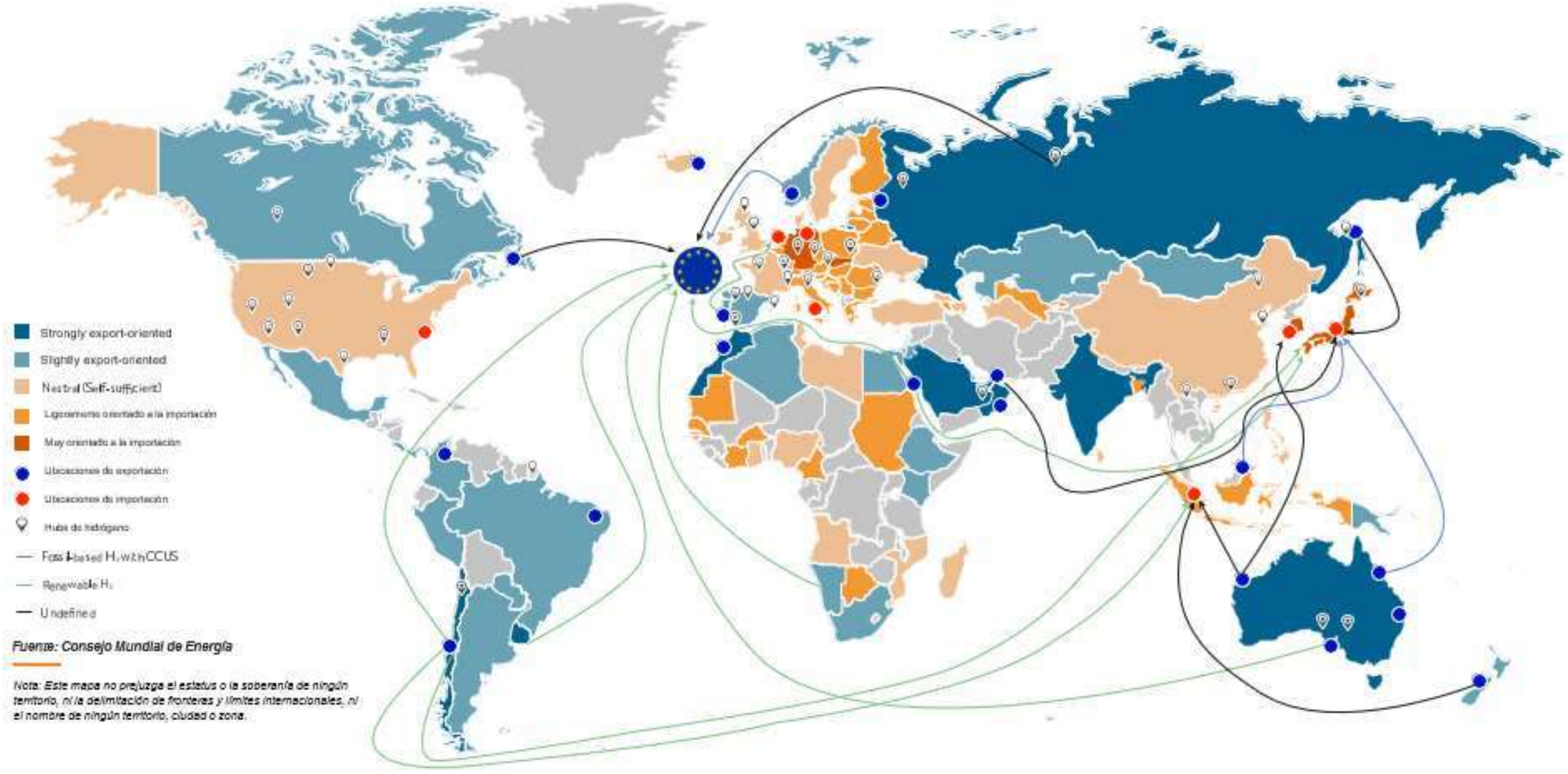


**Electricity**
Access to low cost, *ideally firmed*, renewable electricity

**Existing Infrastructure**
Proximity to grid, roads, water supply and end market

**Firming/Storage**
To increase electrolyser utilisation, options include battery, grid connect (with green PPA) and H2 storage

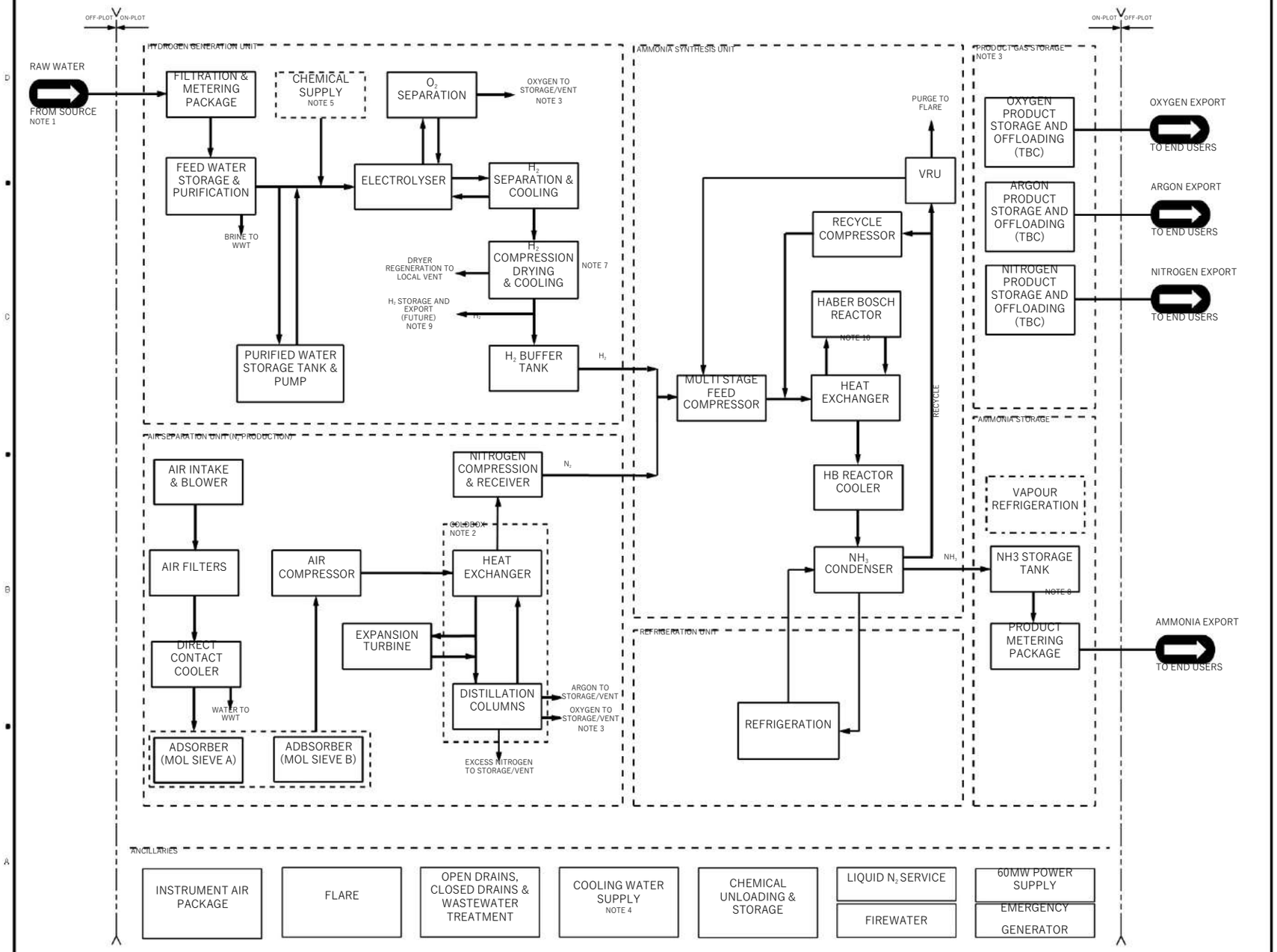
# Mapa de la dinámica potencial de importación-exportación de hidrógeno bajo en carbono en 2040




*Fuente: Consejo Mundial de Energía*

*Nota: Este mapa no prejuzga el estatus o la soberanía de ningún territorio, ni la delimitación de fronteras y límites internacionales, ni el nombre de ningún territorio, ciudad o zona.*

Fuente: Perspectivas Regionales Sobre el Despliegue a Escala del Hidrógeno con Bajas Emisiones de Carbono, Consejo Mundial de Energía en colaboración con PwC y EPRI




AECOM

**PROJECT**

VILLETA GREEN AMMONIA OE

# Our environment, social and governance commitments

AECOM

## What is AECOM's Sustainable Legacies strategy?

Our Sustainable Legacies strategy encompasses how we are integrating ESG factors into everything we do

## What is AECOM doing to increase social value and social impact?

**PARTNERING WITH SME'S**

Partnering with small and medium-sized enterprises to deliver social value through community investment, positively impacting clients, communities and society

**CLIENT ACCOUNT MANAGEMENT TARGETS**

Embedding net zero, resilience and social value targets into our client account management program and the work we bid for

**MEASURING KEY IMPACTS**

Measuring key impacts such as carbon emissions, climate resilience and social value on major projects

## What is AECOM doing to decarbonize?

**SCOPE X™**

Incorporating an ESG action plan for reducing carbon impact by at least **50 percent** on all major projects (our 'ScopeX™' process)

**OPERATIONAL NET ZERO**

by **2021**

**SCIENCE-BASED NET-ZERO**

by **2030**, which includes:

50%

**BUSINESS TRAVEL EMISSIONS**

**50 percent** reduction in business travel

**VEHICLES AND ENERGY**

Decarbonizing all fleet vehicles and switching to renewable energy tariffs

**SUPPLY CHAIN**

Developing carbon reduction targets in partnership with our supply chain

**OFFSETTING**

Offsetting residual carbon by creating our own nature-based solution projects

## What is AECOM doing to advance equity, diversity and inclusion?

**DIVERSITY**

Ensuring our project teams reflect the diversity of the clients and communities we serve

**SOCIAL EQUITY, DIVERSITY AND INCLUSION**

Ensuring that our work with clients and communities promotes social equity, diversity and inclusion

35%

**WOMEN IN SENIOR LEADERSHIP**

We have set an industry-leading, near-term target of women comprising at least **20 percent** of senior leadership roles and at least **35 percent** of the overall workforce.

## What are we doing to enhance our governance to deliver sustainable legacies?

**ASSESSING RISK**

To develop an enterprise framework to assess ESG risk in potential projects

**ACCOUNTABILITY AND ADVOCACY**

To drive leadership accountability and advocacy through specific ESG goals/ metrics in annual goals

**TRACKING AND REPORTING**

To track and report on ESG performance targets in line with leading industry benchmarks (i.e., Sustainability Accounting Standards Board [SASB] and Task Force on Climate-related Financial Disclosures [TCFD])

There is
NO
PLANET B

# You have big challenges, we have bigger solutions

## ABOUT AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of $13.1 billion in fiscal year 2022. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

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