
AECOM
Low-Carbon
Future

UNITED GOAL

AECOM

Low-Carbon Future

The Next 25 Years

As the world confronts climate change, a concerted effort is required to curb the rise in global temperatures by actively transitioning to a low-carbon future. This ambitious yet essential goal requires every country to reduce not only greenhouse gas emissions but ambient concentrations. AECOM has the experience and resources to support governments, technology providers and industry in achieving this vital objective.

2.7°

Limit rise in global temperature to below 2.7° F from pre-industrial levels

50-52%

By 2030 reduce net greenhouse gas emissions by 50-52% below 2005 levels

2035

Create a carbon pollution-free power sector by 2035

CO_2 NEUTRAL

2050

Become carbon neutral by 2050

Source: The United States' nationally determined contribution in line with Article 4 of the Paris Agreement.

contact us

ONE PATH

AECOM

Pathways to a Low-Carbon Future

Achieving carbon neutrality by 2050 will require transformative changes to how we produce and consume goods and services, but there are several obstacles along the path to overcome — none of them insurmountable. We can reach our desired destination by combining near-term efforts to reduce greenhouse gas emissions with development and implementation of technology, regulations and infrastructure to promote sustainability.

- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

contact us

OUR ROLE

AECOM

What is
Decarbonization

Decarbonization describes the process of reducing and ultimately phasing out carbon dioxide emissions from artificial processes. Within the power sector, this is ultimately accomplished by transitioning to “zero-carbon” generation, such as renewable energy.

Since the elimination of fossil fuel–derived power cannot happen overnight, an important step along the way is to actively decrease the carbon intensity of existing power generation facilities. Specific actions include improving the efficiency of operating facilities, lowering the carbon footprint of the supply chain, and supporting the use of natural gas as a bridge fuel from coal to renewables.

For renewables to surpass coal and natural gas as our main source of power, it will be necessary to develop and invest in long-duration energy storage.

How AECOM is Helping:

- ↗ Reducing the carbon footprint of coal-fired power plants
- ↗ Supporting the reliable operation of combined cycle gas turbines as base load units
- ↗ The storage and delivery of renewable power

Click text above to learn more

What is...

- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

contact us

OUR ROLE

Decarbonization

Reducing the carbon intensity of coal-fired power

As the United States transitions away from fossil fuel–derived power, coal will remain a vital, near-term component of our power supply. For those coal-fired power plants that continue to operate, steps can be taken to reduce their carbon intensity. From supply chain decisions through power generation and pollution control and waste management, AECOM can help assess the impact of business and operational decisions on both costs and carbon emissions.

Methods of Lowering Carbon Intensity:

- Improving waste heat capture
- Lowering minimum operating temperatures
- Reducing parasitic loads
- Transitioning to less carbon–intensive feedstock

What is...

- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

Reducing the Carbon Footprint of Coal

AECOM provided turnkey delivery of a process capable of reducing flue gas sulfuric acid concentrations upstream of the air heater to a few ppm, via injection of a soda ash solution between the boiler and SCR. By lowering the acid dew point and associated corrosion concerns, the air heater baskets were replaced with a model providing a greater heat transfer area, permitting more efficient heating of the combustion air. As a result, plant efficiency improved by more than 2% and CO_2 emissions were reduced by more than 160,000 tons per year.

↖ Decarbonization Home

contact us

OUR ROLE

Decarbonization

Switching from coal to natural gas…for now

Combined-cycle gas turbine (CCGT) power plants emit roughly one-half the amount of carbon dioxide as coal-fired power plants for the same amount of energy produced. Many were designed for limited and intermittent operation to provide peak power. To properly bridge the gap from coal to renewables, many existing plants are in need of upgrades to improve reliability, availability and flexibility so they are capable of baseload or load-following generation.

AECOM can identify appropriate system upgrades and provide the engineering, design and project management services to modernize and improve the reliability of CCGT plants in a cost-effective manner.

AECOM System Upgrades Offered:

- Plant water supply
- Boiler water treatment
- Fuel supply and controls
- Cooling infrastructure
- Emission controls and reagent supply
- Process and equipment Monitoring
- Weather protection systems

What is…

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

AECOM

Improving the Reliability of Natural Gas

AECOM provided detailed design, engineering, procurement, and construction services to upgrade the demineralized (demin) water system for a 460 MW, 2-on-1 combined cycle power plant. The treatment system purifies river water to the quality required for the production of steam in the heat recovery steam generator (HRSG).

In follow up to a system assessment AECOM conducted to determine where investments could be made to improve the reliability and availability of the demin system, we provided turnkey delivery of a schedule-critical and outage-driven retrofit that consisted of replacing the microfiltration unit with ultrafiltration, replacing the two-stage reverse osmosis unit with a current model, and adding a new electro-deionization system for polishing. The latter system was designed to operate either standalone or in series with the existing, mixed bed ion exchange units.

Following project completion, the upgraded demin process has provided more consistent water quality while reducing the amount of chemicals needed for treatment. A reduction in outages and maintenance associated with corrosion of and deposition on the HRSG tubes is expected, as is less of a decline in HRSG efficiency over time.

↖ Decarbonization Home

contact us

AECOM

OUR ROLE

Decarbonization

Storing energy for long-lasting power

We've all heard it — "the wind doesn't always blow and the sun doesn't always shine." Key to renewable energy dethroning fossil fuels to meet America's energy needs is the development and implementation of energy storage that balances supply and demand.

AECOM supports technology providers in the development of long-duration energy storage solutions. We also work directly with utilities to evaluate and compare the technical and economic impacts of energy storage options based on needs and location.

AECOM Services Offered:

- Conceptual design
- Techno-economic assessments and FEED studies
- Detailed design
- Turnkey project delivery

What is...

- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

Extending Renewables Reach

In 2016 AECOM partnered with Hydrostor Inc. to aid the development, marketing and implementation of their compressed air energy storage technology. The long-duration energy storage technology stores energy in the form of compressed air either deep underwater or deep underground in "flooded" geological formations. When power is in demand, the compressed air is released through an expander to spin a turbine and drive a generator to supply energy to the grid.

AECOM assisted Hydrostor with process development activities such as the storage and reuse of heat generated during compression. We also provided conceptual design, capital cost estimate development, and detailed design for technology demonstrations and commercial applications.

Decarbonization Home

contact us

OUR ROLE

AECOM

What is

Carbon Capture & Sequestration

Carbon capture and sequestration (CCS) is the process of removing CO_2 from fossil fuel–derived flue gas and other large industrial sources for perpetual storage, such that it is never released into the atmosphere. CCS typically involves four steps:

1. Pre-treatment and conditioning of the gas stream to promote effective and economical capture of CO_2
2. Selective removal and subsequent liberation of purified CO_2 from the gas
3. Drying, compression, and transport (usually via pipelines) of the CO_2
4. Underground injection and geological sequestration

How AECOM is Helping:

- Paper studies and laboratory investigations
- Techno-economic assessments and FEED studies
- Pilot- and demonstration-scale test programs

Click text above to learn more

What is...

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

contact us

OUR ROLE

Carbon Capture & Sequestration

Paper studies and laboratory investigations

Key to the successful establishment of carbon capture technologies as a means of reducing greenhouse gas emissions is their continued development and refinement to augment performance, improve economics and reduce energy requirements.

AECOM has a successful history supporting universities, research consortiums, the US government and technology providers both in reviewing available research and developing and administering laboratory-scale experiments to support proof-of-concept and screening tests, fundamental investigations and process optimization studies.

AECOM Services Offered:

- Literature reviews
- Paper studies
- Market assessments
- Experimental design
- Fundamental laboratory investigations
- Beaker tests
- Bench-scale tests
- Analytical method development
- Simulations and modeling

What is...

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

AECOM

Developing Pre-combustion Carbon Capture

AECOM partnered with the University of Illinois Urbana-Champaign (UIUC) to investigate solid sorbents for carbon capture. The objective was to use first principles to identify materials that could adsorb CO_2 from pre-combusted, gasified coal, and to test those materials in bench-scale experiments mimicking a water-gas shift reactor.

UIUC identified a class of compounds to investigate and performed screening tests on those materials. High-performing candidate sorbents were then sent to AECOM for bench-scale testing in a high-temperature, high-pressure reactor. The gas matrix included CO, CO_2, H_2, H_2O as well as contaminants such as H_2S and NH_3. Test results (i.e., removal, regeneration, energy requirements) were used to develop a conceptual process design that could form the basis of a commercial system.

↖ Carbon Capture & Sequestration Home

contact us

OUR ROLE

Carbon Capture & Sequestration

Techno-economic assessments and FEED studies

Techno-economic assessments (TEAs) are critical to technology development, and the U.S. Department of Energy (DOE) has an established TEA framework to ensure an accurate comparison of disparate CCS technologies. AECOM has performed many TEAs that adhere to DOE guidelines, serving as an impartial, third-party to benchmark technologies. This experience has exposed us to emerging CCS technologies for which we have assessed their scientific viability, industrial readiness, and capital investment requirements.

Front-end engineering design (FEED) activities are key to properly funding and thoroughly planning a project. By progressing engineering prior to soliciting bids for turnkey delivery, uncertainties can be identified and addressed, including in design, plant layout, utility constraints and procurement lead times.

Skilled in process development and as an engineering, procurement and construction firm, AECOM helps clients ensure carbon capture is properly evaluated for site-specific conditions based upon the execution approach (e.g., design-bid-build, design-build, etc.) envisioned.

What is...

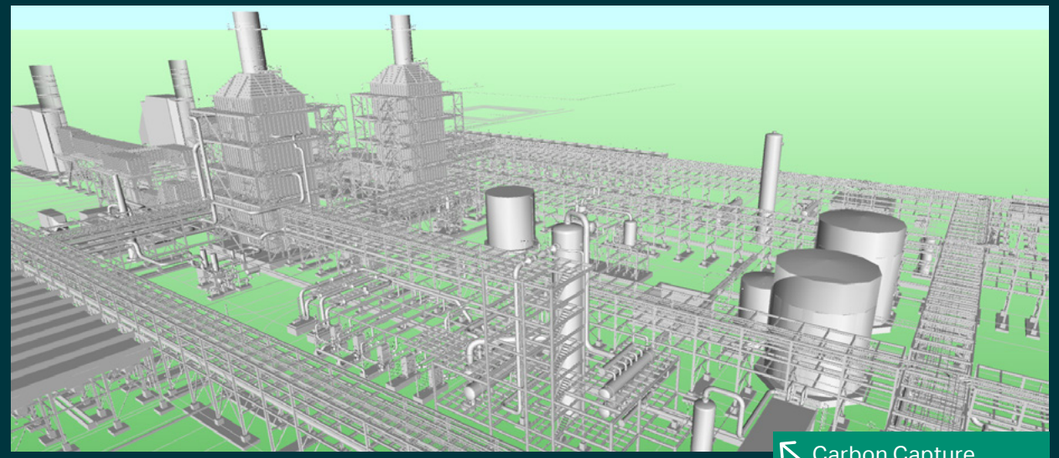
- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

Assessing Carbon Capture from a CCGT

AECOM has been working with the University of Texas on their piperazine advanced stripper (PZAS) CCS technology for more than a decade, including through the support of paper and pilot-scale studies. We are currently the detailed design firm tasked with performing the discipline-specific and balance-of-plant engineering for a DOE-funded FEED, associated with the implementation of PZAS for post-combustion carbon capture at a natural gas combined cycle plant in West Texas.

The host site has advantages like an open footprint, but also challenges like cooling water availability that the project team must overcome to ensure the final product serves as the basis for EPC funding decisions.

Completion of the FEED will provide the basis for determining the capital investment likely associated with capturing 90+% of the CO_2 emitted from a CCGT, as well as potential areas of focus for cost cutting.



↖ Carbon Capture & Sequestration Home

contact us

OUR ROLE

Carbon Capture & Sequestration

Pilot- and demonstration-scale test programs

AECOM has successfully planned, designed, implemented, and operated numerous pilot- and full-scale test programs intended to demonstrate process performance and reliability, using actual process streams at commercial operating conditions.

Testing at pilot- through demonstration-scale is critical to fully understand emerging carbon capture technologies and serves as a valuable segue between laboratory investigations and commercial implementation. Operation at these scales improves the understanding of the underlying principles of the technology and the challenges with process scale up, and it creates surety for the large capital investments needed for commercial facilities.

AECOM Services Offered:

- Host site identification and negotiation
- Detailed design
- System modularization
- Procurement and construction
- Test program development and execution

What is...

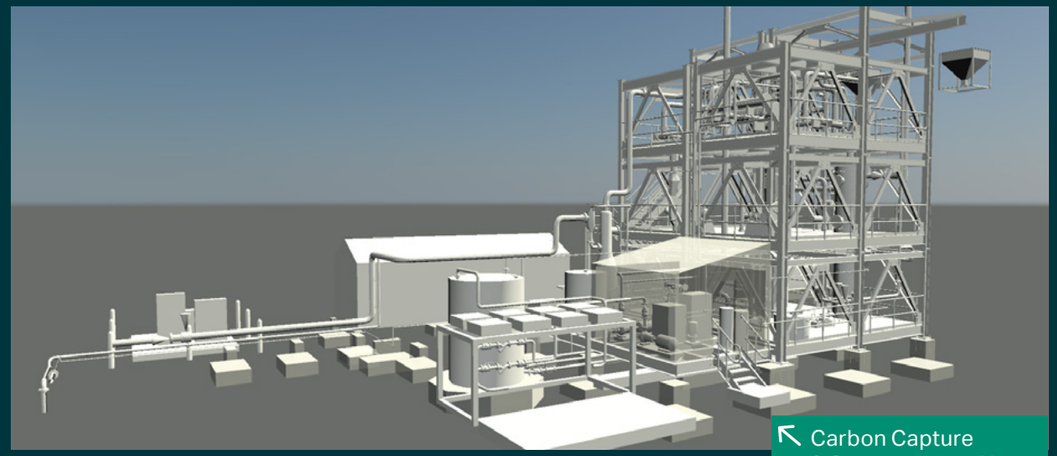
Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

Demonstrating Post-combustion Carbon Capture

Beginning in 2019, AECOM collaborated with Kawasaki Heavy Industries, Ltd. (Kawasaki) to provide the preliminary engineering and estimating support for demonstration of the Kawasaki Carbon Capture (KCC) technology at the Wyoming Integrated Test Center (ITC) – a Ministry of Environment of Japan (MOEJ) projects, as represented by Japan Coal Frontier Organization (JCOAL).

Through pre-FEED and FEED execution, the Kawasaki/AECOM team arrived at a modular, skid-based design capable of capturing CO_2 from the flue gas produced from a coal-fired power plant at a scale of 1,000 Nm^3/hr, all while complying with host-site constraints, including minimizing on-site construction.

With initial funding obtained, AECOM, as the EPC contractor, commenced detailed design in late 2021. Construction completion is planned for late 2023. The testing to follow will focus on the performance and environmental impact of both the carbon capture and sorbent regeneration processes.



↖ Carbon Capture & Sequestration Home

contact us

OUR ROLE

What is Fuel Shifting

Fuel shifting is the act of replacing the use of fossil fuels to power buildings, vehicles, and industries with low- or zero-emission fuels. Much focus is currently on transitioning vehicles away from petroleum-based fuels, but efforts are also underway to reduce the use of natural gas as a source of heat.

How AECOM is Helping:

- Supporting a transition to a hydrogen economy

Click text above to learn more

What is...

- Decarbonization
- Carbon Capture & Sequestration
- Fuel Shifting
- Waste Reduction

contact us

OUR ROLE

Fuel Shifting

Transitioning to a hydrogen economy

In a hydrogen economy, hydrogen contributes to a substantial portion of our nation's energy needs. Since hydrogen is produced, it is a carrier of energy rather than a primary energy source. Therefore, it can be an important extension of renewable energy and key to the associated storage requirements.

Whether through combustion or fuel cell technology, hydrogen can power vehicles, business and homes. It can also be blended with natural gas to reduce carbon emissions. From studies through implementation, AECOM supports clients across the energy and transportation sectors in the evaluation and incorporation of hydrogen as a means of reducing carbon emissions.

AECOM Services Offered:

- Laboratory through commercial-scale demonstrations
- Conceptual design
- Techno-economic assessments and FEED studies
- Detailed design
- Turnkey project delivery

What is...

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

Fueling Vehicles with H_2 from Biogas

FuelCell Energy, Inc. (FCE) has expanded upon its commercially deployed molten carbonate fuel cell (MCFC) technology to arrive at a process that generates electricity, high-purity hydrogen, and thermal energy from directed biogas. This process, known as the SureSource H_2 Trigeneration system, has been successfully demonstrated twice at sub-MW scale.

FCE is deploying the first commercial-scale SureSource H_2 system at the Port of Long Beach in California. The system will use directed biogas from an existing pipeline as the fuel, and the high-purity and moderate pressure hydrogen will be utilized by Toyota in fuel cell-based cars and trucks offloaded at the port. FCE completed FEED for this project and AECOM provided detailed engineering and design services through the procurement, fabrication and construction phases of the project.

In addition to producing up to 1,270 kg/day of green hydrogen, the process will generate 2.3 MW of electricity, up to 0.5 MMBtu/hr of thermal energy, and water. All will be used by Toyota with the remaining excess electricity sold to Southern California Edison under California's BioMAT feed-in tariff program.

↖ Fuel Shifting Home

contact us

OUR ROLE

AECOM

What is
Waste Reduction

Waste reduction encompasses all steps that can be undertaken to reduce the amount of greenhouse gas emissions resulting from the disposal of consumer goods — from conservation and recycling to alternatives to landfill disposal. With methane acting as a significantly more potent greenhouse gas than carbon dioxide, waste reduction includes changes to reduce the former, even if augmenting the latter.

How AECOM is Helping:

- Turning waste into energy
- Reclaiming coal combustion products

Click text above to learn more

What is...

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

contact us

OUR ROLE

Waste Reduction
Turning waste into energy

Energy from Waste (EfW) is an economically and environmentally positive approach to reusing waste as an energy resource, while at the same time reducing the size, cost, and environmental impacts of landfills. EfW plants extend the useful life of the solid waste, converting it into electricity and/or heat for industrial processing and district heating systems, filtering out harmful substances and recovering metals and other material for reuse.

AECOM provides a number of EfW services, because it is a robust and effective energy option to produce power while treating waste and reducing emissions as an alternative to fossil fuels.

AECOM Services Offered:

- Environmental compliance management
- Regulatory approvals and permitting
- Feasibility studies
- Financial analysis
- Preliminary design and development
- Engineering, procurement, and construction
- Process consulting and system optimization

What is...

Decarbonization | Carbon Capture & Sequestration | Fuel Shifting | Waste Reduction

Supporting Waste to Energy

AECOM currently monitors the operational performance of the Pasco County Refuse Recovery Facility — a 1,050 TPD mass burn Waste to Energy (WTE) facility. We review operations and conducts inspections, particularly during scheduled maintenance outages, to assess the performance of the facility Operator with respect to best operating practices from an industry-wide perspective. We engage facility staff and the Operator to discuss and resolve issues. Findings are summarized in both monthly and annual reports to the County.

Since being awarded the contract in early 2019, our team has helped foster a collaborative relationship between the County and Operator. Operational review meetings that once focused on facility aesthetics now serve to collaboratively identify practices and projects that are critical to the longevity of the facility.

AECOM is also supporting the expansion of the facility to a capacity of 1,475 TPD, including permitting, support for construction contract negotiations and technical consulting on the facility design.

↖ Waste Reduction Home

contact us

OUR ROLE

Waste Reduction

Reclaiming coal combustion products

Coal combustion products (CCPs) like ash and gypsum have long been put to beneficial use, including in the production of cement and as a cement replacement in concrete, offsetting the need for the raw materials they replace. Historically, market limits resulted in a substantial amount being sent to a pond or landfill… until now.

Decreased power generation from coal, coupled with increased investments in infrastructure, have resulted in localized areas where demand for CCPs exceeds supply. This presents the opportunity to reclaim coal ash and even gypsum from landfills and ponds. Since legacy CCPs are associated with greenhouse gases that have already been emitted, their reuse, as a raw material substitute, provides an opportunity to reduce the carbon footprint of the end products they help create.

AECOM works with power plant owners to better understand stored CCP assets and the investment required to maximize their market value, including as a result of monetizing carbon emissions.

AECOM Services Offered:

- CCP reserves characterization
- Beneficial use market evaluation
- Cost/benefit analyses of processing requirements
- Infrastructure design and installation
- Reclaiming plan and operation

What is…

Decarbonization

Carbon Capture & Sequestration

Fuel Shifting

Waste Reduction

Putting Coal Ash to Beneficial Use

The A.B. Brown Generating Station is a coal-fired power plant owned and operated by CenterPoint Energy. The ash pond, commissioned in 1978, contains approximately 6 million tons of coal combustion residuals (CCR).

To comply with the CCR Rule, the ash pond needs to be closed. AECOM supported the owner in evaluating closure strategies — from close in place to closure by removal, with and without beneficial use of recovered coal ash for cement production. Closure by removal with beneficial use was selected as the preferred approach based on cost, environmental considerations, regulatory and community acceptability, and long-term liabilities.

AECOM was retained as the EPC contractor to provide turnkey delivery of the pond closure, including the supporting infrastructure to process and convey coal ash a mile from pond to barge. Over approximately a decade, we will manage the excavation of the ponded ash.

Coal ash will be excavated and stockpiled in a way that allows for sampling and analysis to take place to determine the degree of blending required to meet specifications for cement production prior to being loaded on barges for transport.

↖ Waste Reduction Home

contact us

Contact

Scott Miller

Technology & Business Development

scott.d.miller@aecom.com

Bill Steen, PhD

Process Development & Consulting

bill.steen@aecom.com

aecom.com