Experiences in Developing Municipal Scale Energy Management Systems:

Key Lessons Drawn from Experiences in the United States

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Executive Summary

There are contrasting market conditions and policy drivers that support large scale municipal energy development in the United States and the United Kingdom. In the U.S., this type of energy development includes project investments in energy efficiency and renewable energy, specifically among municipally-owned and operated buildings and facilities.

U.S. municipalities are actively pursuing renewable energy. They are purchasing clean power and harnessing distributed generation to reduce energy costs.

Municipal renewable energy development is active in U.S. states with Renewable Portfolio Standards (RPS) or other requirements providing for incentives such as Renewable Energy Credit and Net-Metering. These requirements set forth incentives which can be utilized to support project financing. Often states with Renewable Portfolio Standards require utilities to purchase renewable energy or renewable energy credits from third-party providers and these standards allow for municipalities to enter into alternative arrangements to procure power, such as Power Purchase Agreements (PPAs).

Municipal energy efficiency development in the U.S. is driven by policies and programs at the state and local government level, but often the key drivers are budgetary constraints and significant deferred maintenance conditions within buildings and facilities. Another principle driver includes "lead by example" sustainability initiatives and an opportunity to utilize bonds, grants or incentives specifically aimed towards energy conservation or clean energy. Often municipal governments are utilizing performance-based contracting for energy savings for comprehensive portfolio-wide projects.

While national U.S. policy does not regulate state and municipal energy efficiency and renewable energy requirements, state legislation or regulatory requirements placed on utilities has established programs which require and incent certain investments in clean technology. Coupled with these state-based programs, there are opportunities for project developers to utilize federal tax incentives towards renewable energy investments and energy efficient equipment.

Combined, these various policies, market drivers and conditions have contributed towards the development of interesting large scale municipal energy projects in the United States.

U.S. Municipal Renewable Energy Development

Across the United States, municipal governments have engaged opportunities for on-site renewable energy on municipally-owned land and assets. Traditionally, there have been two approaches for municipalities to acquire renewable energy. Municipalities have self-financed these projects, owning the asset, and alternatively they have purchased renewable energy through Power Purchase Agreements (PPAs) with third-party providers.

There are historic challenges and advantages to both approaches. A municipal government for example may have access to low-cost financing through the issuance of public debt to construct the project—however as a non-tax paying entity they would lack the ability to monetize federal renewable energy tax incentives available in the U.S. These advantages and challenges are demonstrated by the following table from the U.S. National Renewable Energy Laboratory (NREL):

	Third-Party PPA	Self-Ownership
Advantages	• No/low upfront outlay of capital • Ability for tax-exempt entity to benefit from savings passed on from federal tax incentives • Predetermined electricity price for 15–25 years • No operating and maintenance responsibilities • Path to ownership (if included as an option in PPA)	• Ability to use cheap public debt (through a tax-exempt debt issuance) • Full control over a project: design, operations, and risks • Ability to choose what to do with renewable energy attributes generated by the project (retain or monetize)
Challenges	• The process of negotiating a PPA can be lengthy and costly • Public entity has limited control over project design, operations, and risks • PPA pricing may be sub-optimal (developer could receive most of the financial benefits) • If PPA term is less than the system useful life, the host must purchase the system at fair market value at the end of the term	• The public entity cannot monetize the value provided by federal renewable energy tax incentives • Need expertise to navigate potential revenues from renewable-portfolio-standard-driven subsidies • Debt issues and limitations could prohibit the model • Project management requirements

Table Courtesy of NREL; Financing Solar PV at Government Sites with PPAs and Public Debt

The use of third-party PPAs by municipal governments has been particularly successful in U.S. states with Renewable Portfolio Standards. An RPS is a mandatory requirement to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil fuels and nuclear electric generation. An RPS is the U.S. equivalent of the term "Renewables Obligation" in the United Kingdom.

Twenty-nine U.S. states and the District of Columbia have a Renewable Portfolio Standard. Typically, electric utilities may meet RPS requirements through their own renewable energy facilities or, in many state RPS jurisdictions, through the purchase of Renewable Energy Certificates (RECs). Traditionally, a REC is produced each time a qualifying renewable energy facility generates one megawatt-hour of electricity.

A third-party developer of a PPA can often incorporate the potential long-term value of the Renewable Energy Certificates from a municipal renewable energy project in their evaluation of the capital cost of the project. This in turn can generally reduce the upfront cost to develop the project (for which the developer is responsible under a PPA).

Coupled with the value of the Renewable Energy Certificates, a third-party developer of the PPA can also utilize federal renewable energy tax incentives available in the U.S. These incentives are known as the Production Tax Credit (PTC) and the Investment Tax Credit (ITC) and are designed to reduce the development cost of the renewable energy plant.

The Investment Tax Credit has been a significant U.S. driver for solar energy development.

The renewable electricity Production Tax Credit is a per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold during the taxable year. The PTC applies to technologies such as, but not limited to, biomass, wind, landfill gas, geothermal and municipal solid waste. Congress also allowed for the election of the Investment Tax Credit in lieu of the PTC. The PTC credits, though now expired for new facilities, were a major driver for U.S. wind energy development.

At the municipal level, Ameresco utilized the Investment Tax Credit in lieu of the PTC for the development of municipal landfill gas to energy systems. One such example is in California, where Ameresco installed a 4.3 megawatt landfill gas-to-energy (LFGTE) plant at a county-owned landfill known as the Foothill Landfill in Linden, CA, outside of San Francisco (pictured right).

A nearby city—the City of Palo Alto, purchases the renewable energy from Ameresco's plant through a 20 year Power Purchase Agreement. The plant provides 3% of the City's electric needs. Ameresco has additional Power Purchase Agreements with the City of Palo Alto for other LFGTE plants in California. The total electricity delivered to

the Palo Alto community from Ameresco's renewable plants in California is approximately 125,000 MWh annually.

For U.S. solar development, the Solar Investment Tax Credit is a 30% federal tax credit for solar systems on residential and commercial properties. The tax credit was established in 2005 and remains in effect through December 31, 2016 under current law. The company that installs, develops or finances the project traditionally uses the credit. For municipal projects for example, the developer can utilize the credit to reduce the upfront cost of the project.

Additionally, if the developer does not have the tax equity to utilize the credit themselves they can sell the renewable asset for a negotiated price that accounts for the ability of the buyer to claim the credit. Developers have also participated in other tax equity structures to monetize the investment tax credit while maintaining operation of the renewable asset. The two leading tax equity models in the U.S. are the sale-leaseback structure and the partnership-flip model.

The Solar Investment Tax Credit has been a significant U.S. driver for solar energy development. According to the U.S. Solar Energy Industries Association, the tax credit "has helped annual solar installation grow by over 1,600 percent since the ITC was implemented in 2006 - a compound annual growth rate of 76%."

In Massachusetts, Ameresco utilized the solar Investment Tax Credit and other available state-provided and utility-provided rebates and incentives towards a municipal-wide renewable energy and energy efficiency project at the City of Lowell, MA.

The comprehensive project served 19 municipal facilities and 28 schools totaling 47 buildings, and provided nearly 2 megawatts (MW) of on-site solar energy through five roof-top mounted solar PV systems totaling 341.9 kW and one 1.5 MW ground mount system on a city-owned capped landfill (pictured above). In addition to the schools, Ameresco also implemented an energy efficiency project at the Lowell Public Housing Authority. Combined, these projects reduced the City's energy-related operational expenditures by more than 25% annually. The projects are summarized below:

- £13.7M ($21.1M) Energy Savings Performance Contract (ESPC) for Municipal Buildings and Schools; 20 Year Repayment Term Utilizing Guaranteed Energy Savings; utilized £781,320 ($1.2M) in utility-provide rebates for energy efficient equipment;

- A £5.9M ($9M) Energy Savings Performance Contract for Public Housing Authority; and
- Power Purchase Agreement for 341.9 kW rooftop PV systems and 1.5 MW PV system at capped landfill; utilized £781,320 ($1.2M) in state solar rebates; utilized Renewable Energy Certificates; utilized Investment Tax Credit.

Tax-exempt entities such as municipalities, have also utilized specialized low-cost federal bonds for renewable energy and energy efficiency authorized by the U.S. Congress. These types of bonds have provided low-interest financing for public sector renewable energy projects. This includes for example Clean Renewable Energy Bonds and Qualified Energy Conservation Bonds. These bonds have been used primarily in the public sector by electric cooperatives, states, cities, and counties.

In Minnesota, Ameresco incorporated the use of a low-cost financing Qualified Energy Conservation Bond (QECB) for a solar installation at a large airport. The 3 MW solar installation at the Minneapolis St. Paul International Airport, once constructed, will be the single largest solar system in the State and will generate close to 20% of the airport's total power supply when operating at peak capacity.

The project utilized a federally-subsidized QECB to finance the majority of the £16.3M ($25M) PV project.

Under a QECB interest on the bond is taxable but the U.S. Treasury offers a direct cash subsidy to the bond issuer to subsidize the interest costs. The QECB subsidy is generally correlated with U.S. Treasury yields. This QECB subsidy typically yields net project financing costs for issuers ranging from .5% to 2%. For the Minneapolis St. Paul International Airport project QECB, the financing cost was less than 1%.

The Minneapolis St. Paul International Airport solar panels are being installed on the top deck of two terminal parking structures (*rendering above, courtesy of the Metropolitan Airports Commission*). The renewable energy project also includes converting more than 7,700 metal halide light fixtures in all four parking ramps to energy-saving LED technology. Ameresco is expected to complete construction of the project by October 2015. The installation will increase Minnesota's cumulative solar capacity by roughly 20%.

U.S. Municipal Energy Efficiency Development

Municipal energy efficiency development in the U.S. is often driven by a number of factors facing the local government. These factors span budget constraints, deferred maintenance, policies and programs and the availability of incentives and private-financing to recoup investments in energy efficiency.

Additionally, 20 states have enacted an Energy Efficiency Resource Standard (EERS) which can drive residential, commercial and public sector energy efficiency programs and investments. In turn, these programs can provide incentives to local governments in the form of rebate programs.

Increasingly, cities are also striving to lead by example through sustainability initiatives and are examining opportunities to streamline operations or to privatize certain facilities. Some states, like Massachusetts for example, also provide technical assistance to local governments to pursue clean energy projects.

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At the federal level, there is a tax incentive available for commercial energy efficiency in the form of a tax deduction based on a dollar per square foot energy efficiency improvement. The deduction allows for a tax-exempt public building owner, such as municipality for example, to assign this deduction to qualified companies that install the energy efficiency improvements.

While Renewable Portfolio Standards have provided for opportunities to generate Renewable Energy Certificates (RECs) in several U.S. states, there is not yet a formally developed state or national registry for energy savings certificates or energy efficiency credits. Connecticut is reported to be the only U.S. state that has allowed for the trading of energy efficiency credits for compliance purposes.

Still, public sector entities are able to pursue energy efficiency through more traditional mechanisms. In the U.S, local governments are served by public and private mechanisms for energy efficiency improvements. This can come in the form of state and utility programs for energy efficiency, offering rebates, grants and incentives. Additionally, municipalities utilize the privately-delivered market for energy efficiency the majority of which is served by Energy Service Companies (ESCOs).

Typically, a municipal government may pursue incremental improvements for energy efficiency through their own capital funds or through available incentives in the form of small-scale investments. This may include, for example, the replacement of short-term payback measures such as lighting replacements or the purchase of a data analytics software system to analyze opportunities for energy savings.

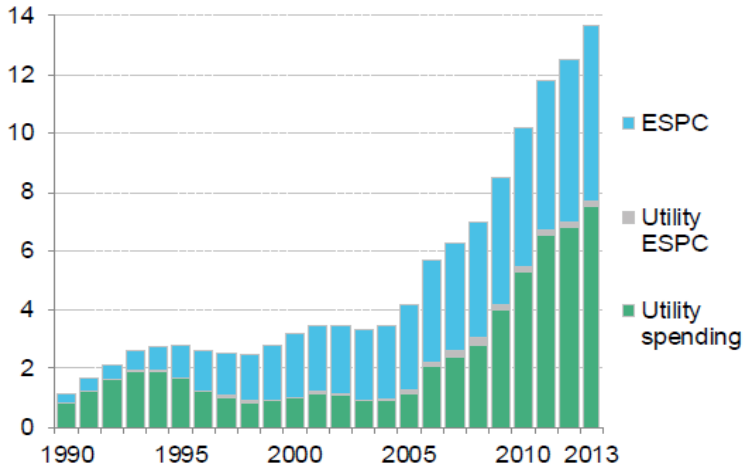
These investments may also be made in coordination with rebates and grants which incent the replacement of certain energy-related equipment or encourage the weatherization of buildings.

During the U.S. economic recession for instance, a major federal grant program for energy efficiency provided over £2.1 billion ($3.2 billion) in Energy Efficiency and Conservation Block Grants to cities and states. These type of grants allowed for municipalities to perform small-scale energy audits, implement lighting retrofits and make incremental but important energy efficiency investments.

For comprehensive energy conservation projects within existing buildings and facilities, municipalities typically leverage the private sector by partnering with Energy Service Companies (ESCOs). This sector is primarily comprised of companies specializing in the implementation of energy efficiency and renewable energy projects through mechanisms such as Energy Savings Performance Contracts (ESPCs), Power Purchase Agreements, Design/Build and Efficiency Services Agreements (ESAs). The majority of the ESCO sector revenues are attributable to ESPCs.

In the U.S., investments in energy efficiency through utility programs and ESPC projects are comparative. While ESPCs can utilize utility-provided rebates and incentives, they do not rely on those incentives to develop a project. The following chart by Bloomberg New Energy Finance demonstrates U.S. energy efficiency investments among these markets:

US estimated investment in energy efficiency through formal frameworks ($USD bn nominal)



Graphic Courtesy of Bloomberg New Energy Finance, 2014 Fact book

State and local governments engaging the services of ESCOs utilize a variety of financing mechanisms including, capital dollars, loans, bonds, and leases to finance energy efficiency projects. Often, cities, counties, municipal agencies and school districts lack the availability of funds to effectively self-implement energy projects. This is demonstrated by the following table provided by the U.S. Lawrence Berkeley National Laboratory:

Table 3. Financing methods used by ESCO customers (2009-2011) [25]

Market Segment	Cash	Partial Cash	Term Loan	State/Local Bond	Lease	Other	Total
Federal (n=19)	40%	7%	0%	3%	19%	31%	100%
State/Local (n=24)	15%	14%	16%	31%	23%	0%	100%
K-12 Schools (n=25)	7%	8%	18%	34%	28%	5%	100%
Univ/College (n=23)	20%	16%	22%	22%	19%	0%	100%
Health/Hospital (n=16)	33%	16%	28%	1%	21%	1%	100%
Public Housing (n=6)	17%	3%	5%	4%	58%	13%	100%
C&I (n=16)	50%	4%	23%	2%	5%	16%	100%

Table Courtesy of Lawrence Berkeley National Laboratory Report "Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry", September 2013

Among the financing methods for municipalities, ESPCs are a mature and well-establish mechanism in the U.S. dating back to the mid-1980s.

The ESPC is a contractual agreement between an Energy Service Company and a client entity for a large energy savings project. ESPC projects typically reduce energy consumption by 15% to 35% with average contract terms ranging between 10 to 20 years. In the U.S., these contracts are authorized at the federal, state and local government level and are often used by local governments.

The ESPC provides municipalities and other clients with turnkey comprehensive energy conservation measures at no additional cost. These agreements often include a *contractual guarantee* by an ESCO that ensures the cost savings realized as a result of the ESPC will be sufficient to finance the upfront cost of the project.

ESPCs are attractive to municipalities as they provide services which are often otherwise not available to a public entity within its own resources. This includes for example an energy audit, design engineering, construction management, arrangement of long-term project financing, contractual guarantees, commissioning, retro-commissioning, operations and maintenance, and ongoing measurement and verification of the installed measures.

Typically, ESPC projects are financed by third-party financial institutions through a variety of mechanisms including tax-exempt lease-purchase agreements (also referred to as a municipal lease) and municipal bonds.

Tax-exempt lease-purchase agreements are a common municipal financing tool. They are a popular alternative to bonds and loans given they often do not constitute a debt obligation or require voter approval. Ameresco has utilized these types of agreements for large-scale energy efficiency projects serving municipal entities.

In Boston, Massachusetts, the Boston Housing Authority (BHA) (pictured) undertook an ESPC with Ameresco in 2010 to address 13 public housing developments spanning 4,300 units and over 3 million square feet. A municipal lease agreement was utilized for the £43.4M ($66.7M) project at no additional cost to the housing authority.

The BHA provides housing to approximately 10% of the City's residents. The ESPC project is the largest in U.S. public housing history and successfully addressed buildings that were more than 60 years old with energy equipment and systems that had reached the end of their useful life. Seventeen Energy Conservation Measures (ECMs) were implemented throughout the portfolio of public housing buildings resulting in a 37% reduction of water use and a 36% reduction in natural gas consumption.

The efficiency measures are estimated to reduce CO_2 emissions by 13,000 tons annually. In addition to the energy and environmental benefits associated with the project, the housing authority also wanted to incorporate a jobs training program into the construction of the project. Ameresco and the City of Boston created a pre-apprenticeship program that provided jobs skills and training to more than 100 housing residents during the three years of project construction.

Increasingly, municipalities are also examining opportunities for distributed generation as part of energy efficiency projects. Opportunities for on-site solar, geothermal and combined heat and power (CHP) systems can support mission critical facilities such as hospitals, police stations and fire departments.

In dozens of U.S. states there are opportunities through net-metering programs for customers of certain electric distribution companies to generate their own electricity in order to offset their electricity usage. In turn, they can also receive credits for any electricity that they generate but do not use. These types of programs vary by state but have been particularly successful in Arizona, California, Colorado, Maryland and Massachusetts. In Massachusetts, for example, the law also provides for a public-sector "set aside" for net-metering. This has encouraged and allowed for municipalities to pursue distributed generation projects.

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