

# Hydrogen Markets

Our Capability

H<sub>2</sub>  
HYDROGEN



## Energy Services | Enabling Hydrogen

### AECOM leverages a combination of direct Energy services with our supporting expertise in full infrastructure delivery for realisation of Hydrogen Projects

AECOM aspires to be the infrastructure partner of choice for clients seeking to adopt hydrogen solutions as part of their Net Zero transition.

Our Hydrogen offerings reinforce our wider infrastructure brand and support our decarbonised Energy priorities of Renewable Generation (including Offshore Wind) and associated Electrical Infrastructure (including Distributed Generation).

#### RENEWABLE ENERGY

- Green Hydrogen Electrolysis
- Hydro / Solar / Wind / Geothermal generation
- Tidal Energy / Marine (Off-shore)
- Biomass Co-generation / Energy from Waste

#### NEW FUELS

- Hydrogen fuelling infrastructure
- Carbon Capture Utilization and Storage
- Full Mobility / Transit services inc. fleet conversion
- DNO negotiation and stakeholder management
- Electric Vehicle Charging Infrastructure
- LNG / CNG / Biofuels

#### PROJECT DEVELOPMENT, PLANNING & CONSENTS

- Conceptual Design
- System/Feasibility Studies
- Energy and Sustainability Master Planning
- Energy Benchmarking, Engineering and Modelling
- Stakeholder Engagement & Outreach
- Licensing / Permitting
- Strategic & Enterprise Energy Management
- Utility Privatization

#### PM/CM

- Program/Project Management & Control
- Procurement & Construction Contracts
- Construction Management & Construction Support
- Facilities Optimization & Management

#### PROCESS ENGINEERING

- Hydrogen Electrolysis and Process
- Process Safety | HAZID-HAZOP
- Desalination
- Balance of Plant

- General Engineering and Design Services
- Industrial Facility Upgrades
- Traditional Generation

#### ENVIRONMENTAL SOLUTIONS

- Emissions & Combustion Products Control (Air Quality)
- Water Solutions / Sourcing / Abstractions / Treatment
- Wastewater Treatment
- Environmental, Social, Health Impact Assessment & Permitting
- Environmental Management Information Services
- Cultural Resources & Engagement
- Contaminated Land Management / Brownfield Redevelopment
- Public Involvement & Multi-Media Communication
- Geotechnical Survey and Design

#### ENERGY SOLUTIONS

- Electrolysis Solutions
- Energy as a Service (EaaS)
- Energy Savings Performance Contracting
- Utility Energy Services Contracting
- Integrated Value Chain Management
- Measurement & Verification
- Operations & Maintenance Services

#### ENERGY EFFICIENCY

- Continuous Commissioning
- Design Engineering
- Energy Audits
- Energy Efficiency Upgrades
- Energy Project Delivery
- Retro Commissioning
- Smart Buildings/High Performance Buildings
- Utility Incentive Programs

#### ENERGY DISTRIBUTION & STORAGE

- Hydrogen Storage & Distribution Solutions
- Transmission & Distribution (LV-MV-HV)
- Maritime / Interconnectors
- Battery Storage infrastructure development
- Pumped and other Energy Storage Solutions
- Micro Grids
- Routing / Siting Assessment
- Survey and Right-of-Way Support

#### SMART ENERGY

- Artificial Intelligence/Machine Learning
- Disaggregated Sensing and IoT
- Digitalization
- Predictive Maintenance
- Prototype Engineering
- R&D Program Management Support
- Smart Lighting Networks

#### ENERGY RESILIENCE

- Hydrogen Conversion Safety Consulting
- Carbon Capture Utilization and Storage
- Climate Adaptation & Resiliency
- Climate Change / Adaptation Solutions
- Flood protection
- Emergency Response Planning and Support
- Seismic Risk Assessment and Mitigation

#### ASSET RETIREMENT

- Facility Demolition, Decommissioning and Redevelopment
- Coal Combustion Residuals Management
- Nuclear Waste Management



# Powering Energy

## We deliver methods, project life cycle and relevant service

AECOM's combination of global experience and integrated technical capabilities delivers strategic solutions that improve and modernise infrastructure, enhance sustainability and resiliency, and benefit the community.

AECOM has engineered and/or constructed more than 280 GW of electrical generation capacity across the world. We provide clients a single source for multidisciplinary engineering, environmental and management services. From international and domestic market analysis, to siting and permitting, through final project development and execution, we develop, design and construct projects that enhance infrastructure, reduce energy and water consumption, and generate traditional and renewable power.

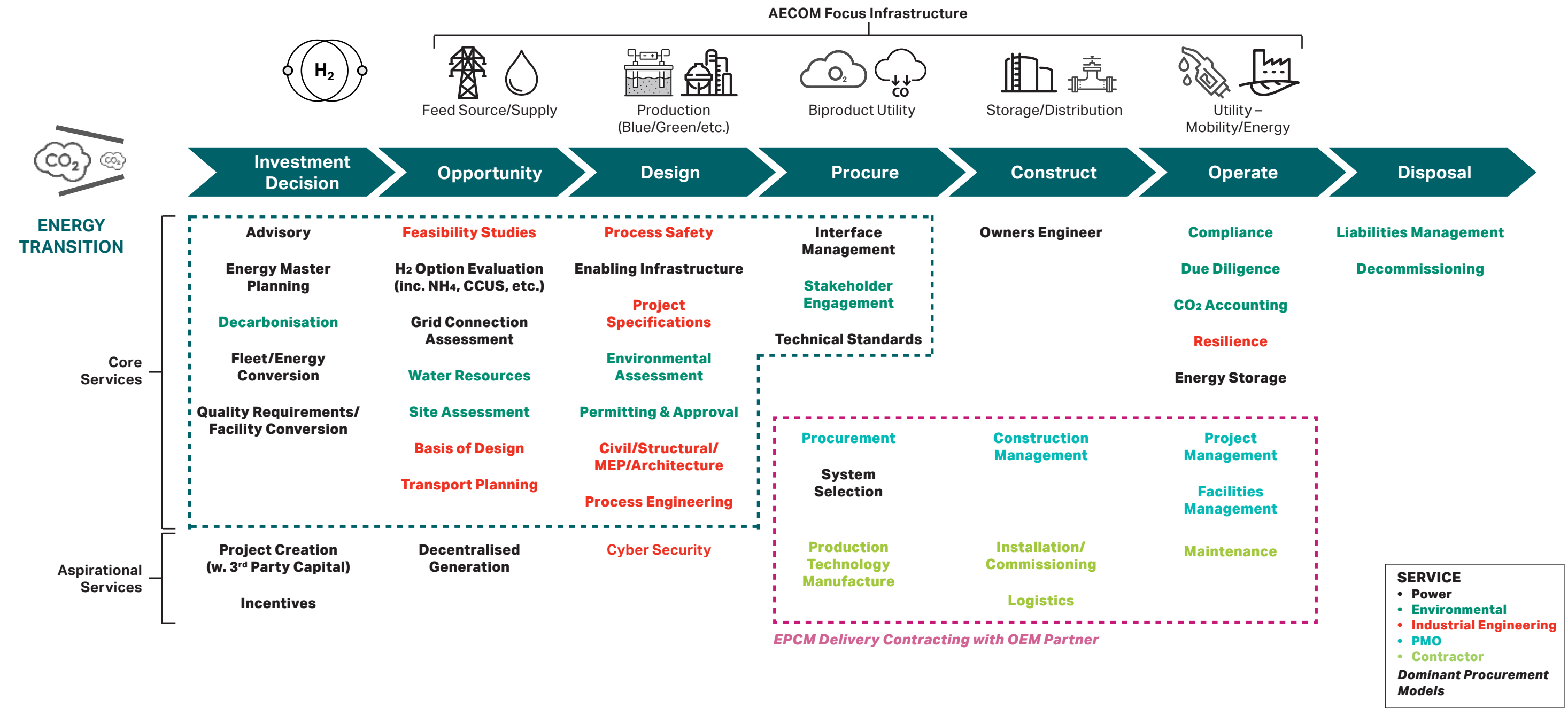
Our understanding of the big picture – such as the interconnection between generation, transmission, storage, grid improvements, conservation and efficiency – allows us to deliver a holistic energy strategy tailored specifically to our clients' needs.

Through our network of engineers, scientists, planners and construction specialists, we provide our clients with technology neutrality, a track record of innovation, proven tools and processes, and current industry knowledge.

While our experience with renewable and alternative energies includes everything from biomass and geothermal, to solar, wind, and hydroelectric generating systems, the following sections of this document focus on our qualifications and experience delivering a wide range of wind, solar and energy storage projects across the world.



# Hydrogen | AECOM's Suite of Services





# Environmental Permitting and Planning

## SERVICES

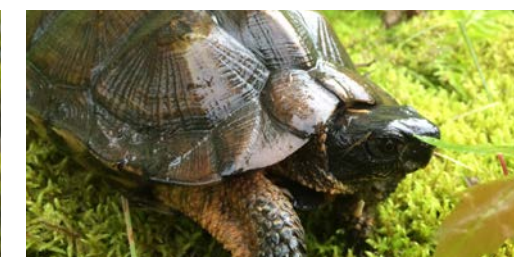
- Siting, Project Feasibility and Permitting Strategy
- Digital Engagement (PlanEngage) Digital Data Management
- Environmental Policy Development
- Environmental/Social Impact: EIA/EIS/ESHIA/CEQA/NEPA/SEPA
- Baseline Field Studies/Ecology
- Next-Gen Digital Data Capture Technology
- Project Permitting Program Management
- Environmental Mitigation, Monitoring and Planning
- Regulatory Permitting/Negotiation
- Traditional and Virtual Stakeholder/Public Engagement
- Visual and Noise Impact Assessment, Modeling
- Fate and Effects Transport/Dispersion Modeling
- Program Management for Large Programs

Understanding a proposed project's potential environmental and social impacts and regulatory constraints is critical to the development of timely and cost-effective project plans, evaluative studies, sound engineering designs, effective stakeholder management and successful permitting.

By anticipating and addressing permit requirements early on in the project design, we help implement a permitting strategy, development schedule and mitigation plans that expedite permit acquisition and compliance. Expert regulatory negotiations throughout the project help resolve technical and external stakeholder issues and create favorable permit conditions while achieving the ultimate goals of maintaining project schedules and ensuring compliance.

This method has contributed to successful projects for a broad range of government, energy (oil and gas, wind, solar, tidal), industrial, waste disposal, utilities, mining and real-estate clients worldwide. For example, our thorough approach helped us prepare one of Australia's largest and most comprehensive environmental impact statements and technical studies for a mining expansion project.

Across our broad impact analysis, assessment and permitting practice, our experience serves to achieve our clients' goals, ensuring they are operating according to their own business requirements as well as complying with regulatory requirements.



**Learn more about AECOM's Environmental Permitting and Planning Digital Tools and Innovations**

<https://innovating-environment.aecom.io/>

**More Information:** [AskEnvironment@aecom.com](mailto:AskEnvironment@aecom.com)



# Enabling Infrastructure/Balance of Plant for Hydrogen



From the early planning stages through to construction, we combine our broad global reach with our strong regional presence to implement industry best practices and deliver effective local solutions across the entire life cycle of vital hydrogen infrastructure.

## Areas of Expertise

- Strategy & Planning
- Engineering & Design
- Construction
- Operations & Maintenance
- Decommissioning & Closure

## Our Approach

Around the world, AECOM plans, engineers and oversees construction on complex and essential hydrogen transport and manufacturing infrastructure. With more than 80 years of infrastructure design and development experience, we've gained an in-depth understanding of the infrastructure industry and its intricate commercial and policy drivers. We work with some of the world's leading public and private organizations, helping them deliver hydrogen infrastructure.

## Experience

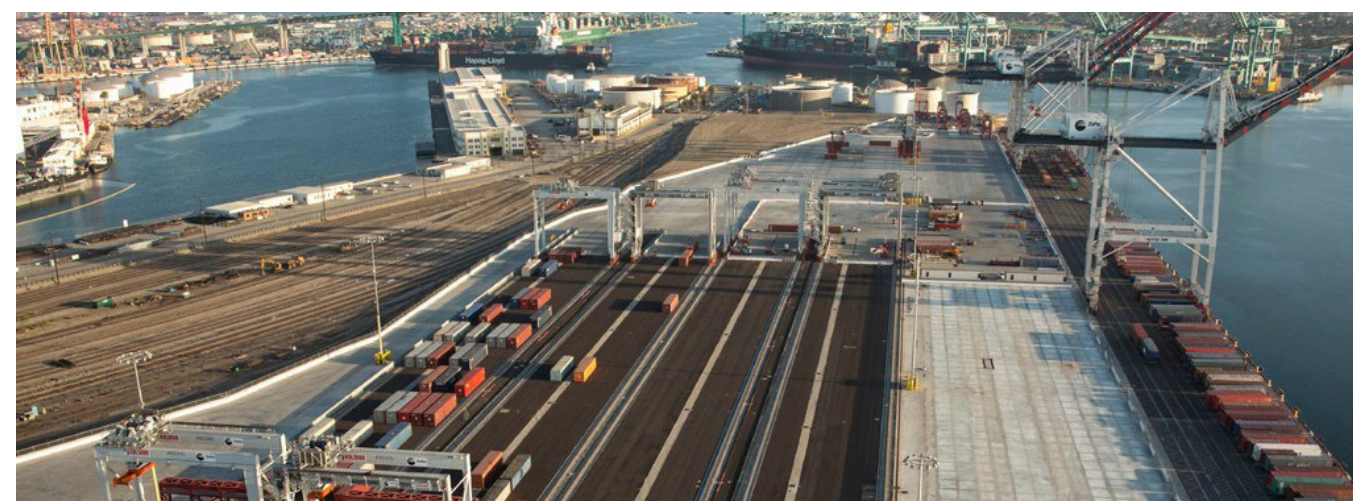
We focus on applying the right skills at the right time to deliver successful projects around the world. We have a large portfolio of experience that includes due diligence, planning, design, engineering and construction projects across a range of locations and facilities worldwide. We collaborate with our clients to provide high-quality, well-managed professional services that meet their program and budget goals.

## Transforming Innovative Ideas Into Real-world Solutions

Our client relationships are built on an appreciation of business needs and a proven record of innovative and cost-effective project development. From the early planning stages through to construction, we combine our broad global reach with our strong regional presence to implement industry best practices and deliver effective local solutions across the entire life cycle of infrastructure.

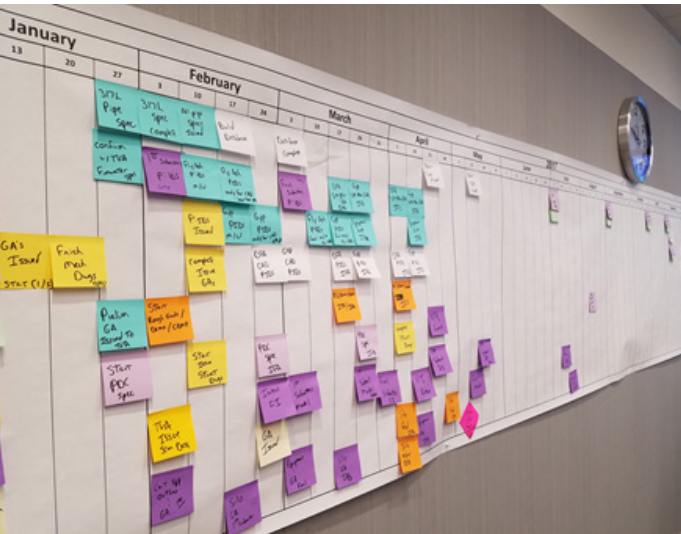
## Key AECOM Attributes

- **Innovation is key** when it comes to hydrogen projects. Our approach enables us to achieve best-value solutions over the entire life cycle of a project.
- Our planners, simulation and logistics specialists, engineers, architects and economists are at the forefront of energy, industrial, pipeline and transportation trends. We've built our reputation on **incorporating new technologies** in projects throughout the Americas.





# Pre-FEED and Concept Design for Hydrogen



Whatever the project requirements, AECOM assembles an experienced and talented team of engineering and support professionals who employ tested and proven processes and state-of-the-art tools that positions projects for an efficient, streamlined detailed design stage and eventual overall success.

More Information: [AskEnvironment@aecom.com](mailto:AskEnvironment@aecom.com)

## Overview

We understand that a sound project foundation begins with a focused front end engineering design execution approach. Regardless of project type and complexity, we provide a multi-disciplinary approach that is supplemented with a structured work process and industry professionals with over 25 years average experience.

## Our Approach

For more than 80 years AECOM has successfully demonstrated the benefit of employing a well-planned FEED effort, the result, meeting Project or Program objectives both in cost and schedule.

The AECOM FEED Model deploys a three-gate process referred to as Front-End Loading (FEL), these gates are:

FEL I	FEL II	FEL III
Scope Definition	Conceptual Development & Preliminary Engineering	Basic Engineering & Design Data

The purpose of the FEED process is to:

- Engage all the client and AECOM stakeholders early in the project assuring better project definition in scope, design definition, schedule, and cost.
- Preparation of the basis for detailed design, procurement as well as construction, commissioning, startup, and operation.

## HANDOFF TO DETAILED DESIGN

At the conclusion of FEED, AECOM arranges all of the project definition documentation into a well-organized and complete package that can be transferred directly to the AECOM detailed design team and utilized to finalize procurement, construction documents and plans, commissioning and startup. The AECOM FEED team remains available for consultation and to provide any needed clarifications to the detailed designer as they work through the development of the detailed design documents.

## FRONT-END LOADING (FEL)

We are heavily committed to a disciplined FEL effort on our projects. Our project methodology and business focus is driven toward intense teamwork with our clients in the early project phases to achieve the best possible project definition. By proactively driving the decision-making process, we provide high quality estimates, schedules and workflows without large expenditures.

FEL involves significant consensus building and project team buy-in to scope areas as the project concepts are developed, requiring extensive communication — something we have the systems and protocol in place to make happen.

## Areas of Expertise:

### PRE-FEED DELIVERABLES

- Site Health and Safety Plan
- Project Design Basis/Project Objectives Defined
- Project Scope Document
- Basis of Design Documentation/Design Criteria Set
- Project Management Plan (PXP)
- Updated Project Controls Plan
- Critical Milestones Defined
- Project Procedures
- Update Process Description
- Preliminary Scope Documents
- Initial Tie-in Plans
- Written Discipline Scopes
- Utility Summary & Infrastructure Requirements
- Control Systems Philosophy/Control Logic
- SMART Planning Work Process Map
- EPC Schedule- Level III FEL 3
- Risk Mitigation Plan
- Class 4 Feasibility Estimate – Maturity Matrix for (+-20%)
- FEL 2/Pre-FEED Summary Report

### FEED PACKAGE DEVELOPMENT

- Identify and Select Concepts
- Provide Cost Data to Guide Business Decisions
- Prepare Project Basic Documentation
- Definition of Scope of Work
- Process Modeling

- Equipment Specification & Sizing
- Requisitions for Long-lead Equipment
- Cost Estimating
  - Team building/alignment sessions
  - Scoping (programming)
  - Site and geotechnical information
  - Basic data
  - Engineering flow diagrams:
    - Process flow
    - Material of construction
  - Design pressure/temperature
  - Environmental issues
  - Piping and instrumentation diagrams
  - Electrical single-line diagrams
  - Process control strategy
  - Major equipment specifications
  - Instrument definition
  - Project estimates

### FEED SERVICES AND DELIVERABLES

- Conceptual and feasibility studies
- Process descriptions and flow diagrams
- P&ID development
- Energy and material balances
- Equipment choice, design and specifications
- Equipment performance arrangements
- Controls philosophy/control logic
- Engineering and construction estimates and schedules
- Long lead procurement and constructability
- Start-up and commissioning services

## Pre-FEED and Concept Design for Hydrogen *(continued)*



### Key AECOM Attributes

- The benefit of using AECOM is our experience of front end development work processes further enables our development of achievable, realistic and predictable project outcomes.
- A continued focus on constructability is an essential and integral part of the way we do business. By incorporating techniques into our projects, we have continually demonstrated that constructability offers the largest single opportunity to reduce total installed and long-term O&M costs, as well as providing the best possible project definition.
- Our FEL development is focused on meeting the challenge at-hand under the guidance of our best practices, such as value engineering and constructability. We work with our clients to develop project scopes and estimates while considering return on investment, critical path mitigation and contracting strategies.





# Global Advisory for Hydrogen



As agnostic experts in the deployment of hydrogen technologies, we help appraise the suitability of decarbonised energy models and then facilitate the transition to the right hydrogen solution safely, cost effectively and in a manner that does not compromise existing business operations.

## Areas of Expertise

- Writing the Standard
- Advising Adoption
- Technology Agnostic Experts
- Project Delivery Partnerships
- Production to Utility Capability
- Strong Public and Private Sector Relationships

## Our Approach

As the world's trusted infrastructure consulting firm, AECOM seeks to partner with clients to solve the most complex challenges and build sustainable legacies for generations to come. We enable customers to evaluate, develop and deliver the benefits of integrating clean hydrogen seamlessly across a suite of decarbonised energy solutions into existing and future infrastructure. We are creating jobs, enabling the energy transition and improving the world in which we live.

AECOM are not a producer, handler or direct user of hydrogen: We enable customers to evaluate, develop and deliver the benefits of integrating hydrogen seamlessly across a suite of decarbonised energy solutions into existing and future infrastructure.

## Key AECOM Attributes

- Proven ability to develop business cases for hydrogen projects and implement on an integrated basis on behalf of clients (design, consenting, procurement, project management, commissioning and handover).
- Leaders in deploying complex infrastructure, developing regulatory guidance / operating standards, and engaging stakeholders successfully.
- Focus on enabling and interface works and work in partnership or as owners engineer to manage process technology for production / utilisation. Additional capabilities in water / waste for complete solution
- Tailor offering from advisory through design into procurement and construction management.

Investment  
Decision

Opportunity

Design

Procure

Construct

Operate

Disposal

## MOBILITY



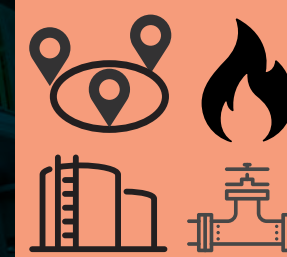
Proven EPCM credentials in Hydrogen storage and dispensing to full suite of transit customers and energy providers

## PRODUCERS



Market leading permitting excellence, enabling new developments inclusive of all supporting infrastructure and tie ins (including renewable generation/electric infrastructure links/ CCUS/process water). Supporting FEED/OE role for delivery of hydrogen and associated intermediaries

## HUBS



Recognised place building and industrial skills enable development of integrated energy hubs including all supporting infrastructure. Advisory through planning to delivery potentially including "as a service" models for distributed



## Global Advisory for Hydrogen *continued*

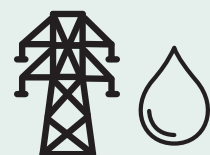
### Areas of Expertise

- **WRITING THE STANDARD.** As leaders in the field of deployment of complex infrastructure we are developing regulatory guidance and operating standards for the manufacture, transportation and use of hydrogen (and hydrogen carriers such as ammonia). This position puts us in ideal place to share global best practice and deploy these standards efficiently. We are able to engage stakeholders successfully and understand the implications of adoption by ultimate clients and associated incentives for doing so.
- **ADVISING ADOPTION.** AECOM helps clients understand if hydrogen (or an alternative) is the right solution to their specific challenge. We develop business cases for hydrogen projects, informed by our track record of implementing comparable projects on behalf of our customers. We draw down our design, consenting, costing, procurement, project management, commissioning and handover skills to understand and mitigate risk. Our ability to understand the synthesis of economic, social and environmental considerations of new industries combined with our engineering pedigree guides our stakeholder engagement process successfully.
- **TECHNOLOGY AGNOSTIC EXPERTS.** AECOM are not a producer, handler or direct user of hydrogen: We enable customers to evaluate, develop and deliver the benefits of integrating hydrogen seamlessly across a suite of decarbonised energy solutions into existing and future infrastructure. As agnostic experts in the deployment of technology we help appraise the suitability of decarbonised energy models facilitating the transition to the

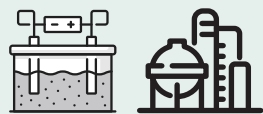
right solution safely, cost effectively in a manner that does not compromise existing business operations. We align the enabling infrastructure requirements of developments for optimised operation of all forms of hydrogen projects.

- **PROJECT DELIVERY PARTNERSHIPS.** AECOM act as your Delivery Partner across the lifecycle of hydrogen projects. We provide end to end advisory, project development and delivery services for infrastructure requirements on an integrated basis. AECOM have permitted more hydrogen infrastructure than any of our peers. Our global hydrogen engineering centre of excellence provides cost effective expertise to our local design teams. Our knowledge of the supply chain informs our world renowned procurement, project management and construction management teams to commission and deliver a full range of hydrogen infrastructure safely where it is needed.
- **PRODUCTION TO UTILITY CAPABILITY.** AECOM have successfully enabled some of the worlds leading clean hydrogen production facilities from electrolytic combination with offshore wind and hydropower to integrated chemical synthesis of hydrogen with associated carbon capture and storage technologies. AECOM have a particular pedigree in decarbonisation of transport systems and the associated hydrogen mobility infrastructure.
- **STRONG PUBLIC AND PRIVATE SECTOR RELATIONSHIPS.** Through our strong Public and Private sector relationships we are focussed on successfully positioning hydrogen hubs and delivering the full spectrum of integrated infrastructure requirements.

### AECOM Focus Infrastructure



Feed Source /  
Supply



Production  
(Blue/Green/etc.)



Biproduct  
Utility/Storage



Storage/  
Distribution



Utility – Mobility/  
Heating/Energy





# Carbon Capture, Utilization and Storage (CCUS)

## 1

### AECOM Expertise

- Leading the first Development Consent Order (DCO) granted for a CCUS project for Keadby 3, UK
- Providing permitting, consenting and engineering support at the world's largest CCUS project in Louisiana, USA
- Helping define Best Available Techniques (BAT) for the sector including helping to draft regulatory guidance
- Supporting deployment of CCUS, building on lessons learned from global projects
- Detailed design and costing for carbon recovery, compression and transport processes

## 2

### Services

#### ENVIRONMENTAL:

- DCO/planning applications
- Environmental Impact Assessment (EIA), Permit applications
- Best Available Technology (BAT) assessments
- Air Impact assessments

#### ENGINEERING:

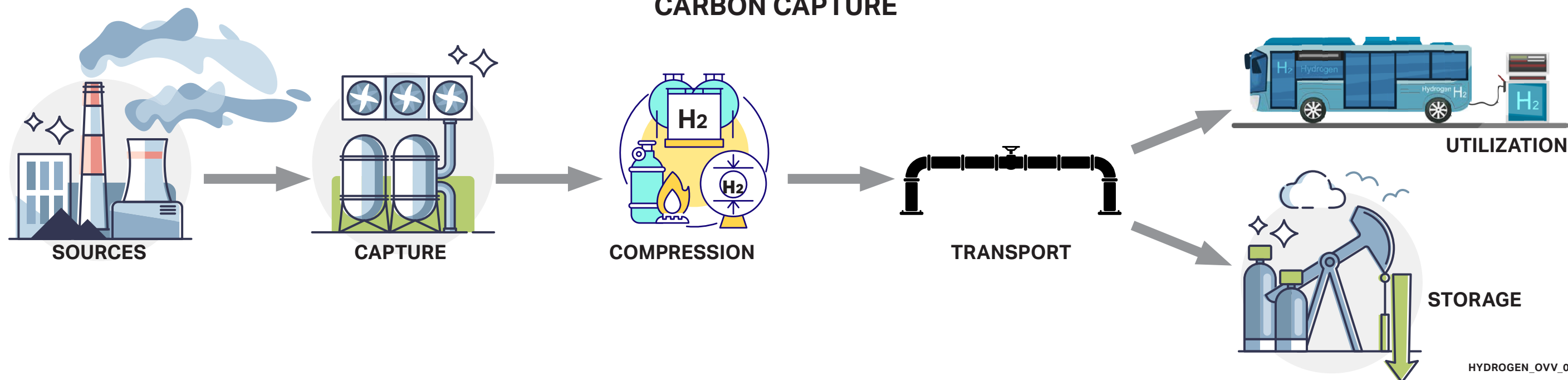
- Process and Engineering Concept Design for CCUS plant including layouts, heat and mass balance, and costing for process and utilities
- Supporting licensor discussions
- Safety Case assessments

## 3

### Differentiators

- Planning and DCO experience – 18 CCUS projects to date
- Supporting first ever full chain gas-fired CCUS project
- Consenting and engineering expertise together in-house
- Understanding of BAT and Licensor confidentiality concerns
- Experienced team and ability to work across multiple disciplines and internationally

## CARBON CAPTURE





# Hydrogen Production



AECOM has a deep bench of engineers that have completed conceptual designs to detailed engineering for hydrogen compression and storage, steam systems, power generation, and other balance of plant utilities.

### Areas of Expertise

- Hydrogen Safety
- Hydrogen Transportation
- Hydrogen Storage
- Hydrogen Use Cases

### Overview

Hydrogen has been manufactured from fossil fuels for decades and there are established procedures for compressing, storing, and transporting it, however Green Hydrogen, electrolysed from water and zero emission when powered by 100% renewable sources, has yet to be commercialised at scale. Green Hydrogen is an emerging zero emission energy source that will be a key fuel to support decarbonisation. The situation is moving fast with electrolyser manufacturers in the US, Western Europe and China vying on product, production capacity and project size on an almost weekly basis. Successful project delivery will require these new electrolyzers to be safely integrated into hydrogen storage and transport systems.

### Our Approach

AECOM has completed numerous feasibility studies for new process technologies involving hydrogen production, gas processing, and CO<sub>2</sub> capture; these have been to inform national government policy, in support of our large oil and gas clients, or to inform the thinking of the new breed of private developers. We recently completed a white paper about green hydrogen production from solar power for one such private developer to better understand the pathway to developing such a facility. The paper covered the technical production aspects, process safety, permitting, and reporting. Technical considerations included solar power generation profiles, electrolyser selection and performance, water demand, wastewater, and hydrogen compression, storage, and transportation. Process safety included discussions about PSM (OSHA requirements), flaring hydrogen, safely venting oxygen, and electrical area classification. Environmental sections included the applicable permits and regulations that would apply to a green hydrogen facility in California

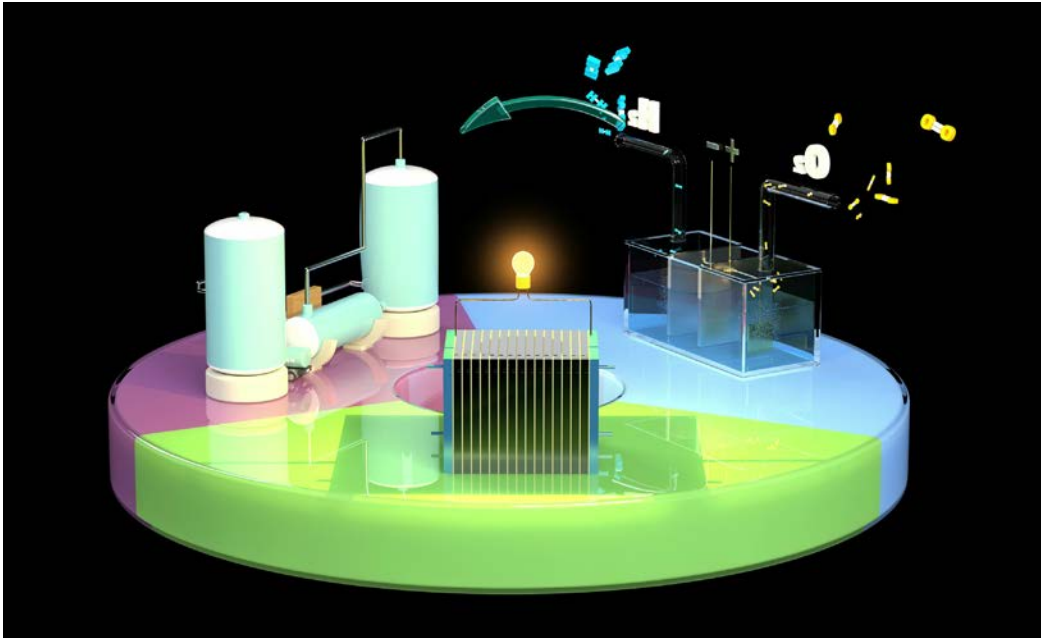
### Areas of Expertise

**HYDROGEN SAFETY.** For AECOM, the delivery of safe hydrogen projects is core and we have a very active Process Safety Management team with years of hydrogen experience, and this experience will be critical as we expect to see green hydrogen projects in environments with little or no prior explosive risk exposure.

**HYDROGEN TRANSPORTATION.** Projects will require an extensive expansion of hydrogen transportation infrastructure including pipelines and shipping. AECOM has an experienced pipeline group that can support evaluations of hydrogen pipeline infrastructure; they have delivered numerous hydrogen plant and pipeline designs in the Gulf Coast of the US associated with refineries.

**HYDROGEN STORAGE.** Subsurface gas storage may be a component of the hydrogen ecosystem. AECOM has designed pressure control stations to assess gas withdrawal flow rates that meet the design conditions at all field pressures, to include the late season reduced storage pressures. In addition, we can help developers and operators manage risk to stored hydrogen stability from the presence of sulphides, carbonates and other impurities that may be in the existing geosphere and could potentially create instability of the storage cavern or the stored hydrogen.

**HYDROGEN USE CASES.** As volumes of supply increase, green hydrogen will have many uses. We have evaluated business cases for the use of hydrogen in many of these applications such as: the rail industry, for peaking power, both as pure hydrogen and mixed with NG; for heavy goods logistics; and the role that electrolysis can have in decarbonising the water industry. One such example is support to hydrogen and battery traction trials in the UK where we developed the business case assimilating asset lives, rail infrastructure network characteristics, technological advances, and key contractual insertion points. We supported the client, the UK Department of Transport, in bilateral discussions to understand the supplier landscape, appetite and readiness to perform trials, and helped develop specifications for the trial in terms of new instructions for tenderers and contract development.







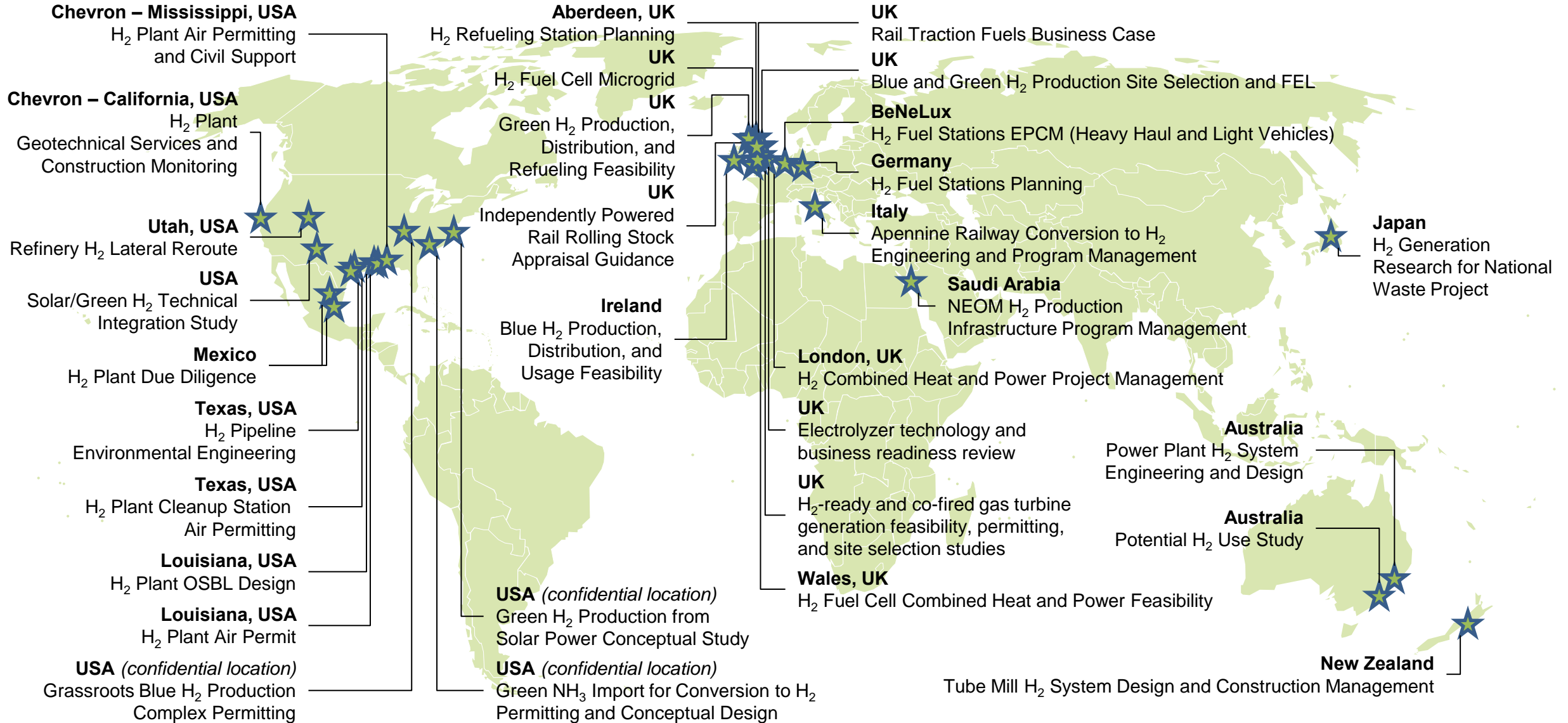
# AECOM experience

Active in over 500 green  
Hydrogen projects globally

**H<sub>2</sub>**  
HYDROGEN



# AECOM Representative Hydrogen Projects across the Globe





# 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)

**Contract Value**  
USD 138K

**Years**  
2021-present

Proud winner of the 2022 Climate Change Business Journal Award for Project Merit: **Renewable Energy**



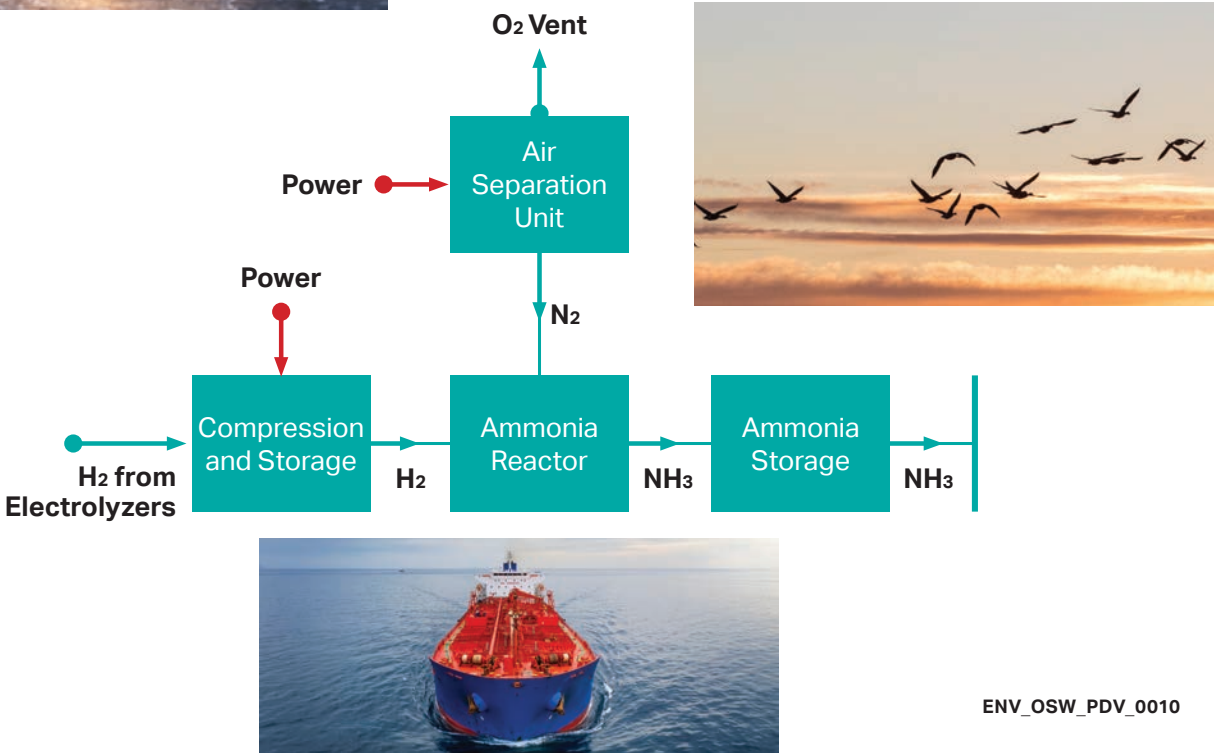
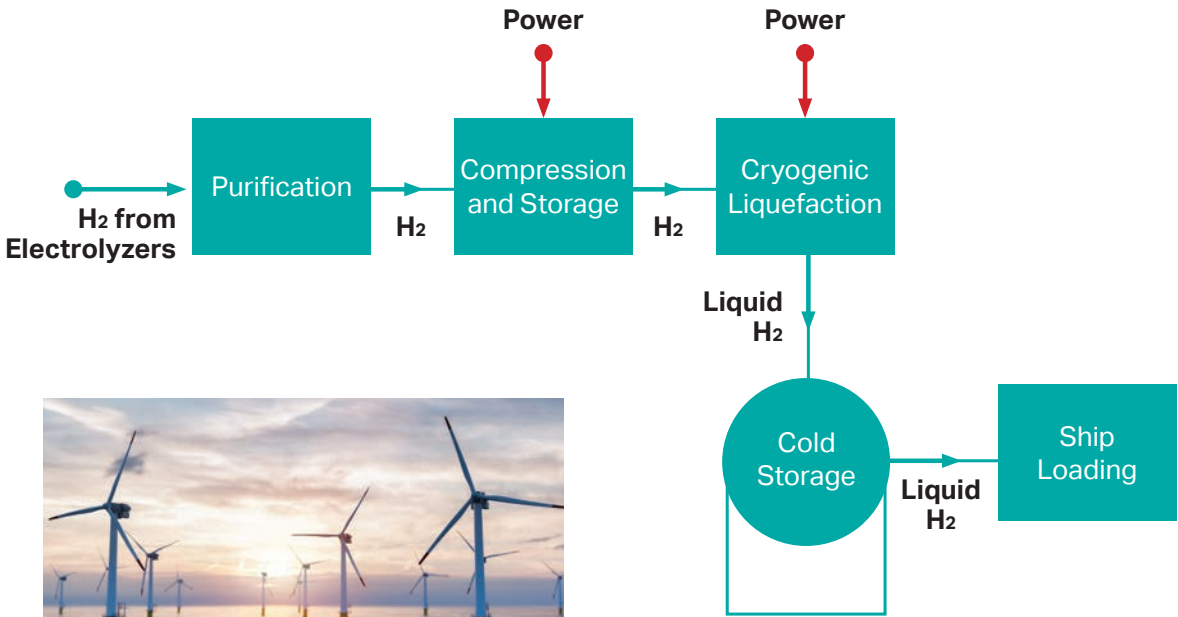
## Project Overview

The hydrogen molecule (H<sub>2</sub>) 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<sub>2</sub> production, storage, and distribution technologies are rapidly evolving, and regulatory frameworks for managing relevant aspects of H<sub>2</sub> production from offshore wind energy (H<sub>2</sub>-OSW) will need to anticipate emerging H<sub>2</sub>-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





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

### 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<sub>2</sub>-OSW) permitting and for safety enforcement under BSEE. The hydrogen molecule (H<sub>2</sub>) 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<sub>2</sub> energy sector is a United States (US) federal priority supporting national energy security and resilience, contributing to climate and environmental policy goals.

Developed through diversified research and interactive workshops, AECOM developed a report and peer-reviewed journal article to recommend updates to permitting and regulatory guidance, including amendments for existing leases, integrating H<sub>2</sub>-OSW in the existing OSW stakeholder engagement process and fully incorporating H<sub>2</sub>-OSW on the OCS as an option in future leases. We have also included recommendations for the environmental assessment requirements and provide suggestions to repurpose some of the existing regulatory frameworks including OCS oil and natural gas to address potential regulatory gaps. Our final report also includes recommendations for technology development, analyses of diverse business cases, and additional research avenues to promote adaptable development, reduce potential environmental impacts, and design mitigation measures.



More Information: [AskEnvironment@aecom.com](mailto:AskEnvironment@aecom.com)





# 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

**Contract Value**  
USD 3.7MM

**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-19<sup>th</sup> 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<sub>2</sub> 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<sub>2</sub> 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





## Alternate Fuels Assessment



SMUD has committed to achieving net zero carbon in its power system and operations by 2030 without sacrificing reliability or affordability. Key to achieving this objective is the decarbonization of its thermal fleet of LM6000 units

**Client**  
Sacramento Municipal Utility District

**Location**  
California, US

**Contract Value**  
USD 138K

**Years**  
2021-2022

**More Information:** [AskEnvironment@aecom.com](mailto:AskEnvironment@aecom.com)

### Project Overview

The client has set a bold goal to eliminate 100% of their greenhouse gas emissions from their electric generation by 2030. Their “Zero Carbon Plan” will reduce emissions, improve local air quality, overall resident health and create jobs. One arm of the plan involves investigation of new technologies and business models, including launching pilot projects and programs to test and prove new and emerging technologies and develop paths for prioritizing technology adoption and scaling.

The Project will deliver a recommended approach to achieving net zero generation for SMUD’s Carson and Proctor and Gamble generating units over the 2025 to 2045 period, including the potential to switch out the units.

### Client Benefits

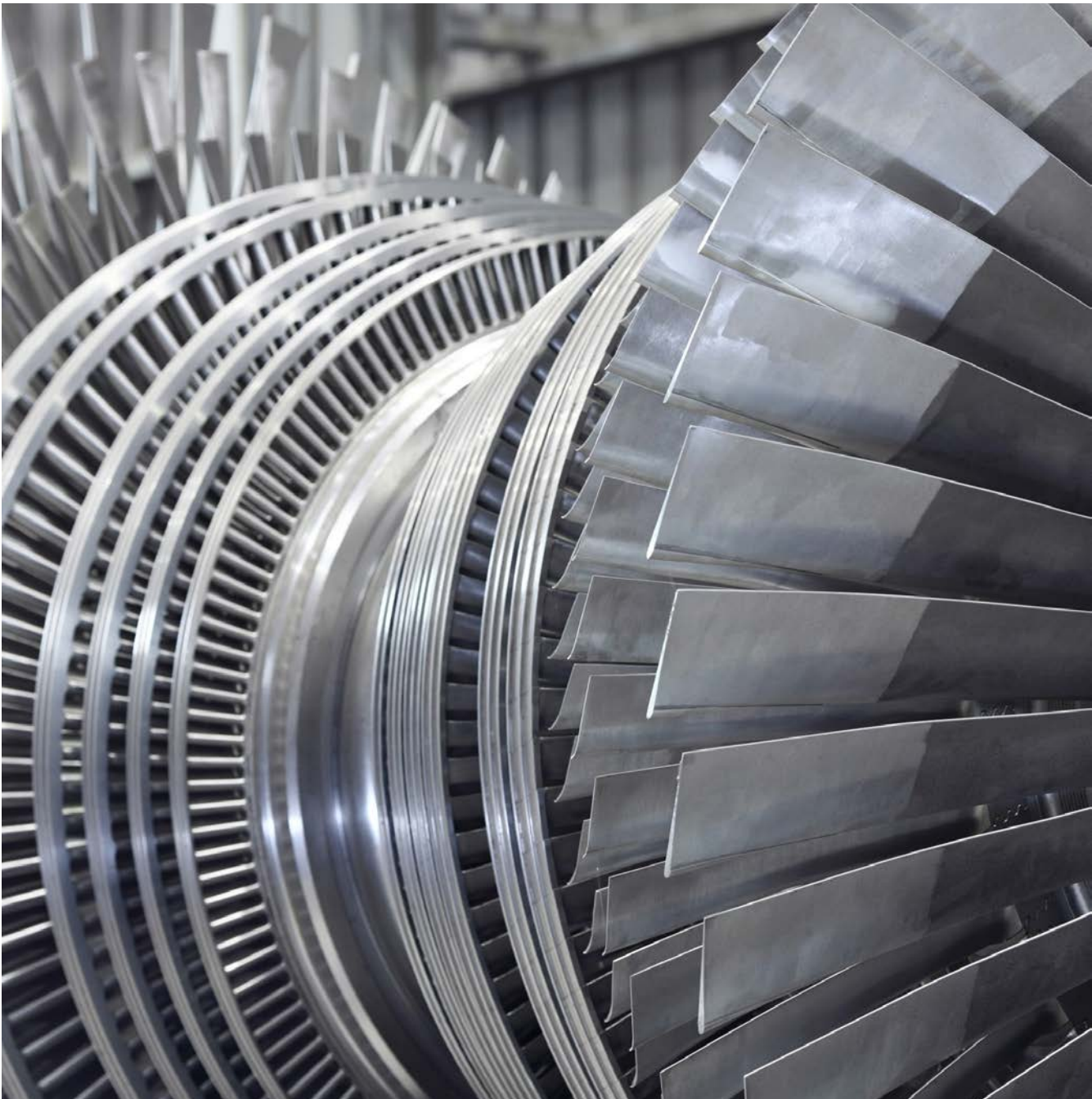
- Retiring/refueling the client’s gas power plants will help them reach their zero emissions goal.
- The client is targeting operating a portion of their plants using green hydrogen and biofuels such as renewable gas from landfills, biodiesel and other renewable sources as needed to operate for reliability.

### Work Performed

AECOM and Energia conducted a feasibility study into decarbonization options for SMUD’s fleet of aero derivative combined and open cycle gas turbines. The study involved assessment of a range of potential low carbon gaseous and liquid fuels, technical readiness of the prime movers and the supply chain capacity.

The study included a high-level cost assessment of power plant conversion and emissions treatment for hydrogen readiness and indicative costing of suitable sized biomethane production facilities.

AECOM is also providing environmental review and supporting technical studies, and permitting assistance.





## 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 \$14.4 billion in fiscal year 2023.

See how we are delivering sustainable legacies for generations to come at [aecom.com](https://aecom.com) and [@AECOM](https://twitter.com/AECOM).

