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Smart Energy Solutions

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From planning to implementation... global perspective

AECOM's Resilient Cities Initiative



Cities have become the front line for many of the world's most pressing challenges, from climate change, water scarcity and air quality, to economic disruption, public health and social instability. The scope of these issues extends beyond individual departments or agencies, beyond city boundaries and beyond the public sphere or private sector.

Yet it's essential that cities find solutions. In the next 20 years, the world's urban population will grow by more than two billion people. We are in the midst of the urban century.

Fortunately, cities have the capacity to address these global challenges — and meet local demands. At their best, cities have a density that makes transportation and housing more efficient, reduces per capita resource and energy use and lowers carbon emissions. They boost individual mobility and opportunity and drive economic growth. They foster diversity, creativity and social progress. Building successful cities is essential to creating a more sustainable world.

Which is why we're asking the question, what's next in making cities resilient? How do we plan for healthy urban growth?

The answer lies in a new approach: a whole-systems approach to better prioritize projects, plan ahead, protect vulnerable assets and provide sustainable growth. At AECOM we're pursuing ways to connect the best ideas and insight, from across communities, professions and regions and from public and private sectors, to help cities overcome their challenges and build a brilliant future.



A New Smart City of Samsung Xi'an, China

Client: Samsung

Just south of Samsung's semiconductor plant at the historic city of Xi'an, the technology and electronics company is developing the 500-hectare Samsung Smart City. The new town is located at the center of the new Hi-Tech Industries Development Zone in Xi'an's Gaoxin District. The extensive zone is being developed to house more than 2,100 high-tech companies.



Queen Elizabeth Olympic Park London, UK

Clients: London Legacy Development Corporation, Greater London Authority, UK Olympic Delivery Authority, Thames Gateway Development Corporation, London Development Agency, London Boroughs of Hackney and Newham
Rather than design a masterplan for a single event — the Olympics in 2012 — we designed a masterplan for 2040. Our work on a myriad of projects in East London, including the original vision that secured London's Olympic bid, are bringing to life what has long been the UK's most deprived urban area.



Vizag Smart City Master Plan Visakhapatnam, India

Client: City of Visakhapatnam, India (funded by USDTA)

AECOM is developing the Smart City Vision master plan for Visakhapatnam (Vizag), India. The project is advancing the Vizag's efforts to make it more efficient and sustainable through the development of smart and interconnected infrastructure, communications and data systems. Vizag was recently announced as a winner in the first phase of the Government of India's Smart Cities Challenge. As an awardee of the Smart Cities Challenge, financing of Vizag's development and modernization efforts will be partially supported by the central government of the Republic of India. Under the project, which is funded by USTDA, AECOM and its partners are developing a planning framework, development strategy and set of high priority investment projects for smarter urban development. The projects will leverage innovative technologies, data analytics and delivery approaches to close gaps in public services, reduce congestion in logistical systems and improve access to urban amenities. The goal of the smart city plan is to enhance economic competitiveness and improve quality of life in Visakhapatnam.

From planning to implementation... closer to home

Thinking and planning regionally with multiple stakeholders across different sectors

AECOM is a leader in integrated planning and engineering solutions for a sustainable energy future. The company's mission is to help its clients reduce energy and water consumption, develop renewable sources, cut carbon emissions and improve infrastructure and community resilience. We understand the state and have worked closely with area municipalities and local stakeholders.

Ranked #1 in Transportation by Engineering News Record, AECOM is also a leader in mobility solutions and recognizes the direct and growing connection between the modern utility grid and vehicle electrification. We have performed vehicle electrification feasibility studies and infrastructure assessments for clients across the U.S. and globally including the Colorado Department of Transportation, Ohio Clean Fuels, and Highways England.

We are uniquely qualified to assist clients in assessing the growing demand for electric vehicles and other smart infrastructure solutions and the opportunities and challenges that this demand provides.





Colorado DOT Electrified Roadway Pilot Project Study Statewide

Client: Colorado Department of Transportation

AECOM is teamed with the Sustainable Electrified Transportation Center of Utah State University (SELECT) to develop a study and design a pilot project for wireless power transfer technology that could inductively charge electric vehicles.



E-Highway Demonstration Program Carson, CA, USA

Clients: South Coast Air Quality Management District

AECOM has been working on a number of projects enhancing the AECOM successfully led the pilot project civil integration of Siemens' E-Highway technology, which aims to electrify freight transport using an overhead catenary through a heavily used freight corridor. The demonstration project will test technology that powers trucks using overhead cables and on-vehicle equipment, installed on four Volvo freight trucks for this pilot.



Securing a Gateway for Global Trade Long Beach, CA, USA

Clients: South Coast Air Quality Management District

As part of the largest port complex in the United States, and a critical gateway to global trade, the Port of Long Beach is an important economic engine vital for Southern California. Strategies for climate adaptation measures are being developed for its maritime infrastructure and operations. Adaptation is integrally linked with the port's triple-bottom-line responsibilities of economic, environmental and community stewardship.

To understand and manage the challenges ahead for the port, we are undertaking a multi-year study to understand the vulnerabilities faced by the port's infrastructure and operations and to develop a climate resiliency strategy to address those vulnerabilities.

Energy Assurance Microgrid

AECOM was selected to provide comprehensive services for the planning, design and development of an energy assurance microgrid for the City's downtown area

Client: City of Berkeley, CA, USA

Location: Berkeley, CA, USA

Years: 2015 - Ongoing

Services:

- Energy system planning and engineering
- Regulatory and economic feasibility analysis
- Review and development of business case, financing and implementation models for energy assurance microgrid and related infrastructure
- Distributed generation improvements



AECOM is leading a consulting team that includes staff from the Lawrence Berkeley National Laboratory ("the Lab"). Initial work under the assignment is focusing on system feasibility and configuration. AECOM assisted the City in securing and is now implementing a California Energy Commission (CEC) grant to develop the business plan and technical configuration of the Microgrid system. Central to the project work is a TBL analysis of microgrid benefits and detailed technical modelling of microgrid scenarios integrating both SSIM and the Lab's Distributed Energy Resources Customer Adoption (DER CAM) model.

The project also includes outreach to key stakeholders and facilitation of their input. In addition to detailed system modelling, work under the CEC grant covers detailed evaluation of microgrid feasibility including preliminary engineering design, distributed generation modelling, regulatory analysis, business model identification/review, financial and economic evaluation and identification of operational models for microgrid implementation. The CEC grant was awarded in 2016 and project work will continue through 2017. The project is currently underway and on schedule.

Microgrid and Smart City Support

AECOM is supporting ComEd's Exelon utility serving Northeastern Illinois with its Bronzeville Microgrid and Community of the Future smart city initiative

Client: Commonwealth Edison (ComEd)

Location: Chicago, IL, USA

Years: 2016 - Ongoing

Services:

- Smart city program design and consulting
- Microgrid performance metrics development
- Best practices analysis
- Smart street light deployment modelling and optimization planning



The historic Bronzeville neighborhood, located on Chicago's Southside is proposed as the location of ComEd's first microgrid. Additionally, the Bronzeville neighborhood has been targeted for a broader ComEd Smart Community of the Future initiative that builds on the utility's investments in grid modernization to pilot and deploy a range of smart city technologies.

AECOM is helping ComEd evaluate development of integrated resilience performance metrics for the Bronzeville microgrid and related grid modernization and smart city improvements. The metrics analysis focuses on defining the measurable and deliverable resilience benefits of grid modernization initiatives such as the Bronzeville microgrid system and includes the electrical system, critical infrastructure and community resilience. Community of the Future smart city support includes development and implementation of strategies for stakeholder outreach and engagement related to ComEd's Community of the Future, smart city, grid modernization and microgrid initiatives in Bronzeville. Outreach approaches consider both general awareness and engagement related to the development of specific technology applications associated with the smart city investments.

Finally, AECOM is assisting ComEd with planning for comprehensive modernization of urban street light systems to achieve energy savings, implement smart city service improvements, increase revenue generation opportunities and support City sustainability and resilience goals. AECOM has developed a detailed implementation approach that optimizes energy savings, prioritizes critical system upgrades and targets smart city service enhancements to areas of high need.

Community Readiness for EVs and Charging Infrastructure

To provide Clean Fuels Ohio and the stakeholder organizations with a clear path for supporting the adoption of electric vehicles, AECOM developed a comprehensive understanding of best practices, policies, codes and case studies of EV supporting communities. The final goal of this process was to develop a set of templates for municipalities, regional and state organizations, as well as private sector stakeholders interested in supporting EV deployment

Client: Clean Fuels Ohio

Location: Cleveland and Columbus, OH, USA

Years: 2011 - 2012

Services:

- Market analysis
- Demographic trends
- Policy studies



AECOM was engaged by Clean Fuels Ohio (a non-profit organization) to develop an implementation plan for electric vehicles in Columbus, Cleveland and along the I-71 corridor. The project was designed to seamlessly integrate all of Ohio's EV readiness activities and stakeholders to produce a replicable, ready-to-implement deployment plan for plug-in electric vehicles, charging infrastructure, safety training, consumer education, marketing

and associated policy solutions including zoning, code, permitting, inspection and other incentives. As the project lead, AECOM also integrated information from more than 20 project partners, including local utilities, educational and research institutions, local units of government, state agencies and metropolitan planning councils. Concurrent to the technical analysis of demand, implementation best practices and coordination of multiple

team member efforts was the need to support the development of an effective marketing program that would best support the implementation plan. AECOM also developed long-term forecasts for EV demand upon which to base the need for corresponding infrastructure. The effort required the analysis of demographic, economic and socioeconomic patterns across a broad region.

This effort focused on the following elements:

- Potential early adopter populations, geographic locations, concentration, and behavior characteristics to determine location of early infrastructure to support their acceptance and adoption of the technology.
- Assessment of the economic incentives, barriers, and conditions needed for EV adoption to move from the Early Adopters to general consumer usage and support.
- Demand characteristics for specific zoning and land use types to understand the impact of EV adoption on local governments, employers, retail and utilities.
- The economic and fiscal impacts of EV adoption and infrastructure implementation was examined to determine the potential impact upon units of government, individuals, utilities and interested stakeholders in EV development.
- Opportunities and challenges posed by EV adoption related to utilities, electrical grids and the deployment of new technologies to improve environmental sustainability, grid resilience and infrastructure demands caused by EVs.

Assessment of Growing Plug-in Electric Vehicle (PEV) Demand and Charging Services

AECOM was hired to provide third-party consulting services for the evaluation of impacts on the Roseville Electric Utility (Utility) due to growing customer demand for at-home, at-work, and recreational and pass through transient plug-in electric vehicle (PEV) charging

Client: City of Roseville, California

Location: Roseville, CA, USA

Years: 2017 - Ongoing

Services:

- Project management
- Projection of PEV charging technology
- Projection of PEV charging utilization trends
- Assessment of the utility's PEV role
- Assessment of PEV's impact on the distribution grid, utility power resources, and electric load forecasting
- Reporting



AECOM assisted the Utility in accessing business strategies and distribution/operational plans in regards to expanding customer demand for PEV charging services in the City of Roseville, California. This study will be used as part of an effort to create an electric utility business plan for the Utility's response to customer PEV demand. Ideally, this plan will provide information that will be used to direct utility operations, business policies, and customer program development that will support customer expectations and preferences and facilitate the utilization of PEVs in the City of Roseville. The study will assess various scenarios and recommend operational and business practices that may be adopted by the Utility.

AECOM completed an evidence-based projection of PEV and PEV charging technology considering established policies, market drivers, PEV availability, and anticipated technological advances from 2018-2028. The resulting information, in combination with City of Roseville specific data, was then used to model PEV uptake at the utility transformer level. The model outputs include PEV system peak demand impacts, system consumption impacts, CO₂ impacts, feeder peak demand impacts, and demand management impacts. With this information, the City of Roseville can properly serve and manage PEV charging load and support the development of PEV charging infrastructure.

Colorado DOT Electrified Roadway Pilot Project Study

The growth of electric vehicles has been limited by motorists' concerns over vehicle range and charging infrastructure. AECOM is building a solution—inductive roadways that allow electric vehicles to charge as they drive

Client: Colorado Department of Transportation

Location: Denver, CO, USA

Years: 2016 - Ongoing

Services:

- Wireless power transfer technology
- Inductive charge for electric vehicles
- Feasibility and planning studies and pilot project



AECOM is teamed with the Sustainable Electrified Transportation Center of Utah State University (SELECT) to develop a study and design a pilot project for wireless power transfer technology that could inductively charge electric vehicles. The study is to develop a pilot project in Colorado that could be scaled and extended to serve both electric freight trucks and eventually include light duty vehicles to further promote electric vehicle adoption. The technology for the inductive charging would be installed in a lane of traffic to allow for electric vehicles to wirelessly charge while in-motion. The technology, while still being developed, would be tested to better quantify the efficiency of the system as well as the performance in varying conditions.

The study and pilot project are part of AECOM's role on Colorado DOT's RoadX program, which aims to identify, develop and deploy new innovation and technology in transportation.

E-Highway Demonstration Program

The E-Highway innovation supplies trucks with power from an overhead contact line. This means that not only is energy consumption cut in half but also local air pollution is reduced

Client: Siemens Industry, Inc., Mobility Division

Location: Carson, CA, USA

Years: 2015

Services:

- Local permitting and planning
- Traffic design
- Civil design
- Roadway technology integration



AECOM has been working on a number of projects enhancing the AECOM successfully led the pilot project civil integration of Siemens' E-Highway technology, which aims to electrify freight transport using an overhead catenary through a heavily used freight corridor. The demonstration project will test technology that powers trucks using overhead cables and on-vehicle equipment, installed on four Volvo freight trucks for this pilot. The E-Highway concept is particularly effective from an environmental and economic point of view on heavily used and relatively short truck routes, e.g. between ports, industrial estates, freight transport centers and central transshipment terminals.

AECOM tasks for the E-Highway project included local permitting and planning, traffic design, civil design and roadway technology integration of a 1-mile pilot project located in Carson, California. The intention of the project was to demonstrate the viability of the technology to be used to create a zero emissions highway. The project was done for South Coast Air Quality Management District and in coordination with the City of Carson and both the Ports of Los Angeles and Long Beach.

Boston Smart Utilities Vision

AECOM was selected by the Boston Planning and Development Agency (BPDA) to develop the City's Smart Utilities Vision



- Water and Wastewater including water reuse technologies, water recapture and integrated green infrastructure
- Data and Telecommunications for utility operations and end users

The project will:

- Promote utilities that are easier to build, maintain and upgrade
- Reduce energy/water costs for residents/businesses
- Provide infrastructure hardened against flooding and heat waves
- Result in world-class utilities that attract businesses
- Integrate cutting edge technologies for innovation

The project incorporates six phases, resulting in a final report and recommendations:

- Phase 1. Describe the Base Case
- Phase 2. Define the Opportunity
- Phase 3. Define the Construction Plan
- Phase 4. Sketch the Implementation
- Phase 5. Take it to Scale: Plan on how to implement in other areas of Boston
- Phase 6. Chart the Course Forward

The Boston Smart Utilities Project is a collaborative effort between city government and Boston's utility companies that will offer a new model for integrated planning among energy, transit, water and communications utilities. By improving coordination among utilities, the Project aims to make utility services in urban neighborhoods more affordable, resilient, equitable and sustainable. City departments collaborating with the BPD include the Mayor's Office of Streets, Transportation and Sanitation, the

Mayor's Office of New Urban Mechanics, the Mayor's Office of Environment Energy and Open Space, the Department of Information Technology, Public Works Department, the Boston Water and Sewer Commission and the Boston Transportation Department. The smart utility technologies that are being considered include:

- District energy and microgrids
- Smart transportation including autonomous and electric vehicles, smart transportation management and vehicle-to-grid initiatives

Client: Boston Planning and Development Agency

Location: Boston, MA, USA

Years: 2016 - Ongoing

Services:

- Smart City technology evaluation
- Planning and engineering analysis
- Triple bottom line modelling

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About AECOM

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. 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 had revenue of approximately \$18.2 billion during fiscal year 2017. See how we deliver what others can only imagine at aecom.com and [@AECOM](https://twitter.com/AECOM).

