Energy Storage
Providing Holistic Solutions to the Energy Industry
AECOM is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries.

92,000 employees
500 offices worldwide
150 countries
7 continents
As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM companies have annual revenue of approximately US$18 billion.

**Complex challenges**
Governments and organizations rely on us to help them solve the complex challenges critical to their missions and mandates, such as shaping cities, delivering water and energy, restoring damaged ecosystems, mobilizing defense programs and protecting people and property from natural and manmade threats. These are the challenges that define our work.

**Connected expertise**
Our clients face tough challenges, and we work to understand and solve them better than anyone else. We match the complexity of these challenges with the diversity of our expertise, spanning all phases of the development life cycle—design, build, finance, operate and manage. This experience delivers innovative solutions that transform communities and improve lives.

**Transformational outcomes**
The result of our work is not just a single solution, but an outcome in which circumstances are dramatically changed for the better: the revitalization of a neighborhood, the next generation of a business, the growth of an economy, the stabilization of a country, or the health of the planet. This is how we are built to deliver a better world.
AECOM delivers creative, sustainable, cost-effective and value-added solutions across your whole business life cycle.
Why AECOM

We provide our clients with integrated solutions supported by strong technical capabilities.

As a global leader within the energy industry, our fully integrated firm can provide services and solutions to help interconnect energy storage solutions. AECOM has extensive experience delivering energy storage projects from concept through to planning and delivery.

AECOM provides a Sustainable Solutions Turnkey (SST) program, which includes project development, engineering and project implementation. Each process ties the studies to execution.

This fully-functioning program has moved from a ‘pilot’ status project to a marquee service for PG&E’s New Revenue Development (NRD) department.

AECOM has the ability to leverage our global reach and integrated services to create, design, and safely deliver energy storage solutions in a variety of applications. AECOM’s experience and resources in energy storage:

Concept assessment
- Site selection
- Technology selection
- Conceptual design and system sizing
- Grid-interconnect investigation
- Risk analysis

Techno-economic assessment
- Feasibility studies
- Social impact assessment
- Cost estimations
- Financial modeling
- Economic benefit assessment
- Ancillary service benefits

Project planning
- Planning and permitting
- Environmental impact assessments
- Stakeholder management plan
- Resource planning
- Life cycle analysis
- Risk and hazard assessments
- Cost assessment

Project management
- Construction and site management
- Environmental health, and safety management
- Commissioning services
- Project reporting and stakeholder management
- Contract management

Engineering, procurement, construction
- Mechanical
- Electrical
- Civil
- SCADA
- Grid connection and integration
- Transmission and distribution
- Water/marine
- Fire and safety assessment
- Construction and site management
- Procurement services
- O&M schedules
- Operational efficiency assessments

Industry Recognition

Engineering News-Record’s 2016 Top 500 Design Firm Survey recognized us as the industry’s #1 firm overall.

#1 Design Firm
#1 Site Assessment and Compliance
#2 Clean Air Act Compliance
#4 Power
AECOM provides a variety of services required to execute and deliver energy storage projects across the globe. Our broad range of project management services, coupled with our technical resources, allows us to thoroughly plan, develop and execute environmental reviews, permitting, engineering and design, procurement, construction and commissioning.

Experience

AECOM is recognized as an industry leader within the energy industry and continues to expand its offerings to clients all over the world. More recently, AECOM has developed significant experience within the energy storage markets ranging from market analysis (international and domestic), siting and permitting and project execution.

AECOM has developed a process and methodology for strategic sustainability planning to help prospective clients with developing a holistic strategy to evaluate energy generation and storage, energy efficiency and conservation methods.

The Sustainable Systems Integration Model (SSIM™) can help clients identify an optimal energy storage solution that is politically and financially acceptable. This methodology can be used to model energy storage systems to determine demand charge savings during peak and off-peak periods.

A summary of energy storage initiatives and projects include:
- Compressed Air Energy Storage (CAES)
- Demand Charge Management
- Balance-of-plant system design, integration of turbo-machinery into overall plant design
- Adiabatic - CAES initiative
- Underwater - CAES initiative
- Multiple pumped storage projects serving as member of developer team
  - Rocky Point Pumped Storage project
  - Ludington Pumped Storage project
- Sample of battery storage projects:
  - 6 MW/1.5MWh US Government
  - 6 MW/1.6MWh Australian Mining Company
  - 1 MW/1MWh AusNet Services
  - 500 kW/2MWh Goleta, CA

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- Energy storage study prepared for Australian Renewable Energy Agency (ARENA)
- Siting and permitting activities for multiple energy storage projects
- AECOM designed, constructed and operated an off-grid hybrid power system using 20 kW diesel generator, 1.44 kW solar array and lead-acid battery storage system
- AECOM developed hybrid power system utilizing 600kWh battery storage system for Bugala Island, Uganda, Africa

**Pioneering**

Pioneering the integration of innovative energy storage technologies within the utility sector fits within the mission and company experience at AECOM. Legacy AECOM was part of a joint venture to design and engineer the original McIntosh CAES facility located in McIntosh, Alabama.

AECOM has a long history in working with Southern Company including several of the operating entities such as Alabama Electric Cooperative who owns the CAES facility.

During the time of commissioning, the McIntosh CAES facility had a maximum power output rating of 110 MW and utilizes a 19,000,000 cubic foot cavern as the air storage reservoir.

Air is stored at a maximum capacity of approximately 1,050 psig and is used to fire natural gas for electricity generation.

AECOM is currently involved in several energy storage initiatives including assessment of Pumped-Hydro Storage projects in California as well as advanced-CAES technologies. AECOM’s project experience and design expertise are critical to leveraging new technologies within the power industry.
AECOM has been serving our clients for decades as a leading provider of EPC services in the power, water and wastewater, and oil and gas industries. Across all components of the project cycle—pre-project planning studies, design, build, finance, and operate—we are uniquely positioned to deliver a differentiated service, working globally and delivering locally.

As a trusted partner, we draw together teams of engineers, planners, architects, landscape architects, project and program managers, environmental specialists, economists, scientists, cost and schedule specialists, consultants, procurement specialists and construction specialists—all dedicated to finding the most innovative and appropriate solutions for clients.

Whether we serve clients at one phase of the project life cycle or throughout it, our role is to apply creative vision, technical expertise, interdisciplinary insight and local experience to address complex challenges in new and better ways.

Engineering

AECOM’s engineering services range from master planning, project/program management, subject matter expertise (SME) consulting to front-end engineering design (FEED) through detailed design of issued for construction (IFC) packages. AECOM’s toolkit for engineering services leverages the latest technologies and engineering analytical capabilities including:

- CFX computational fluid dynamics engineering
- Hysys/ASPEN process simulations
- Plant 3D design platforms
- Laser scan “as-builts” of existing facilities

Consistent with our lean execution approach, AECOM understands the importance of our services being tailored for our clients. Through side-by-side planning and collaborating with our clients, we strive to streamline every project’s work products and adapt our framework to seamlessly incorporate client standards, specifications and preferences, avoiding inefficient “one size fits all” approaches.

Committed to delivering the highest quality product on all assignments, AECOM is an ISO 9001 2008 certified firm and implement our Quality Management System (QMS) on all projects. The QMS contains detailed documentation on quality procedures in addition to instructions and forms that every project team must use while performing QA/QC reviews.

AECOM has instilled in our staff a philosophy of quality as an ongoing work performance process rather than an isolated activity that occurs only at predetermined intervals. This process includes the following:

- **Project Execution Plan**
  AECOM prepares a project execution plan customized with information specific to the project and client to align the staff with the project goals and requirements.

- **Multi-Step Quality Process**
  AECOM employs a multi-step QA/QC process including discipline detail checks, intra-discipline and independent technical reviews prior to submission to verify the quality and integrity being delivered to our clients.
Procurement

AECOM offers the full range of in-house procurement services, including supplier/subcontractor pre-qualification; prime agreement review and flow-downs to suppliers and subcontractors; issuance of request for quotations; commercial and technical bid reviews and bid tab preparation; purchase order and subcontract preparation and issuance; submittal and invoice tracking; supplier expediting, and vendor surveillance. Our procurement professionals have the work process framework to efficiently serve clients both in the private sector as well as federal services complying with the Federal Acquisition Regulation procedures.

Representative capabilities include:
- Global sourcing
- Purchasing and expediting
- Integrated supply chain management and logistics optimization
- Subcontracting
- Materials management
- Procurement auditing
- Supplier performance evaluations

Construction

AECOM’s construction services experts provide clients with an extensive range of pre-construction and construction-related services and solutions for projects of varying scope, budget, schedule, and complexity. As a project progresses—or increases in complexity—we customize our services to fit each clients’ unique needs and requirements. Our suite of services covers every aspect of a client’s project, from design to completion. Representative capabilities include:
- Constructability reviews
- Value engineering
- Cost estimating
- Scheduling
- Sustainability strategizing and implementation
- Bid package preparation
- Procurement
- Document control
- Bid evaluation
- Field supervision
- Safety programs
- QA/QC
- Cost control
- Closeout and warranty procedures
- Building commissioning
- Logistics panning
- Materials and equipment receiving and reporting
- Field engineering
- Estimating
- Startup and commissioning

From left:
Wind Turbine Project
Lancaster, U.K.

LG-1 1.386 MW Hydroelectric Powerhouse
James Bay, Quebec, Canada

Diablo Canyon Plant Steam Generation Replacement
Avila Beach, California, U.S.A.
AECOM provides a wide range of services to the wind and solar energy industry throughout the U.S. including traditional consulting and engineering design services as well as EPC.

Our integrated services framework achieves speed to market by bringing together a unique combination of engineers, planners, scientists, and project managers. We provide energy analysis and planning, environmental management, conceptual design, detailed design, engineering, procurement, project management, construction management and asset management.

Our program/construction management services provide the project with controls that clients require managing their projects and providing banking and financing partners the information they need to track the project’s status.

These project controls include project scheduling, estimating, cost control, document control, risk management, compliance management, forecasting, asset management and owner’s engineering services.

We help developers and end-users evaluate solar energy options, navigate regulatory environments, and implement solar strategies from buildings and facilities to large-scale, utility-size solar fields built to deliver energy to thousands of homes and businesses.

Representative capabilities include:
- Siting studies and alternatives evaluation
- Critical issues/constraints analysis
- Asset and property transfer due diligence
- Transmission analysis
- Interconnection studies
- Technology due diligence and selection
- Plans of development
- Power purchase agreement review
- Economic analysis and financial pro-formas
- Constructability assessment
- Preliminary engineering and design
- Detailed civil, mechanical and electrical engineering design
- Environmental resource studies, surveys and impact assessment
- Resource assessment
- Groundwater modeling
- Hydrology studies, scour analysis and hydrologic design
- Permitting
- Public involvement, planning and implementation
- Project and construction management
- Owner’s engineering
- Turnkey design-build
- Compliance plan development, implementation and monitoring
- Avian and bat protection plan design and implementation
- Worker environmental awareness program training
- Compliance management system/database development and implementation

Solar and Wind Energy

AECOM

Beacon Solar
Kern County, California, U.S.A.

Below:
Marine Core Base, Camp Pendleton
Landfill PV Project
San Diego, California, U.S.A.

Noble Environmental Power Wind Parks
New York and Michigan, U.S.A.

Energy Storage
Project Management

AECOM employs a project management methodology that is highly successful and embodies certain organizational principles, repeatedly used as keystones to achieve a fully integrated effort that meets standards of quality, adheres to cost estimates and schedules and attains client acceptance. These principles include:

- Establishing clear lines of communication, responsibility and authority
- Using uniform means of collecting and disseminating information
- Establishing and maintaining realistic baselines, cost estimates, and schedules—against which performance can be measured
- Promoting the use of standardized and disciplined work practices for all project participants and verifying compliance with these practices
- Assigning personnel with proven leadership and experience whose first priority is to the project
- Satisfying the technical, cost and schedule requirements of the project

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Health and Safety Excellence

AECOM places the highest priority on the protection of safety and health of our employees, contractors and stakeholders. Our safety culture is rooted in behavioral-based safety, both on and off the job, to ensure our safe habits achieve our safety goals. We achieve sustainable safety excellence by commitment through the entire organization, from our CEO through our field teams through:

Leadership Commitment. Safety is the foundation of how we work in the field, at our project sites, and in our offices.

Behavior-Based Safety. Our culture is rooted in a behavior-based safety program, both on and off the job.

Training. Safety and quality training are delivered starting on the first day of employment, then reassessed and renewed annually.

Continuous Improvement Driven by Results-Oriented Leadership. Our recordable incident rates have declined steadily, even as our company has grown, diversified its services, and increased its geographic reach.
AECOM has extensive experience in working with our clients to integrate new technologies and assess impacts to current operations and corporate profitability. AECOM has worked with several energy storage technology suppliers and end-users with design and permitting of energy storage assets. AECOM has worked with a myriad of energy storage technologies ranging from the mature technologies such as pumped hydro and compressed air energy storage to emerging technologies such as grid connected batteries and underwater compressed air energy storage.

AECOM provided permitting services for the world’s first underwater compressed air energy storage system located near Toronto Island, Ontario, Canada.

AECOM also provide project design and permitting services for a grid connected Li-ion battery energy storage project in southern California. Considered the first project of its kind in Santa Barbara County California, AECOM is responsible for gathering information to address key issues based on project’s urban location as well as impacts to biological and cultural resources. A comprehensive environmental document was prepared to support the application process and address potential safety-related issues related to this energy storage technology.
McIntosh Compressed Air Energy Storage

Pioneering the integration of innovative energy storage technologies within the utility sector fits within the mission and company experience at AECOM. We were part of a joint venture to design and engineer the original McIntosh compressed air energy storage (CAES) facility located in McIntosh, Alabama. AECOM has a long history in working with Southern Company including several of the operating entities such as Alabama Electric Cooperative who owns the CAES facility.

During the time of commissioning, the McIntosh CAES facility had a maximum power output rating of 110 MW and utilizes a 19,000,000 cubic foot cavern as the air storage reservoir. Air is stored at a maximum capacity of approximately 1,050 psig and is used to fire natural gas for electricity generation. This project was recognized for several awards and technology achievements including POWER Magazines 1992 Power Plant Award.

Underwater Compressed Air Energy Storage

AECOM has partnered with Hydrostor, Inc. to assist with expanding the world’s first underwater compressed air energy storage system located in Toronto, Ontario, Canada. The main objective for this project is to increase system generation capacity and larger air cavity.

WDG battery storage integration to PV project

AECOM prepared interconnection applications for three battery-based energy storage projects in Southern California Edison service territory. Each has planned capacity of 2MW. They are collocated with existing solar energy projects that AECOM helped develop but they are stand alone in terms of interconnection, power offtake and ownership. Preliminary design was based on automation and power technologies.

Solar World PV project in Puerto Rico

AECOM is currently engaged with SolarWorld on a PV project in Puerto Rico that has an energy storage component. We are providing on-call, as-needed, technical services for a 10 MWh PV project that has roughly 5 MW of battery energy storage. The purpose of the battery energy storage system is to smooth power ramps due to the intermittent generation resource as well as provide frequency response to the utility during off-nominal frequency events as required by PREPA, the utility provider.

Underwater-Compressed Air Energy Storage Techno-Economic Analysis

Given AECOM’s global footprint and technical diversity, we are exploring alternatives to conventional energy storage technologies such as Li-ion batteries, Pumped-Hydro, etc. AECOM is performing due diligence and techno-economic analysis of a novel approach to store compressed air in an underwater air cavity which uses the head from water above to store air at pressures greater than >300 psig. Similar to the CAES technology, this technology seeks to provide grid support and time-shifting of renewable energy for locations near coastal areas or islands/microgrids.

We approach energy storage opportunities armed with a multi-talented resource pool and a creative spirit and have developed significant experience within the energy storage markets ranging from market analysis (international and domestic), siting and permitting and project execution.
Delivery and consumption of energy is changing across the globe.

Technology, innovation, regulatory and policy changes, and renewable energy assets continue to transform current energy business models. Energy storage technologies can have immense impact by stabilizing the electricity grid and providing a myriad of services valued by stakeholders.
About AECOM

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