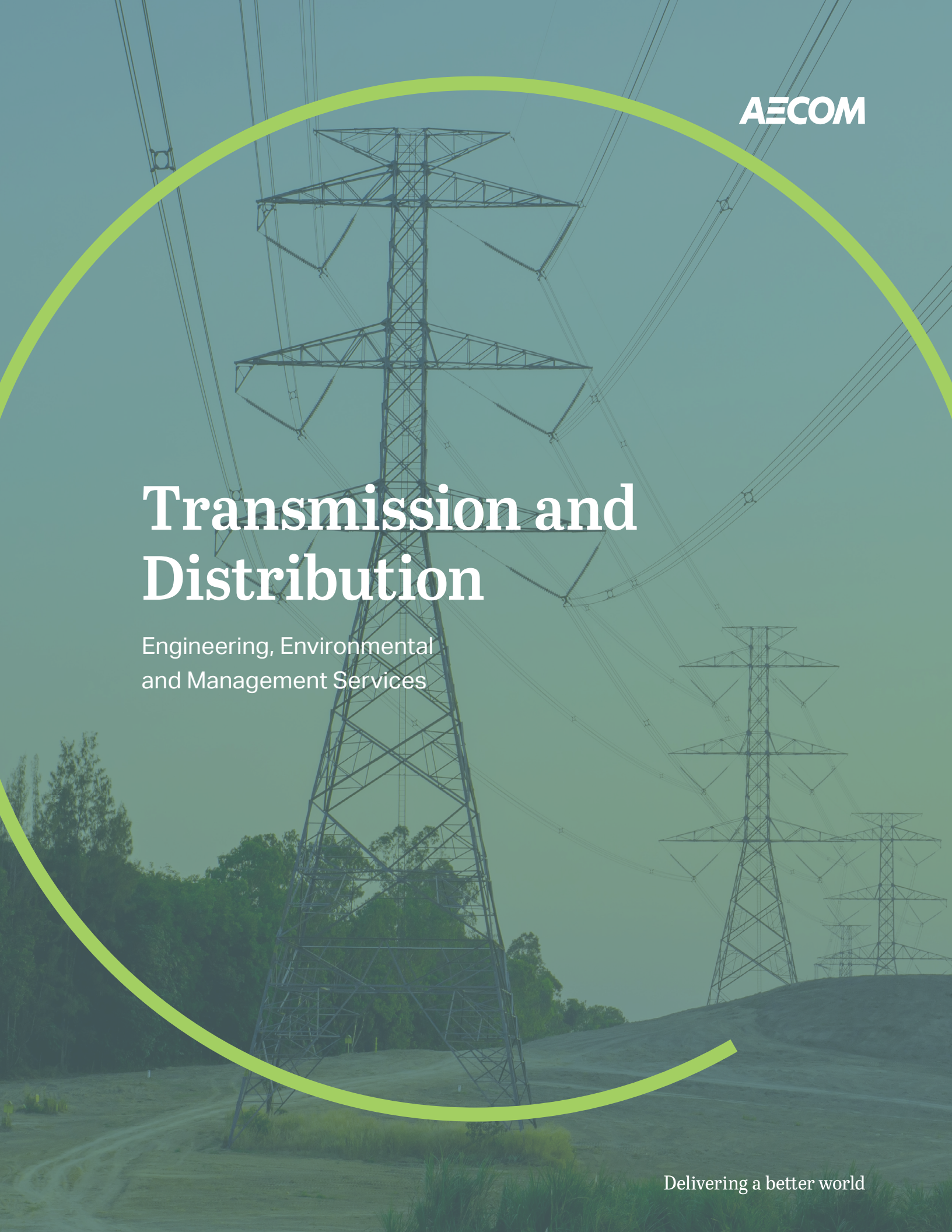


AECOM

Transmission and Distribution

Engineering, Environmental and Management Services

Delivering a better world

CONTENTS

A brief history

Facts and figures

1.

AECOM launched when a handful of employees from design and engineering companies shared a dream of creating an industry-leading firm dedicated to making the world a better place.

2.

AECOM became an independent company formed by the merger of five entities. While our official founding was in 1990, many of our predecessor firms had distinguished histories dating back more than 120 years.

3.

Since then, more than 50 companies have joined AECOM and, in 2007, we became a publicly traded company on the New York Stock Exchange.

4.

AECOM is the world's premier infrastructure firm with an unrivaled heritage delivering design, planning, engineering, consuing and construction management solutions.

47,000 people

Fortune 500 #163

Work across seven continents

2 Million Work Hours Awards

Revenue $13.2 billion in fiscal year 2020

100% Rating on Corporate Equality Index / Best Places to Work for LGBT Equality 2021

Accolades

- ENR rankings No 1
- Environment Firm
- Transportation Design Firm
- Facilities Design Firm
- Mixed-Used Buildings
- Education Buildings
- Aviation
- Highways
- Chemical Remediation
- Top 10 Military Friendly company 2020
- Military Friendly® Top 10 Company
- Military Friendly® Top 10 Supplier
- Diversity Program
- Military Friendly® Top 10 Employer
- Military Friendly® Top 10 Spouse Employer
- National safety council: 155 Perfect Record Awards
- Achieved a minimum of 12 consecutive months without a recordable injury or illness.
- For each award, achieved a minimum of one million consecutive hours without an injury or illness that resued in days away from work and zero fatalities.

At AECOM, we're delivering a better world.

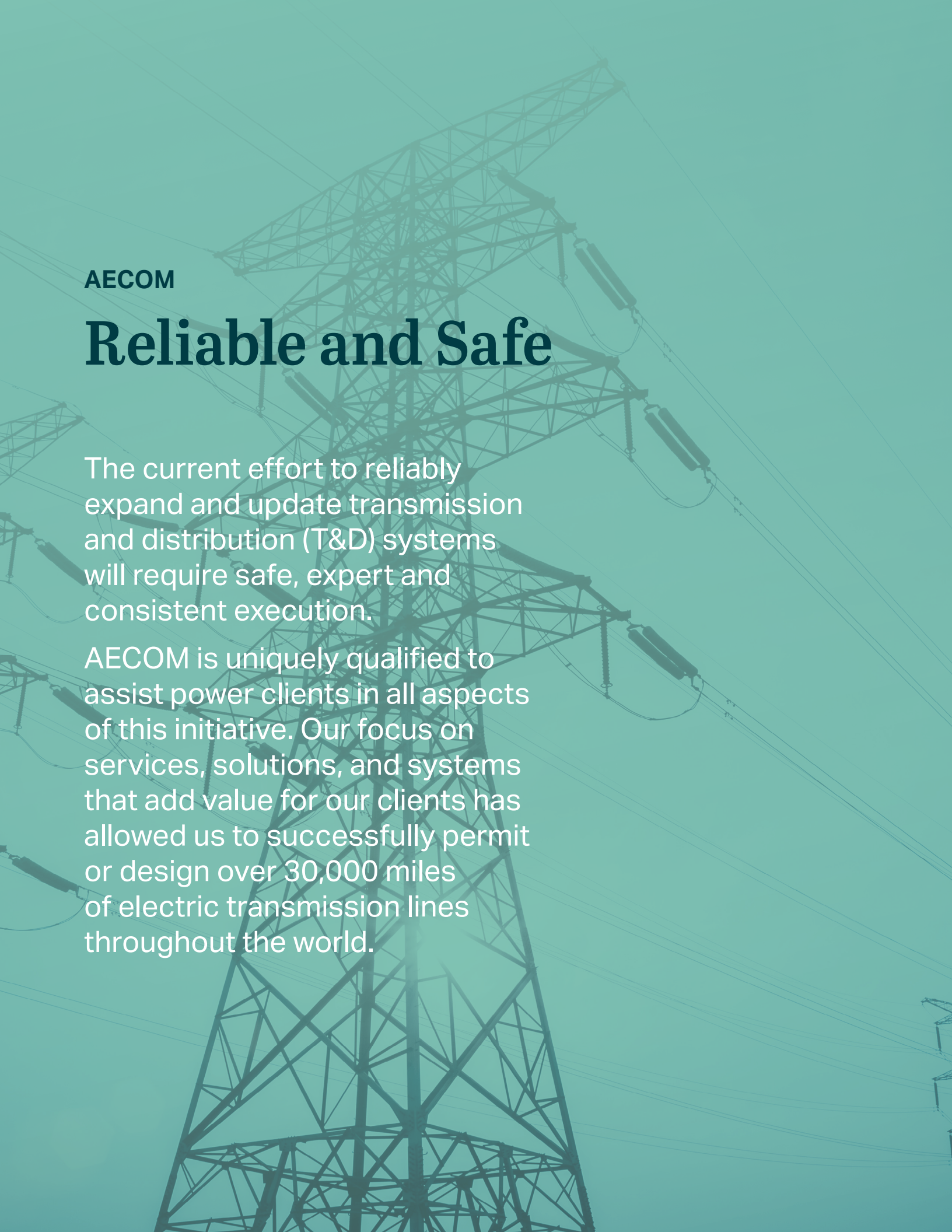
As the world's most trusted infrastructure consulting firm, we're committed to managing our business with the upmost responsibility and to always strive for better – reducing emissions, creating social value or diversifying our senior leadership and workforce.

We understand both the urgency of the challenges facing our society and our responsibility to respond in an impactful and enduring way. Armed with this consciousness, we're leading the change toward a more sustainable and equitable future, partnering with those who want to make a positive difference in the world.

We're listening to clients and the communities we serve to improve lives and livelihoods, and to create sustainable legacies for generations to come.

Thinking without limits is what keeps us at the vanguard. Ideas have no borders, and this ethos is embedded in our culture. The full scope of our global expertise is available to anyone who needs it, wherever they are based.

We're trusted advisors — planners, designers, engineers, consultants and program and construction managers — delivering professional services spanning cities, transportation, buildings, water, new energy, and the environment. Working throughout the project lifecycle, we're one team driven by a common purpose to deliver a better world.



AECOM

Reliable and Safe

The current effort to reliably expand and update transmission and distribution (T&D) systems will require safe, expert and consistent execution.

AECOM is uniquely qualified to assist power clients in all aspects of this initiative. Our focus on services, solutions, and systems that add value for our clients has allowed us to successfully permit or design over 30,000 miles of electric transmission lines throughout the world.

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 leader in electric power delivery systems, we provide comprehensive, life-cycle services for T&D projects, from alternative route analyses, licensing and permitting, conceptual engineering, right-of-way services, and public involvement to detailed engineering and design, geotechnical engineering and subsurface investigation, site design, construction management, and regulatory compliance.

AECOM is active in all types of transmission projects. AECOM is a premier, fully integrated professional and technical services firm positioned to design, build, finance and operate infrastructure assets around the world for public and private-sector clients.

From those we manage on behalf of owners, to projects on which we provide individual services, we complete new greenfield transmission and substation projects, and we also provide services for rebuilds, voltage upgrades, substation expansions and interconnection.

We routinely provide environmental assessments (EA) and environmental impact statements (EIS) to support the National Environmental Policy Act (NEPA), as well as routing studies, constraints analysis and testimony to support state license applications for transmission lines.

AECOM also offers unparalleled services to meet all distribution needs.

Our project expertise includes network systems for cities, military installations, distributed generation, residential distribution systems, and systems for industrial centers. Our wide range of computer-aided engineering and design capabilities facilitates quick responses to clients' needs for rehabilitation, upgrades and expansion of existing facilities, or the design of new distribution systems.

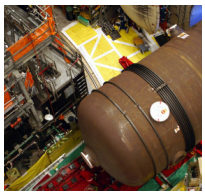
Power Markets We Serve

AECOM brings the broad capabilities of our heritage companies into one streamlined organization. Our legacy companies include environmental and engineering powerhouses Woodward Clyde Consultants and Dames and Moore, as well as EBASCO, United Engineers and Constructors and Washington Group International and URS.

Hydropower and Dams

- Hydropower project feasibility studies and concept development
- Dams, reservoirs and hydraulic structures
- Power plant design, refurbishment and automation
- River basin studies and sustainable water resource planning
- Hydrological, topographical and geotechnical investigations
- Flood studies and safety evaluations
- Asset valuations and management

Nuclear



- Preliminary project analysis
- Private participation / financing advice
- Preliminary engineering
- Civil, mechanical and electrical engineering design
- Balance of plant
- Public involvement, planning and implementation
- Environmental resource studies and impact assessment
- Permitting
- Project and construction management
- Waste treatment advisory services

Thermal and Geothermal

- Least cost generation expansion planning
- Power plant feasibility studies concept design
- IPP project planning and development
- Power systems analysis, system planning, protection, controls and SCADA
- Design and construction of thermal and geothermal power plants
- EPCM
- Due diligence / investigations
- Rehabilitation and upgrades
- Asset management

Transmission and Distribution

- T&D network planning
- Power systems analysis
- Substation and transmission line design
- Earthing analysis and design
- Power system protection
- Communications
- SCADA and energy management systems
- Load despatch centres
- Metering
- Asset valuations and management
- High voltage underground cables
- Distribution engineering
- Project/program and construction management
- Protection and controls design
- Secondment services

Wind and Solar

- Preliminary project analysis
- Wind assessments
- Load forecasting
- Private participation / financing advice
- Preliminary engineering
- Civil, mechanical and electrical engineering design
- Public involvement, planning and implementation
- Environmental resource studies and impact assessment
- Permitting
- Project and construction management

Transmission and distribution (T&D) is just one aspect of AECOM power services.

Additionally we provide services to the following markets: hydropower and dams, nuclear, thermal and geothermal as well as wind and solar.

The current effort to reliably expand and update transmission and distribution (T&D) systems will require safe, expert and consistent execution. AECOM is uniquely qualified to assist power clients in all aspects of this initiative. Our focus on services, solutions, and systems that add value for our clients has allowed us to successfully permit or design over 30,000 miles of electric transmission lines throughout the world.

Project Planning, Transmission Permitting and Authorization Capabilities

Feasibility Studies

Initially, for any transmission project, there are many questions to be answered regarding alternative routes, line designs, parameters, approaches, and concepts. The feasibility study lays the groundwork for permit evaluation and alternatives comparisons, and can also provide an economic assessment by including estimated project cost development. The study leads to decisions on design philosophy and criteria, configuration, operational aspects, ratings and economics, as well as feasible routes, constructability, and costs. AECOM is fully equipped to assist clients in early studies to establish an approach for their project.

AECOM can coordinate questions regarding voltage level, high voltage alternating current (AC) versus high voltage direct current (DC) approaches, overhead versus underground installations, and reliability issues, with consideration of system planning and analysis. Physical aspects and system performance, when addressed simultaneously, optimize the transmission line project.

> PPL greatly appreciated everything the AECOM team did to support this successful PUC application. Your knowledge and professionalism were a welcome additional to our PPL Team.
>
> PPL Electric Utilities

AECOM also performs generation interconnection studies and electric power system planning and analysis. We can perform short and long-range studies, plans, comprehensive technical and economic studies, and feasibility reports. As new facilities are needed, AECOM provides recommendations for transmission lines and related equipment best suited to the development of the transmission system, consistent with economic balance, investment efficiency, and reliability criteria. Scheduling of new projects is optimized by our system planning well in advance of the need for construction, thus ensuring proper timing and commissioning.

We use industry standard software compatible with that used by major utilities, Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs), North American Electric Reliability Council (NERC) and Federal Energy Regulatory Commission (FERC).

Typical system studies provided by AECOM include:

- Long-range transmission studies
- Analysis and reduction of losses
- Transient stability studies
- Reliability studies limitations
- System protection studies, relay selection, setting, coordination
- Voltage stability studies and expansion plans
- Short-range plans and system
- Steady state load flow studies
- Short circuit studies reinforcements
- Reactive power (volt-ampere reactive, VAR) planning
- Transient analysis, switching and lightning surge studies

Routing and Siting Services

Route selection is a discipline that has evolved, aided by the increase in the availability of high-quality digital data and improved mapping and analysis technology. It is important to understand, however, that the fundamentals have remained the same—the applicant needs a viable route from one point to another that minimizes the negative effects on natural resources, cultural resources, communities, and other sensitive receptors.

As the project development continues, AECOM can expertly provide route selection studies. To comply with requirements for state licensing—such as a Certificate of Public Need and Necessity Certificate of Public Convenience and Necessity (CPCN) or similar approval—a transmission owner must describe the studies conducted to assess anticipated impacts associated with the proposed project, and the steps that have and will be taken to minimize impacts. These studies must take into account features such as scenic and historic areas, land use, soil and sediment, plant and wildlife habitats, terrain, hydrology, and landscape. AECOM will evaluate impacts to these and other elements during a route selection study.

Whatever route selection methodology is used, the most critical element is the experience and judgment of the route selection team. AECOM recognizes that the appropriate routing methodology is dependent on the nature, size, and location of the proposed project, and we make recommendations that reflects these factors, as well as schedule and cost. We will propose a methodology that conforms to widely accepted techniques and has withstood rigorous agency and regulatory review, yet uses the latest data sources, technology, and decision analysis tools to aid a transmission owner in the selection of a sound, defensible, and constructible route, as well as a feasible alternative.

One methodology we use is based on our adapted version of the Overhead Electric Transmission Line Siting Methodology published jointly by the Georgia Transmission Corporation and the Electric Power Research Institute (EPRI). The quantified information generated allows AECOM clients to communicate a sound rationale for selecting the chosen routes, and the relative merits of every route can be easily compared.

Decision points in the process include:

- Definition of opportunities and constraints to be considered
- Delineation of the initial study area
- Development of alternative corridors
- Creation of alternative routes within the corridors
- Weighting of evaluation factors
- Ranking and scoring of routes (both quantitative and qualitative)

Based on our routing studies, AECOM staff will support public open houses and meetings, prepare license applications, and be available for expert witness testimony to explain the details of the process and answer challenges.

At AECOM, information management software is used to analyze, characterize, and display project data. The ability to integrate project information into a single model-based interface allows for sophisticated visualization and efficient analysis of data, thus saving time and money in decision-making processes. AECOM also offers stand-alone data-management application solutions, both Internet and desktop based. We are a certified ESRI® Business Partner and routinely use the ArcGIS™ suite of products. AECOM also maintains similar partnerships with AutoDesk and Bentley." AECOM also implements internet mapping services solutions using industry-standard software packages.

Early in the development process, AECOM initiates building the project database not only with typical spatial data from points, lines, and polygons, but with an understanding that these data can and should be the foundation of project decision making from feasibility through design, construction, operations, and even for reclamation or restoration, as necessary. To that end, we begin assembling available data to build a three-dimensional (3D) model of the project area—a model that can be adapted with finer scale data at specific locations when additional data are available and necessary for subsequent steps in the development process. For example, given current tools and available data, AECOM generates a viewable surface model can be generated for hundreds of square miles within less than an hour and can view that model with other data in multiple file formats and coordinate systems without converting these native files. This allows our team to efficiently demonstrate the environmental and engineering opportunities and constraints within project areas, which can be updated real time. This provides a modeled view that is dynamically updated as additional data are available. This methodology streamlines the decision-making process, essentially reducing the number of iterations between planning and engineering, and greatly reducing the time it takes to make any revisions, such as those needed for visualizations or design.

Public Involvement and Multi-Media Communication

Industry experts agree that public response to proposed transmission projects is a "make or break" challenge. AECOM believes in early, planned and managed public interactions and can provide support and expert assistance at any phase in the process. Our in-house strategic communications staff has experience with transmission projects, but also brings best practices from other sectors, to continuously improve our processes and build successful projects. We can help plan a fully interactive program, or support our client's staff with specific tasks.

AECOM designs and supports multi-media communications programs, including building, hosting, and supporting interactive web sites to keep the public informed of the progress of projects on an ongoing basis. We are also experienced with comment response management and can provide ongoing summaries of public comments. In addition, AECOM produces videos using scripts, maps, and visuals.

Often project stakeholder communications are furthered by maps and visualizations of the final appearance of a project. AECOM provides maps, 3D renderings, and interactive models for viewing a project's future appearance. These static and interactive visuals can be used with regulatory agencies, the public, and other stakeholders.

Survey and ROW Support

In support of electric transmission, AECOM has extensive experience providing surveying and mapping services. In many states, AECOM licensed survey crews will survey a right-of-way (ROW) baseline, meeting all accuracy requirements and referencing any coordinate system as appropriate. AECOM has expert staff in using industry standard software applications such as AutoCAD, Microstation, and ArcGIS. These applications are used to create ROW maps; American Land Title Association (ALTA)/National Society of Professional Surveyors (NSPS) Land Title Surveys, and maps of all critical features such as tree lines, buildings, and mowed areas. In addition, this data can later be combined with Power Line Systems - Computer Aided Design and Drafting (PLS-CADD) design drawings to produce plan and profile images. Our staff is also proficient at research to identify locations of underground utilities. We offer management services for ROW agents if title research, right of entry, or acquisition is required.

AECOM has significant experience with data acquisition, data management, and critical analysis of 3D imaging data. Additionally, we have experts in Light Detection and Ranging (LiDAR) and orthophotography acquisition and processing, as well as 3D image visualization. Such data might be necessary to define the location of wetlands or to efficiently survey terrain and geographical features with high accuracy. When such 3D data is collected, AECOM will ensure highly accurate data collection, processing, and management.

Environmental Assessment and Permitting

The permitting effort for transmission and substation projects depends on both project location and regulated activities during the construction phase and/or the operations phase. The focus of the effort is not only to identify necessary permits, but also to identify ways to obtain regulatory approval in the most efficient, cost-effective, and streamlined manner. The AECOM approach is to avoid the need for a permit or to fulfill criteria for waivers or exemptions, minor projects, or general permits where possible. AECOM identifies construction and design elements of a project that can realistically be modified to reduce the permitting effort.

AECOM has achieved an outstanding record of project approvals and a reputation for excellence. These accomplishments reflect our understanding of regulatory requirements, the integrity of our environmental studies, and the competence of our project management and technical personnel. Key concepts embodied in our approach include:

- Commitment of experienced project personnel with qualifications carefully matched to requirements and responsibilities
- Use of systematic, comprehensive, defensible, and understandable study and decision methodologies appropriate to the project study area and issues
- Development of an effective dialogue with key agency personnel, special interest representatives and, where appropriate, the general public to obtain effective public input, enhance communications, and reduce potential conflicts
- Communication of study issues and results through clear, concise writing and attractive, informative graphics
- Ongoing and close coordination of major project-related activities with our clients to achieve all project objectives within the required time frames and in the most cost-effective manner.

Our staff manages projects and demanding project schedules in an efficient and cost-effective manner.

We manage projects of all sizes and degrees of complexity, from feasibility studies to projects with public interest, land ownership, environmental issues, and engineering constraints. We provide clients with comprehensive environmental services including agency coordination, environmental permitting, and planning and design services.

Initially, AECOM conducts a detailed needs assessment, based on project-specific design and construction plans, in the form of a matrix. The matrix identifies potential federal, state, regional, and local permits and approvals necessary for full implementation of the project, as well as agency contacts, the purpose of the approval, time frames for application preparation and agency review, and precAECOM or studies and approvals. In this manner, from the outset, permitting is integrated into the project, from siting to design to construction sequencing. Once a permitting strategy is developed,

We have successfully completed EIS documents with federal agencies including the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), the Bureau of Indian Affairs (BIA), the National Park Service (NPS), and the Department of Energy (including Western Area Power Administration).

AECOM will initiate pre-application agency meetings and prepare permit applications.

Our staff conducts the necessary environmental studies, including:

- Wetland delineation, functional value impact assessment
- Threatened and endangered species and habitat inventories and impact assessments
- Ecological restoration
- Electric and magnetic fields (EMF) calculations and impact assessment
- Cultural resources studies (archeology and historic structures)
- Erosion and sedimentation control plans
- Storm water permitting and pollution prevention plans
- Water quality
- Visual impacts
- Land use analysis
- Noise and air assessments
- Environmental construction monitoring
- Socioeconomic assessment

The wide range of project experience by AECOM brings with it specialized expertise in terms of project management, professional resource management, and client relationships. Having extensive experience with literally thousands of jobs both large and small, we are keenly aware of the importance of understanding and responding to the unique requirements of each job assignment.

Our extensive experience includes conducting and preparing EAs, EISs, applications for CPCNs, and other environmental documents. The majority of our work is prepared in response to the requirements of NEPA, Council on Environmental Quality (CEQ) regulations for implementing NEPA, and other associated regulations. Many of these are under third-party contracting arrangements between the applicant and a lead federal agency.

AECOM professionals and support personnel understand the dynamic and diverse needs of today's complex regulatory world. This understanding, combined with the breadth and depth of our experience in environmental assessment, environmental impact analysis, and environmental permitting, allows us the opportunity to provide affordable, yet practical solutions.

Environmental Mobile Application for Projects (EMAP) Deployment Success

AECOM's EMAP has saved significant time, costs and resources on numerous field survey, impact assessment and permitting projects through:

- Cost savings. EMAP increases efficiency in the field by eliminating hard copy (paper) forms, field notebooks, and multiple data formats and devices. This application also reduces time spent creating summary reports and crunching field data in the office, and streamlines postprocessing.
- Improved data quality. EMAP eliminates multiple data formats/devices and transcription errors and limits time-related costs for errors. EMAP enables real-time data to be viewed and edited in the field. Attribute data is collected in real-time, not recorded by hand in a notebook for data entry on a later date.
- No additional usage fees. AECOM specialists load and run EMAP on industry-standard Trimble GeoXH units, eliminating extra usage fees and charges
- Experienced AECOM GPS specialists. AECOM has an experienced nationwide network of field technicians, with a diverse resource staff available for assistance.
- Professional appearance to permit applications. EMAP produces clean, professional data forms directly through Microsoft Access that do not require further manipulation. Many of our competitors still submit hand-written, labor intensive data forms in their permit applications.
- Data storage. Attribute data, field photos and sketches, and GPS data are stored in one central Geodatabase, regularly backed up to ensure that data are never lost.

Cultural Resources Services

AECOM has undertaken hundreds of cultural resources management projects throughout the United States on behalf of public and private clients, including transmission line companies and agencies. These projects range in scope from small-scale surveys to extensive excavations. We provide cultural resources expertise from a number of local offices, ensuring local and regional knowledge.

Our management plans are tailored to the needs of each client and address the requirements of federal legislation enacted to protect cultural resources. We have represented clients during the consultation process with federal agencies, State Historic Preservation Offices, Native American Tribes, and the Advisory Council on Historic Preservation.

AECOM offers assistance with diverse types of cultural resource services, including the following:

Cultural Resources Management Planning

- Memoranda of understanding and programmatic agreements
- Inventory and treatment work plans and research designs
- Section 106 guidance
- Cultural resources management and historic preservation plans

Cultural Resources Assessment

- Literature/archival reviews
- Field inventories
- Evaluations of prehistoric and historic archaeological properties
- Evaluations of architectural properties
- Historic American Building Survey and Historic American Engineering Record documentation
- Oral history

Archaeological Excavations

- Test excavation and research to evaluate significance
- Full-scale data recovery, including excavation, analysis, and interpretation

Native American Tribe Consultation

- Coordination with Tribal groups concerning traditional cultural properties
- Native American Monitoring Plans development and coordination

Agency Consultation

- Agency coordination
- Compliance with state standards and guidelines for archaeological and historical studies

Public Outreach

- Narrative-style documents
- Website development
- Poster displays
- School lesson plans
- Walking-tour brochures

We have a strong safety focus, proactively managing the risks associated with our work and striving for continuous improvement to safety performance.

Health and Safety

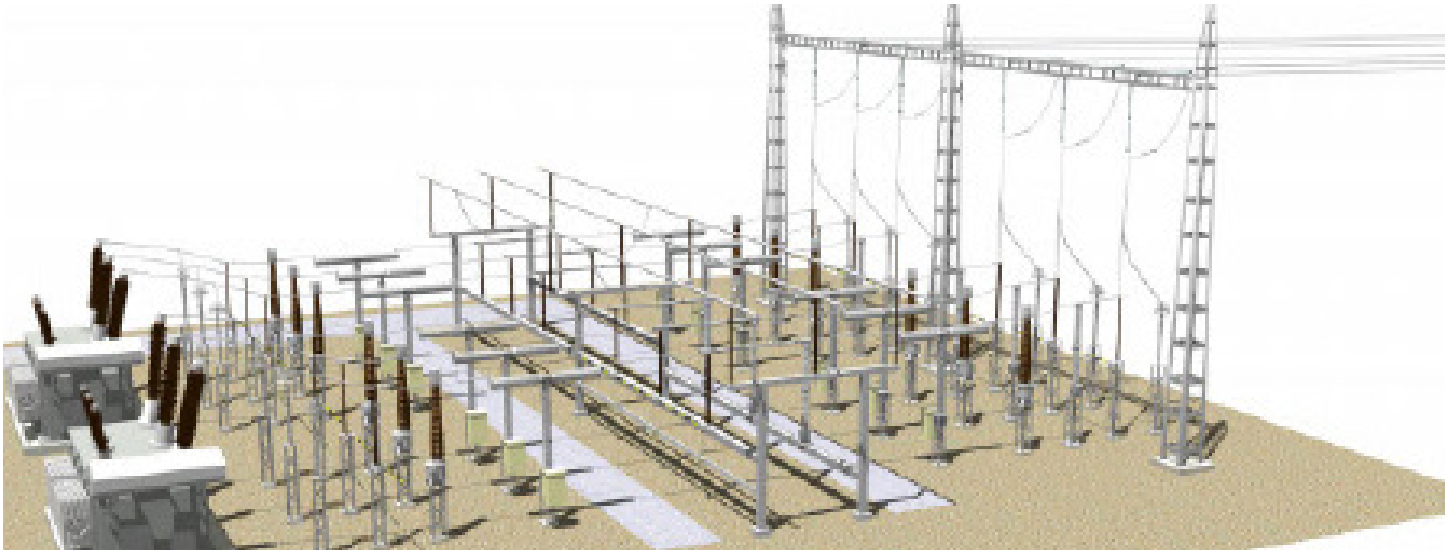
Safety is a core value to AECOM. We are committed to the concept of Zero Harm — to our employees, our contractors, the communities in which we operate and to the natural environment. AECOM understands that excellence in health and safety performance is a top business priority for our energy clients. AECOM's commitment to safety means that everyone on the project receives ongoing, consistent and clear messages from all levels of leadership on what it means to achieve zero harm.

Protecting and promoting the safety and health of our employees, subcontractors, and anyone with whom we do business is a fundamental tenet of the way AECOM approaches projects. Our goals are simple: prevent injuries; maintain a healthy workplace; and protect and preserve facilities, property, equipment, and the environment.

Our Approach

Numerous studies have demonstrated that a safe project is a profitable project. By applying lessons from teams across AECOM's worldwide network, we stay at the forefront of the latest safety tools, technologies, and management systems. Through dynamic safety risk management, supported by a strong safety culture across our worldwide operations, we maintain our reputation as innovators, educators, and leaders in safety.

Transmission and Substation Engineering and Construction Capabilities



Overhead Transmission Lines

AECOM engineers have executed many overhead and underground transmission line projects, offering expertise from conceptual design studies through final engineering, design, and project management services. Engineering services are provided for projects of all voltage levels and technologies, including High Voltage Direct Current (HVDC) and Extra High Voltage (EHV) Alternating Current (AC) AC using the most advanced software.

Conceptual Engineering and Design

The conceptual design optimizes the plan set forth by the feasibility study, setting parameters that will form the basis of detailed design. All aspects of the line design are examined including insulation, optimum conductor size and arrangement, tower or pole types, and foundation design.

AECOM evaluates areas such as field effects, structure loading, sag and tension, and ampacity. We also consider client design preferences and operational and maintenance practices. A Design Criteria Manual documents the results and includes a summary of design criteria, study results, conceptual structure outlines, and other pertinent information. The Manual serves as an overall plan guide document for subsequent detailed engineering and design.

Some studies undertaken during the conceptual design phase include:

- Insulation selection
- Ampacity
- Corona and field effects
- Sag and tension calculations
- Cost estimates-economics
- Shielding
- Foundation parameters
- Radio Interference (RI), Low Votage Impulse (LVI), and corona analysis
- Structure type selection
- Conductor and shield wire selection
- Clearances
- Loss study
- Grounding system
- Audible noise
- Hardware selection criteria

Continuously on the forefront of advanced technologies, AECOM offers investigative and detailed design services in the following areas:

- High phase order transmission
- Static VAR compensation
- Thyristor-controlled series capacitors
- Phase shifting
- HVDC transmission
- Solid state arresters
- Power angle regulation

Detailed Engineering and Design

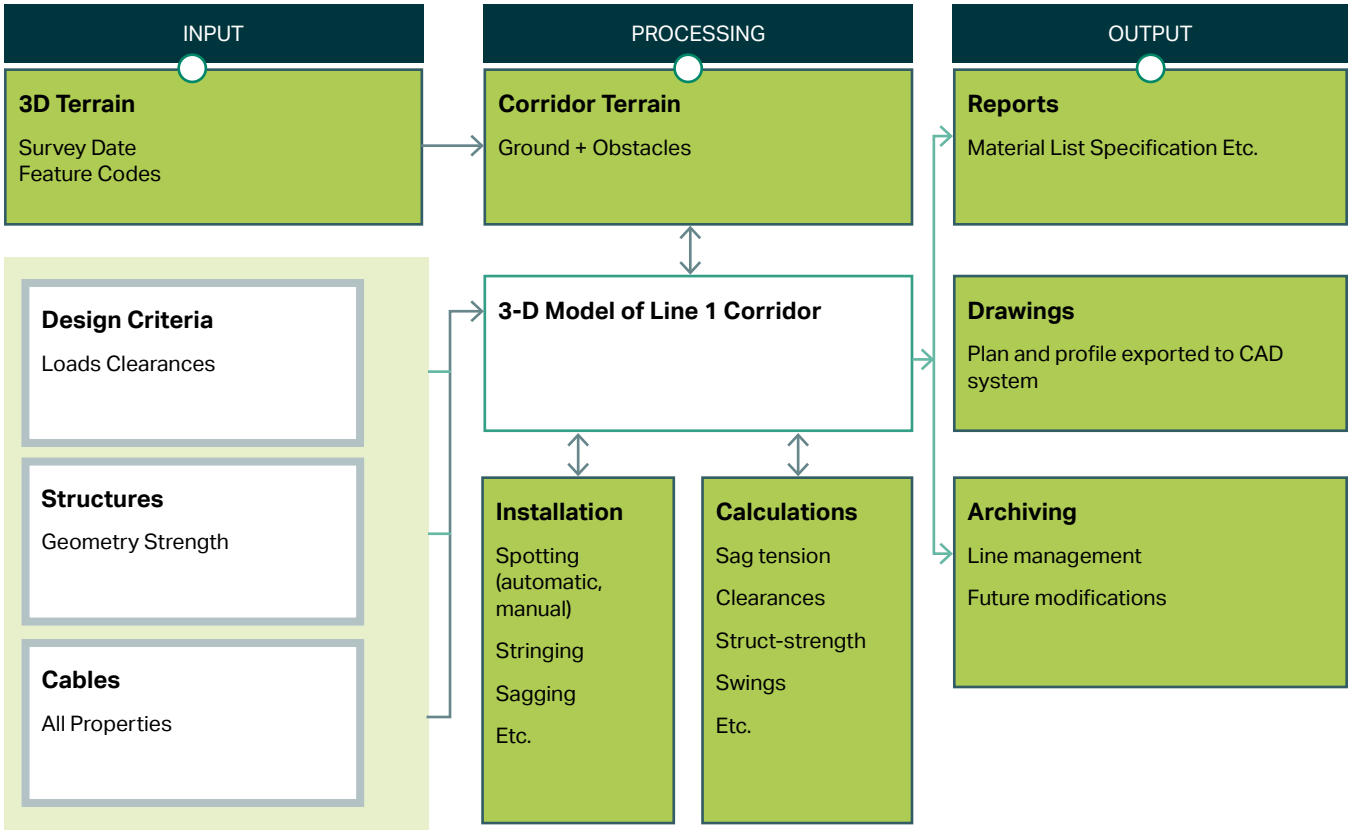
AECOM provides detailed engineering and design to support material procurement, construction, and installation for transmission line projects. Specific areas include:

- Plan and profile development
- Structure design
- Insulator assemblies
- Structure grounding design
- Supporting hardware selection
- Aircraft warning system
- Sag and tension data
- Material specifications
- Structure spotting
- Line optimization
- Guys and anchors
- Foundations design
- Conductor vibration analysis
- Clearance calculations
- Environmental contamination
- Structure load and clearance diagrams

To help reduce costs to its clients, AECOM achieves line optimization through the use of computational software. We employ programs such as Power Line Systems PLS CADD to develop innovative analyses of alternatives.

The figure below displays the PLS CADD components and our methodology of design for complete transmission line design.

Transmission line design computer program mode



Underground Transmission Lines

In the specialized field of high-voltage underground and underwater cable applications, AECOM has technical specialists and management experience in virtually every aspect of AC and DC high-voltage cable engineering and construction. AECOM has performed design and construction services on some of the largest underground transmission projects, including submarine cable projects and horizontal directional drilling cable projects, consistently completing them on schedule and within budget. Experience with cable projects of all voltage levels enables AECOM to identify the most suitable cable technology, route design and installation methods for underground and submarine transmission systems.

Conceptual Engineering and Design

Many utilities today must consider underground and submarine cable installation because of environmental or aesthetic constraints. AECOM offers a full range of services in this technology, and our engineers are familiar with all cable systems including self-contained, solid dielectric, pipe-type, low- and high-pressure fluid, as well as SF6 transmission cable. Some issues covered in preliminary investigations include:

- Technology evaluations
- Insulation requirements
- Conductor design
- Expansion/contraction
- Cable/air terminals
- Oil containment
- Overvoltage and surge protection
- Thermo-mechanical bending
- Auxiliary power systems
- Insulating fluid
- Pressurizing (Oil/SF6) facilities

Detailed Engineering and Design

In performing the detailed engineering and design for underground systems, we provide:

- Cable routing
- Plan and profile development
- Cable sizing and selection
- Splices and termination selection
- Duct bank details
- Jacking details
- Thermal backfill criteria
- Dielectric fluid specification
- Manhole placement and design
- Cathodic protection system
- Fiber optic/communication systems
- Cable pulling tensions
- Pressurizing/circulating plant specification
- Pavement/sidewalk replacement details

Substation Services

AECOM has the experience and technical resources to meet all substation project challenges. We provide a full spectrum of services from conception to commercial operation, including site selection, layout, design, equipment specification, analysis, and protection engineering. AECOM provides substation engineering, design, procurement and installation services. We maintain up-to-date equipment specifications and design criteria of all voltage classes for conventional and advanced technologies. Substation automation is provided including systems with integrated capabilities for monitoring, control, protection and communications at the substation and remote energy control centers. AECOM's substation design experience encompasses the full range of transmission voltage levels as well as open air-insulated designs, and indoor and outdoor SF6 gas-insulated designs.

Feasibility Studies and Site Selection

In the planning stage, alternative plans can have varying impact on substation requirements, whether for new installations or modifications to existing facilities. Study emphasis is on the identification, evaluation, and comparison of these requirements. We follow a systematic process to select the best alternative based on the extent of required system modifications, reliability, installability, construction sequence and requirements, project schedule, and budget impact.

Using estimating techniques and our extensive in-house database, we compare and evaluate the economics and costs of alternatives, giving a concise picture of the bottom line. The feasibility study ultimately leads to decisions on a preferred plan, design philosophy, criteria, operational aspects, ratings, and economics.

Some specific studies undertaken at this stage include:

- Selection of switching scheme
- Physical evaluation
- Establishment of design criteria
- Reliability
- Equipment requirements
- Cost estimates

In choosing a substation site, an initial cost advantage can often be overshadowed by other cost factors. AECOM's alternatives analysis examines all possible sites for layout adequacy, grading, drainage, aesthetics, transmission access, and subsurface conditions. We include relative location by assessing comparative transmission requirements. We provide engineering support to meet the project licensing requirements through the preparation of environmental impact statements, development of environmental preservation plans, preparation of documentation to support utility licensing procedures, and expert testimony as necessary.

Conceptual Engineering and Design

The purpose of this study is to optimize the substation layout and design approach. AECOM works with our clients to reach decisions on major design philosophy and criteria such as insulation ratings, system switching and physical configuration, control system logic, equipment ratings, expansion provisions, and economic aspects. The decision making process for a SF6 gas insulated approach is ideally carried out at this time.

We furnish one line diagrams as the prerequisite for the preparation of equipment specifications. We also prepare general and layout drawings and, where necessary, sectional views are included to illustrate design concepts.

The substation design criteria document describes the main features of the substation, the function, rating and types of major substation components, normal and contingency operating conditions, the control and protection logic, and scheme. Unique and special requirements are also incorporated in this document, which serves as the overall guide for detailed engineering and design. Studies we undertake in this phase include:

- Insulation coordination
- Short circuit
- Ampacity
- Layout selection
- One line development
- Station load analysis
- Parameter/criteria selection
- Economics/costs comparison

Detailed Engineering and Design

AECOM provides complete engineering and design for detailing the conceptual design. We prepare drawings and specifications to support material procurement and construction, and staff will also review and approve vendor drawings. Typical drawings include:

- One line diagram
- General arrangements
- Elevations and sections
- Site grading and drainage
- Structures/foundations
- Control building layout
- Control logic diagrams
- Wiring diagrams
- Conduit/grounding diagrams
- Bills of material

Numerous detailed studies are performed by digital methods including:

- Bus stress analysis
- Structural analysis
- Foundation design
- Shielding angle
- RI/iVI analysis
- Bus load flow
- Balanced cut and fill
- Soil resistivity/grounding
- Ampacity
- Audible noise

Once the initial engineering and design is complete, AECOM prepares technical specifications for procurement of major substation equipment and material items as well as the installation specifications required for construction of the project. AECOM standard specifications form the basis for the project specifications tailored to meet client preferences and requirements as necessary.

Supervisory Control and Data Acquisition (SCADA) and Energy Management System (EMS) projects have been designed for a variety of utility systems by AECOM.

Services we offer include:

- Feasibility evaluations
- Network design
- SCADA communications engineering
- SCADA/EMS integration with other systems
- Remote terminal unit installation design
- Control center design
- Vendor evaluations

Site Civil and Geotechnical Engineering Services

AECOM has been a powerhouse in geotechnical engineering for over 50 years and has completed hundreds of challenging projects requiring state-of-the-art geotechnical engineering and analysis. For transmission and substation projects, AECOM conducts subsurface investigations to determine soil conditions and make recommendations for foundation design. We provide the required analysis for dead end and turning structures.

We offer expertise in site civil engineering, including construction and post-construction stormwater management plans, grading and drainage design and drawings, and erosion and sediment control plans to support each tower structure location and substation site. Our engineers have experience with electric substations and have worked on expansion projects with limited space, and tight clearance requirements. In such situations, AECOM approaches the project with cost savings and schedule streamline ideas.

> We value our relationship with you and your organization and look forward to working with you on future projects in the coming year. Thanks again for your tireless efforts and strong support to Oncor.
>
> Oncor Electric Transmission

Program Management, Construction and Construction Management Capabilities

Project Management and Control

AECOM's approach to management, administration and control of engineering and design emphasizes effective cost and schedule control for each work package.

For our overall project management approach we:

- Develop a thorough understanding of all the program objectives and risks
- Establish communications with clients to assure an integral design
- Define the sequence of work required to achieve objectives and mitigate risks
- Establish a project organization that can complete the work in the most effective manner
- Identify and commit personnel to staff the organization, as well as the facilities and equipment required to perform the work
- Provide the management systems to plan, integrate, measure and control performance on the project

Based on years of experience and hundreds of successful projects, AECOM offers program management for transmission and substation projects, including construction management services. AECOM can manage a large project or a program of smaller projects from inception to commercial operation. We can self-perform as well as manage specific tasks or manage the work of other consultants and engineers. We have developed over 120 transmission and substation Project Execution Procedures which are standardized to provide consistency and repeatability across projects.

In our approach to project scheduling, we work with our client and establish targets and major milestones. After receipt of notification to proceed, we prepare a detailed target and baseline schedule. Managers at each level receive clear details of their responsibilities and deadlines. With the established target schedule, AECOM typically updates the schedule once a month during the Engineering and Design Phase to obtain a current schedule. The following schedule reports are typically used:

Monthly – Project Milestone Schedule

This schedule includes engineering, procurement, and construction milestone activities. It is updated based on the progress of activities during the project stages. Earned value is applied to each task on a detailed basis, assuring that materials and labor are kept on track with cash flow.

Monthly – Drawing and Specification Schedule / Summary

Engineering deliverables (drawings, calculations, studies, reports, etc.) are identified and monitored on a task basis.

Tabular summaries identifying all the deliverable engineering drawings, and specifications, latest revisions, and dates are typically updated on a monthly basis.

Monthly – Purchase Inquiries/Orders Summary

Procurement activities are typically summarized on a monthly basis identifying all inquiry packages completed and issued, received proposals from bidders, bid evaluations, purchase orders, and supplements placed, and other applicable procurement activities.

Procurement

The objective of AECOM's purchasing program ensures that required equipment and materials are purchased cost effectively, on commercially favorable terms, and in a manner that supports the construction of the project in accordance with the project schedule.

For all engineered items, AECOM's procurement program places the primary responsibility for the technical aspects of each contract with the respective AECOM engineering disciplines. Engineering is responsible for the development of appropriate specifications, drawings, and all other necessary design documents required, and for remaining within the project budget guidelines. At the appropriate time in the detailed engineering phase of the project, AECOM Purchasing is available to provide a variety of services.

High Voltage Construction Services

AECOM provides high voltage substation construction services localized to western Canada.

We provide cost-effective services to our high voltage customers including regulated utilities, industrial and municipal-owned electric utilities, oil and natural gas producers, power generators and wind farms.

Our services include:

- Construction, testing, and commissioning
- Equipment installs such as power transformers, circuit breakers and capacitor banks
- Civil-work – surveying, earthwork, concrete
- Wood and structural steel erection
- Grounding grids, rods and wells
- Pipe and wire bus work
- Control cables and support systems
- Cable installations and terminations
- Greenfield and brownfield construction

Construction Management/Construction Support

AECOM provides the full services necessary to manage the construction by assigning experienced personnel to both office and field functions. Our in-house staff has the hands-on experience and capabilities to provide the following construction management/ supervision services for almost any type of project. We can provide pre-construction services (subcontract preparation, constructability review and preconstruction planning); construction planning, estimating, budget evaluation, cost and schedule control; construction contract packaging, procurement administration, and supervision of contractors; construction inspection; field engineering;quality assurance and control; materials management (control, warehousing, storage, and security); startup and commissioning.

Our services typically include:

- Construction control plan
- Construction sequence
- Site quality plan
- Cost control/budget
- Subcontract administration
- Project schedule
- Work force mobilization
- Material/supply administration
- Contractor coordination
- Labor relations

We also develop Commissioning and Checkout plans, considering the specific requirements and constraints of the owner's system as well as the need for equipment. We furnish operating and maintenance manuals covering such topics as equipment/facility description; user's system operational interface; operating instructions for automatic, manual and contingency modes; sectionalizing; system protection; and diagnostic and preventive maintenance.

EXPERIENCE

Ameren Illinois Rivers — 345 kV Substations and Transmission Line Program

The Illinois Rivers Project is part of a portfolio of multi-value projects intended to deliver renewable energy, improve reliability, and provide economic benefits to Ameren's customers.

Client

Ameren

Location

Illinois and Missouri, U.S.

Contract Value

Confidential

Year(s)

2013 - 2015

Project Overview

Ameren contracted with AECOM to provide engineering, procurement, and construction management for five substations, nine transmission line segments, and 375 miles of 345 kV transmission line that interconnect Missouri, Illinois, and Indiana.

Client Benefits

The Ameren Illinois Rivers 345 kV Transmission Line Program consisted of single shaft, self-supported steel poles designed for a single, 3000A, 345 kV circuit, along a 150-foot right-of-way. In addition, six new 345/138 kV transformers were installed. Ultimately, the Ameren Illinois Rivers 345 kV Transmission Line Program will include nine transmission line segments.

Work Performed

General services provided include: engineering, procurement, and construction management.

Scope highlights

- One 345 kV "greenfield" switching station
- Three 345 kV-138 kV "greenfield" substations
- One substation expanded to add a second 345-138 kV transformer

In addition to providing the engineering, procurement, and construction management for the substations, AECOM was also awarded the transmission line work, which included nine transmission line segments and 375 miles of 345 kV transmission line.

Hassayampa-North Gila — #2 500 kV Line Program Management

The project is part of Arizona Public Service Company's ongoing commitment to create sustainable energy for Arizona.

Client

Arizona Public Service Company

Location

Yuma, Arizona, U.S.

Contract Value

Confidential

Year(s)

2015

Project Overview

AECOM (as the Owner's Agent) provided project management services for the Hassayampa-North Gila (HANG) 500 kV #2 Line (HANG #2) Project, a new 112-mile transmission line that runs parallel to an existing 500 kV line in Arizona. AECOM provided a variety of services to ensure that the project met schedule, budget, and quality targets.

Under the terms of the contract, AECOM and Arizona Public Service Company formed a unified project team, with AECOM acting as the Owner's Agent for the project duration.

Client Benefits

This vital project provided the transmission capacity required to supplement existing transmission and generation resources in the area of Yuma, Arizona.

Work Performed

AECOM services included:

- Program management
- Owner's agent
- Preconstruction preparation and management
- Bid cycle assistance
- Risk assessment and mitigation
- Contract management
- Material inspection and management
- Inspection of the construction contractors

Engineering Consultant Services for Transmission, Distribution, and Substation Projects

AECOM is currently providing Value Engineering Services to Duquesne Light Company (DLC) associated with their substation, transmission, and distribution assets.

Client

Duquesne Light Company

Location

Pittsburgh, Pennsylvania, U.S.

Contract Value

$150,000

Year(s)

2021- ongoing

Project Overview

As part of this effort, AECOM reviewed engineering deliverables for three different projects where design is essentially complete (90% or more). Subsequent to this review, our team offered feedback and observations on different design, material, or construction approaches that could be considered to reduce cost and/or schedule associated with implementation of the projects. These collaborative reviews included participation of DLC stakeholders along with subject matter experts from our team in a facilitated review and discussion of the design documents.

A summary of typical tasks conducted for this type of effort include:

Task 1 Value Engineering Workshop

- Task 2 Review of design documents
- Task 3 Prepare for value engineering sessions for each project
- Task 4 Conduct value engineering sessions
- Task 5 Compile all observations along with identified cost and schedule savings into a final report

Potential concepts applied and reviewed by AECOM's team oftentimes includes, but is not limited to:

- Company standards and specifications
- Engineering Re-use and standard designs
- Application of other Engineering Best Practices (EBPs)
- Procurement strategy
- Constructability and modularization considerations
- LEAN construction techniques

For a project of this type, various engineering and construction disciplines are reviewed, but not necessarily limited to:

- Civil construction
- Access roads
- Retaining walls or slope stability features
- Post-construction restoration
- Foundations
- Electrical construction
- Substation work: buildings, equipment, site
- Transmission tower design and installation
- Distribution – conversions, new, deteriorated replacements

With any Value Engineering exercise, our team approaches these types of efforts with an open mind, encourages its clients to do the same, and to collectively brainstorm different considerations that could benefit various project outcomes. Following multiple internal and client-facing workshops, AECOM formally documented the output from each session and built a report summarizing findings and identify potential cost and schedule benefits as a result of these alternative approaches. Depending upon project specifics, outcomes may also include recommendations on modifying procurement approach and implementation contract structuring.

Distribution Automation Program

AECOM has successfully developed a Program Approach and Management Plan comprised of the scope, budget, schedule, human resources, quality, risk, communication/stakeholder, and procurement disciplines required to successfully execute Los Angeles Department of Water and Power's Distribution Automation Program.

Client

Los Angeles Department of Water & Power

Location

Los Angeles, California, U.S.

Contract Value

$5 million

Year(s)

2018 - ongoing

Project Overview

The Distribution Automation (DA) Program will allow the Los Angeles Department of Water & Power (LADWP) to better monitor and control its distribution system through the deployment of new and innovative communication systems, devices, and applications. A reliable and secure two-way communication network will allow LADWP to remotely monitor and control distribution equipment as well as smart meters. Automated distribution equipment will allow the LADWP Distribution System to self-restore and optimize.

AECOM is collaborating with LADWP by forming a Program Management Office (PMO) to create the program and project management infrastructure required to achieve the successful automation of the distribution system by building a communication network and installing the devices and equipment which support distribution automation, reliability, and efficiency of distribution systems for the LADWP.

The DA PMO, guided by a newly developed Program Management Plan (PMP), describes the way the initial planning, final planning, execution, and close-out phases of the program will be planned, managed, and executed. The plan provides guidance on the organizational structure impacting all key personnel involved in the management of scope, budget, schedule, risk, quality, procurement, communication, and stakeholders in accordance with LADWP DA Program goals and objectives. Finally, the plan defines the approach the DA PMO team will use to deliver the breadth of the DA Program and will function as a reference and resource for LADWP stakeholders, vendors, consultants, and subconsultants in completing planning and execution of the program.

Client Benefits

- Aligning the DA Program with LADWP's overall organization and strategic direction.
- Managing scope, schedule, and budget interdependencies among the sub-projects to best serve the program.
- Resolving constraints and conflicts that affect multiple projects within the program.
- Resolving definition issues between the project and the program.
- Managing program risks that impact multiple projects within the program.
- Managing and controlling change requests within shared governance inside the program.
- Ensuring benefits realized across the program and individual projects.

A breakdown of the project scope of work includes providing the necessary resources to provide:

- Definition of the DA Program charter integrated with stakeholder analysis.
- Creation of a PMP.
- Project management oversight to implement, monitor, and control the DA Program for its first three years.
- The training in distribution automation engineering required to manage the program as a capital expense and operation and maintenance effort.

Work Performed

AECOM's partnership with LADWP is structured to empower and support the team's performance at multiple levels, with appropriate stages of oversight and delegated authority. At every level of the program organization, key AECOM staff are on-site working side-by-side with LADWP staff.

Additionally, the AECOM team is developing a Training Program that provides overall framework and strategy, including the goals of the training, learning objectives, and activities that will be performed to develop, conduct, control, and evaluate instructions. These will be used to provide users, operators, administrators, and support staff the necessary means to deploy the systems and solutions.

A key objective of the DA Program is to address training for all organizations impacted by the DA Project roll-out. AECOM is working closely with LADWP staff to develop and implement a training plan to prepare LADWP staff on all changes related to the DA Program roll-out including, but not limited to, changes to business processes, procedures, standards, and system operation.

NASA Ames Research Center Modular Supercomputing Facility

AECOM provided full electrical engineering services for the substation expansion.

Client

U.S. National Aeronautics and Space Administration

Location

Mountain View, California, USA

Contract Value

$1,248,060

Year(s)

2017 - 2019

Project Overview

National Aeronautics and Space Administration (NASA) is adopting new conservation practices with a prototype modular supercomputing facility at the agency's Ames Research Center in Silicon Valley.

The system, called Electra, is expected to save about 1,300,000 gallons of water and a million kilowatt-hours of energy each year, equal to the annual energy usage of about 90 households. One of the benefits of the Electra system is its flexibility, through container modules that can be easily added or removed in sections without disrupting operations

Client Benefits

AECOM provided full electrical engineering services for the substation expansion. The expansion of a 115kV substation supports the master supercomputing facility including a new breaker bay, 115kV gas-insulated switchgear, 30MVA step-down transformer, 27kV Class switchgear, over one-mile of MV and LV distribution specifications.

Work Performed

AECOM provided full electrical engineering services for the substation expansion including developing IFC package, calculations, grounding study, equipment specifications, procurement support, and engineering services during the construction phase. AECOM civil design included:

- Grading, drainage, and a 20-foot-wide perimeter road
- Sidewalk
- Underground utilities and electrical ductbanks
- Manholes and vaults

Structural design included steel structures and concrete foundations for the dead-end structure and a combined reinforced concrete mat foundation for electrical circuit breaker, transformer, and switchgear.

In-City MSA — Transmission Life Extension and Modernization; Smart Generation Transmission Programs

AECOM was selected to support New York Power Authority's $726 million Transmission Life Extension and Modernization Program. We were subsequently awarded a contract for program management and engineering services associated with a $1 billion Smart Generation & Transmission Program.

Client

New York Power Authority

Location

New York, New York, U.S.

Contract Value

T-LEM: $726 million
SG&T: $1 billion

Year(s)

2015 - ongoing

Project Overview

AECOM was selected as one of three engineering firms to support New York Power Authority's (NYPA's) Transmission Life Extension and Modernization (T-LEM) Program. AECOM's work under this program includes overall program management along with development of a master plan, program execution plan, master schedule with associated project controls and document control, and several associated tasks.

AECOM was subsequently awarded a contract for program management (project manager, project engineer, and project controls) and engineering services associated with NYPA's $1 billion Smart Generation & Transmission (SG&T) Program.

AECOM was later also awarded the engineering contracts for the communications backbone, phasor measurement units (PMU) deployment and conceptual design for installation of a new static variable compensator.

Challenges and methods to success

These major programs involved coordination of project management, engineering, procurement, safety, environmental, IT, and compliance groups within NYPA's corporate office and site operations, engineering, and maintenance organizations across the state of New York.

In addition, the SG&T Program includes multiple management consulting organizations, engineering firms, strategic vendor partnerships, and other state agencies.

Client Benefits

Critical success factors include: development of a program work breakdown structure, a Program Management Plan [creating program and project level responsible, accountable, consulted and informed matrices, and clearly defining and communicating a Document Control Plan, a Change Management Plan, a Quality Control Plan, program milestones, project interdependencies, risks, a Project Execution Plan template, and project reporting requirements], and integrating the cost/resource loaded schedules for the T-LEM and SG&T Programs to provide NYPA with an overall impact assessment of these two major programs within their organization.

Work Performed

T-LEM Program Services include:

- **Engineering Services:** 100 mobile video audio recording system (mVar) capacitor bank design/ installation
- **Demo 2:** 100 mVar synchronous condensers and associated ancillary equipment, replace breakers, relays, instrument transformers, metering, wave traps and disconnect switches at: three 115 kV substations, three 230 kV substations, one 345 kV substation and two 765 kV substations
- Station service upgrades
- Replacement of underground cabling/conduit
- Foundation and steel assessments, plan, details, and calculations
- Physical plans, elevations, bill of materials, and installation details
- Protection and control design packages including one lines, three lines, elementary diagrams, wiring diagrams, cable/conduit schedules, logic diagrams, network architecture diagrams, generic object-oriented substation event messaging tables and station/human-machine interface integration files
- **SG&T Program:** This program's current focus is on development and implementation of:
- Design and installation of a communications backbone
- Strategic Asset Management Plan
- State-wide PMU deployment
- Design and implementation of a continuous protection system monitoring platform for hydro and small clean power plants
- Design and implementation of an enterprise architecture supporting a Next-Gen Environmental Management System, Asset Monitoring and Diagnostic Center, with associated data analytics and performance dashboards

Integrated Smart Operations Center

This digital power operations center will help New York Power Authority make optimal, cost-efficient asset management decisions at its power generating facilities that will improve performance, lower operating costs, and help to reduce carbon emissions.

Client

New York Power Authority

Location

White Plains, New York, U.S.

Contract Value

$12.2 million

Year(s)

2017 - 2018

Project Overview

AECOM provided detailed design and construction management of the new, cutting-edge, and digitized power asset monitoring and diagnostic center at New York Power Authority's (NYPA's) headquarters in White Plains.

The initiative is a major milestone in New York Governor Cuomo's Reformation of the Energy Vision strategy to build an energy system that is cleaner, more resilient, and affordable — part of the governor's investment in clean energy, technology, and innovation. All work was completed on schedule and within budget for a grand opening on December 11, 2017.

The project included the full renovation of NYPA's 25,400 gross square feet 8th floor headquarters located at 123 Main Street, White Plains, New York. The project's aggressive schedule included: full design, demolition, and completion of new work within 6 months' time. In order to meet the project schedule, requirements for a separate demotion package was prepared and bid, followed by new construction for the complete fit-out of the 8th floor.

AECOM led the Engineering and Architectural Design team, including subconsultants for complete architectural, interior design, mechanical, electrical, plumbing, and fire protection; security; IT; and audio/visual system design and integration.

Client Benefits

The new Integrated Smart Operations Center (iSOC) will analyze the performance of NYPA's power generation assets and state-wide network of transmission lines to:

- Identify problems and issues before they occur
- Prevent potential service outages
- Reduce repair replacement costs

The new center also advances New York state's goal to become the first all-digital public power utility in the U.S.

A major focal point of the project was the 80-foot wide LED video wall located in the iSOC space, which includes 12 multifunctional workstations and manager offices.

The floor also houses NYPA's emergency operations center, strategy team, technology research and development, and innovation offices. The "Innovation Zone" open plan workspace encourages engineers, program and project leaders, and customers to collaborate on new ideas and develop new solutions and applications.

Work Performed

This project initiated a shift in NYPA's workspace environment and included a focus on collaboration and innovation. The iSOC provides for several NYPA departments to share physical space — aimed to inspire creativity, problem solving, and partnership.

The design process also focused on team collaboration. The design was produced using Autodesk's cloud-based 3D modeling software for building information modeling. This enabled real-time design collaboration and coordination.

Additionally, project data were shared using Bentley's ProjectWise, which was used for information sharing with both the design team and NYPA staff. Digital sharing of project information extended into the construction phase with the use of Procore to manage meeting minutes, action items, submittals, and request for information.

The state-of-the-art center also uses GE Digital's predictive analytics software to forecast and prevent equipment failures and significant outages at NYPA's 16 power plants and more than 1,400 circuit miles of transmission operations.

Sensor Deployment Construction Management

The sensor deployment program incorporated new technologies to perform online monitoring of power plants, substations, and power lines to increase efficiency and productivity and improve resiliency of New York's state-wide public power network.

Client

New York Power Authority

Location

Various Locations, New York, U.S.

Contract Value

$3.035 million

Year(s)

2018 - 2019

Project Overview

AECOM served as the Construction Management team for New York Power Authority's (NYPA's) Sensor Deployment Program, which consisted of the deployment of sensors to support the transformation of the state's power system into a state-of-the-art digital network — moving NYPA closer to its goal of being the first all-digital utility.

Client Benefits

- AECOM provided a tremendous amount of experience with projects of this nature.
- The AECOM Construction Management team worked throughout the state of New York covering over 20 NYPA plants/substations. This allowed for extremely useful collaboration amongst the construction managers throughout the different regions and resulted in overall program efficiencies.
- AECOM construction managers' had a strong understanding of the project objectives from the different NYPA departments (plant personnel, operations, etc.) and managing the expectation of each of these resulted in a smoother execution of the project.

Work Performed

Our responsibilities included:

- Liaison between NYPA site/region staff, NYPA corporate staff (multiple departments), design consultant, and construction/implementation contractors
- Review of all project descriptions to gain an understanding of the project scope, objective, schedule, goals, and deliverables
- Review of NYPA's policies and procedures to be familiar with practices essential to providing these services
- Perform design reviews and constructability reviews as required by NYPA's resident construction manager, project manager, and project engineer
- Monitor construction activities to ensure design, specifications, and contracts were followed and that work was done according to schedule and within budget
- Being present at the work area and monitor "critical activities" when performed. Critical activities included, but were not limited to: excavation, lifts, core drilling, system activation and switching; and system testing and commissioning. Critical activities discussed and defined by NYPA's resident construction manager and/or project manager/engineer regularly
- Coordinate the activities of others by creating project schedules and job scopes
- Provide inspection of all work in place; review and approve construction check-off lists to ensure that work performed was in accordance with the contract specifications and applicable codes
- Prepare daily construction reports documenting progress. Recommend corrective courses of action to NYPA's resident construction manager and/or project manager/engineer when progress was not in accordance with the plan
- Conduct construction meetings and prepare/distribute meeting minutes
- Manage and monitor the contractor's work force to achieve optimum productivity
- Review and comment on bid packages prepared by NYPA engineering and/or architect-engineers to ensure design adequacy and constructability
- Review new contract specifications and drawings to ensure that designed work was constructible. Prepare recommendations to achieve cost reductions and to minimize Additional Work Requests (AWR) and change orders during the work
- Recommend changes in the work plan if efficiencies in work practices could be improved
- Review and make recommendations to NYPA's resident construction manager and/or project manager/engineer on all payment items, including partial payments (contractor invoices), change orders, and claim issues
- Prepare extra work documentation in the form of AWRs for approval by the resident construction manager and/or project manager/engineer
- Aid the NYPA/contractor estimate negotiation process

Supply Management Services — Major Projects Sourcing

The AECOM/SVI team has positioned New York Power Authority to execute projects while optimizing the sourcing benefits.

Client

New York Power Authority

Location

White Plains, New York, U.S.

Contract Value

$3-5 million

Year(s)

2018 - 2023

Project Overview

AECOM, in collaboration with SVI Services, Inc. (SVI) is providing supply management services to the New York Power Authority (NYPA). The services consist of sourcing, procurement, and contractor management strategies and execution support of over $2 to $3 billion worth of infrastructure projects.

Client Benefits

Leveraging off AECOM/SVI's vast experience in the power utility industries, the AECOM/SVI team has positioned NYPA to execute the projects while optimizing the sourcing benefits by:

- Leading and supporting the development of technical specifications, scope of work, and other requirements necessary to attract the best suppliers (architecture and engineering firms, manufacturers, contractors, and other services providers) to support the projects
- Engaging and integrating the key stakeholders (engineering, project management, and operations) into the design and delivery of the Sourcing and Procurement Plan
- Delivering substantial savings through facts-based negotiations, value engineering, and alternative supplier's development
- Managing the sourcing and procurement cycle in support of the project schedule
- Supporting NYPA's Strategic Supply Management (SSM) system in the development and/or improvement of the procure-to-pay (P2P) processes in support of the current and future projects
- Building sustainable processes and knowledge transferring to NYPA's SSM team

Work Performed

Assisting and supporting the Authority's SSM team in the development and execution of procurement strategies and plans to ensure the projects are efficiently executed and in compliance with NYPA's guidelines and New York State Law.

In addition to the development and execution of a Sourcing and Procurement Plan, the team is supporting NYPA in the development and execution of the supplier's identification, selection, and qualification for:

- Request for Information (RFI) management
- Request for Quotations (RFQ) management
- Request for Proposals (RFP) management
- Bid evaluation
- Negotiations
- Contract development
- Expediting the delivery of the equipment and services
- Managing the day-to-day relationship and performance of the selected suppliers
- Development and executing value engineering and improvement opportunities
- Reporting and other supports to the projects

Key deliverables and tasks include:

- Stakeholders engagement ensures requirements and expectations are effectively flow down to the suppliers, prior and during the procurement cycle

- Sourcing and Procurement Plan development including the strategies for sourcing of construction services, engineering, and technical services as well as the major materials, products, and equipment

- Collaboration and integration with the project management and strategic supply management to define the go-to-market strategies, i.e. RFI, RFQ, RFP, etc. and in the development of project delivery models such as design build (DB), engineering, procurement and construction (EPC)

- Supporting the project team in the day-to-day management and performance of the selected suppliers

Transmission Life Extension and Modernization — Document Control Support

AECOM currently provides New York Power Authority with document control support for the Transmission Life Extension and Modernization project.

Client

New York Power Authority

Location

New York, New York, U.S.

Contract Value

$270,000

Year(s)

2016 - ongoing

Project Overview

AECOM currently provides document control support to develop a plan for structuring and organizing documents in the document control filing system, SharePoint.

Client Benefits

Developing document management plans, policies, and procedures for the handling of documents when none are in place or update the current to fit with project needs and changes. This includes the migration of existing files that are not properly filed.

Work Performed

Determine the type of documents created or used and create templates that work best for each document type.

Properly file documents that are legally required for the company's structure, construction purposes, or other reasons.

Scan, organize, and maintain documents.

Control the retrieval and distribution of documents such as Requests for Information and maintain the requests via tracking logs.

Responsible for quality assurance of all submittals received by contractors for review by engineering and any submittals issued to the project field for construction.

Develop, maintain, and distribute documents such as meeting minutes, drawings, drawing log, specifications, approvals and related items.

Periodically train project personnel on records management procedures and policies, which include documentation, retention, retrieval and distribution.

Manage user access to SharePoint.

Transmission Life Extension and Modernization — Project Controls

AECOM provides the New York Power Authority with project control services for the Transmission Life Extension and Modernization Program.

Client

New York Power Authority

Location

White Plains, New York, U.S.

Contract Value

$555,000

Year(s)

2018 - ongoing

Project Overview

AECOM is providing project control services for New York Power Authority's (NYPA's) Transmission Life Extension and Modernization (T-LEM) program.

Client Benefits

AECOM developed several programs, as described below, for this project.

Work Performed

Work Breakdown Structure
AECOM worked with various groups within NYPA to develop a work breakdown structure system that can be deployed on various programs. The structure takes into consideration the various business groups within NYPA as well as the various regions that exist within the NYPA framework.

Cost Loaded Master Schedule
AECOM is developing a master schedule in Primavera P6 that consists of the various regions that are a part of the T-LEM program and includes interdependencies between projects that factor into the critical path. The cost structure maps NYPA's Cost Performance Reports into the schedule based on geographic region.

Document Control Services
AECOM is currently assisting NYPA with document control for the T-LEM program. Our staff is utilizing the NYPA SharePoint network to create workflows and manage the documents that are submitted by the various contractors and consultants that work on the program.

Great Falls 100 KV Upgrade Project

AECOM performed the detailed design for the replacement and upgrade of the generating plant step-up substations at four hydro-electric plants near Great Falls Montana ranging from 20 to 70 MVA.

Client

PPL Montana

Location

Great Falls, Montana, U.S.

Contract Value

$10 million

Year(s)

2013

Project Overview

AECOM performed the detailed design for the replacement and upgrade of the generating plant step-up substations at four hydro-electric plants near Great Falls Montana ranging from 20 to 70 MVA. The scope of work included a review of the existing facilities and documentation, condition assessments of equipment to be re-used vs. replaced, detailed design of upgraded or new substations, and all-new transmission line and transformer protection systems.

At the Ryan Plant (originally constructed in 1915) an existing roof-mounted transmission structure originally designed for eight outgoing distribution lines was replaced with a new structure for two 100 kV lines with disconnect switches.

At the Cochrane Plant (originally constructed in 1958) an existing transformer platform over the tailrace posed an environmental hazard.

At the Morony Plant (originally constructed in 1930) an all-new substation was designed on a pile supported structure that incorporated an oil containment basin, a blast wall, new step-up transformer, 100 kV disconnect switch, dead-end, and new medium voltage switchgear.

Client Benefits

Substation designs were unique developments for each facility to solve different operational problems and space constraints.

Work Performed

The AECOM project scope also included design of a regional Generation Control Center, which provided central control for the five hydroelectric plants operated by PPL in the Great Falls area.

Bay Corridor Transmission and Distribution Project

AECOM is providing design and construction support for implementation of an electrical transmission and distribution system in the southeast waterfront of San Francisco area.

Client

San Francisco Public Utilities Commission

Location

San Francisco, California, USA

Contract Value

$2,076,607

Year(s)

2020 - ongoing

Project Overview

The Bay Corridor Transmission and Distribution (BCTD) project supports San Francisco Public Utilities Commission's (SFPUC) plan to expand electric service to San Francisco customers. The project is constructing an electrical distribution system to supply power to existing and future SFPUC customers along the southeastern waterfront of San Francisco. It will incorporate interconnections with an existing Pacific Gas and Electric Company (PG&E) substation to supply high-voltage (HV) power to the BCTD network. This HV power will be transformed at substations owned and operated by SFPUC, and routed to customers throughout the waterfront area.

AECOM performed planning and design for the a 230kV transmission intertie to PG&E, a new 230kV/ 15kV substation and secondary 12.47kV distribution. The project is being implemented using design-build delivery method. Construction of one phase of the system has been completed and we are now providing construction support services for the project. Project included the following:

- New 125MVA substation including 230kV gas insulated switchgear
- 230kV/12.47kV, 62.5MVA transformers
- 15kV class switchgear
- Substation auxiliary systems
- 12.47kV distribution systems
- Extensive underground duct and cable routings
- Design-build and contract support
- Specification of a central control room supervisory control and data acquisition (SCADA) system

Client Benefits

AECOM's planning support included evaluating options for system capacity and customer demand, interconnect locations to the PG&E system, routing of transmission lines to the new substation, substation configuration and location, voltage levels and routing of the distribution system. Planning and design documents included Alternative Analysis Report for the entire program, three separate distribution packages and the substation package, Design Criteria, Conceptual Engineering Report, 35% Drawings and 35% Equipment and Construction Specifications.

Work Performed

Technical services provided on this project included electrical power and lighting engineering, geotechnical engineering, civil engineering, land surveying, structural engineering, fire protection engineering, landscape architecture, communications and security systems, SCADA design, cost estimating, and utility locating.

The following safety codes were followed:

- National Electric Safety Code
- OSHA Regulations
- IEEE 80/81 Substation Grounding
- Other NFPA/IEEE Standards as applicable

PG&E safety training was applied on this project.

WRF 138kV Substation Design

AECOM was awarded the contract for the design of a 138kV substation for Salt Lake City's new water reclamation facility — one of the largest infrastructure improvements commission by the City in decades.

Client

Salt Lake City Department of Public Utilities

Location

Salt Lake City, Utah, USA

Year(s)

2020 - ongoing

Project Overview

The Salt Lake City Department of Public Utilities' are planning to build a new Water Reclamation Facility (WRF) that will replace the current plant in Salt Lake City. The new sewage treatment facility will be one of the largest infrastructure improvements commissioned in Salt Lake City for decades.

The new WRF will require a new high voltage power supply substation (Power Supply Substation) with a capacity of 20 MVA. The New WRF will receive power from a single radial 138kV transmission supply from Rocky Mountain Power (RMP) and will transform it to 13.8 kV for distribution to facility loads via 15kV, 2000 A-rated switchgear. A revenue metering station will be required near Power Supply Substation, which will be designed, provided, owned, and operated by RMP. The project is being implemented using design-bid-build delivery.

method.

Client Benefits

- New 138kV substation will replace an existing 48kV substation, providing a higher capacity transmission level connection
- New substation will include modern substation safety features such as advanced arc flash mitigation techniques
- Substation will be interconnected with backup generation bank improving the reliability for plant services
- Improved operations and maintainability (motorized disconnects, digitized substation communications system that can be remotely accessed)

Work Performed

AECOM is responsible for providing 100% detailed design (all disciplines) and associated engineering calculations (short circuit studies, protective coordination, load flow, lightning assessment, grounding study using CDEGS, etc.) for the new substation and associated secondary equipment. Major items include:

- Main power transformer (MPT) with a rating of 12/16/20 MVA, KNAN/KNAF/KNAF to transform voltage from a transmission system voltage rated 138kV to a distribution voltage rated 13.8kV
- Automatic on-load tap changer to regulate the 13.8kV switchgear bus voltage under varying load conditions
- 138kV transmission line interconnection design to RMP in accordance with RMP standards
- 138kV motor-operated no-load disconnect switches
- 13.8kV 2000A switchgear lineup to support three incoming mains and over 12 outgoing distribution feeders
- Control building to house electrical equipment
- Advanced SCADA system to communicate with utility and plant control systems alike
- Comprehensive 138kV and 13.8kV system protection based on SEL protective relays
- Security system monitoring and alarm
- 125DC system for protection and auxiliaries
- 208/120VAC station service design

Structural designed included:

- Dead end structure steel frame and foundations
- 13.8 disconnect switch steel support and foundation
- Circuit breaker steel frame and foundation
- Power transformer foundation and containment
- Bus duct support steel and foundations
- Steel pole and foundation

The following safety codes were followed:

- National Electric Safety Code
- OSHA Regulations
- IEEE 80/81 Substation Grounding
- Other NFPA/IEEE Standards as applicable

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle — from 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 expertise and innovation, 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 $13.2 billion in fiscal year 2020. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

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