OPTERRA
ENERGY SERVICES

Request for Information

A Fast-Track To Renewable Energy

Solutions to Support the City of San Diego's Goal of 100% Renewable Energy

City of San Diego

October 28, 2016

An ENGIE company

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City of San Diego

October 28, 2016

Submitted to:

Maureen Medvedyev, Principal Procurement Specialist
City of San Diego
Purchasing and Contracting Department
1200 Third Avenue, Suite 200
San Diego, CA 92101
Email: mmedvedyev@sandiego.gov

Submitted by:

Crista Curtis, Business Development Manager
OpTerra Energy Services
201 Lomas Santa Fe, Suite 480
Solana Beach, CA 92075
Telephone: (619) 241.4673
Email: ccurtis@opterraenergy.com

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CITY OF SAN DIEGO

PURCHASING & CONTRACTING DEPT.
1200 Third Avenue, Suite 200
San Diego, CA 92101-4195

REQUEST FOR INFORMATION (RFI) COVER SHEET
PROGRAM(S) TO MEET CITY'S 100% RENEWABLE ENERGY GOALS
ADDENDUM A

Subject: Solutions to Support the City of San Diego's Goal of 100% Renewable Energy

Date Issued: September 23, 2016

Response Date and Time (Closing Date): **October 28, 2016 at 3:00 p.m.**

Questions/Comments Due Date: **October 5, 2016 at 5:00 p.m.**

City Contact Name and Information: Maureen Medvedyev, Principal Procurement Specialist, Mmedvedyev@sandiego.gov

Respondent's Information:

Respondent Name: OpTerra Energy Services, Inc.

Address: 201 Lomas Santa Fe Dr., Suite 480, Solana Beach, CA

Telephone No. and E-Mail Address: 619-241-4673, ccurtis@opterraenergy.com

Website: www.opterraenergy.com

Authorized Representative Name and Title: Crista Curtis, Sr. Business Development Manager

Representative's Original Signature:

Date Signed: October 27, 2016

TO BE CONSIDERED, RESPONDENT MUST :

1) **Provide all requested information identified in this Cover Sheet.**
2) **Submit all requested information described in the RFI.**
3) **Submit all requested information on or before the Closing Date.**

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October 28, 2016

Maureen Medvedyev, Principal Procurement Specialist
City of San Diego
1200 Third Avenue, Suite 200
San Diego, CA 92101-4195

Re: City of San Diego Program to Meet 100% Renewable Energy Goals

Dear Ms. Medvedyev,

As a leader in renewable energy and resource conservation, OpTerra Energy Services is thrilled to respond to this Request for Information and help guide the City of San Diego towards its bold goal of achieving 100% renewable energy by 2035.

The caliber and scope of a project that transitions the City of San Diego to 100% renewable energy by 2035 requires a company with a large suite of solutions, extensive experience, creativity, and flexibility. OpTerra offers turnkey, integrated energy efficiency solutions across the U.S. and North America. Our comprehensive offerings include customized projects, advanced technologies, and an expedited, data-driven process backed by decades of experience. As a subsidiary of multinational energy provider, ENGIE, OpTerra has access to advanced global capabilities, yet retains a local focus. Our solid financial backing allows us to provide this holistic approach and guaranteed outcomes, while absorbing risk for the City.

OpTerra Energy Services' mission aligns with the City of San Diego's Climate Action Plan (CAP) goals, which extend beyond renewable energy. OpTerra leverages energy efficiency and renewable energy programs to improve economic development and community engagement. Our collaborative process and programs create partnerships that save money, generate revenue, and improve assets while protecting the environment.

The RFI document enclosed outlines our Three-Tiered Integrated Program that will make the City of San Diego successful in achieving its goals. This solution begins with our data analytic software which analyzes how city facilities use energy and prioritizes conservation projects to decrease demand. We will then implement renewable energy solutions sized to this new reduced energy demand. Through this cohesive, efficient solution, the City of San Diego will go beyond energy-related State mandates and emerge even more prominently as a sustainable leader.

As an active, contributing member of the Zero Emission City (ZEC) initiative for the City of San Diego through the World Business Council of Sustainable Development (WBCSD) and participation in organizations such as Cleantech San Diego and San Diego Regional Chamber of Commerce, OpTerra demonstrates its commitment to proactively engage in discussion and pursue new opportunities which promote energy and GHG emissions reduction locally. Serving the City from our San Diego regional office, we are committed to utilizing and developing the local workforce, catalyzing not only environmental sustainability, but economic benefits to the City of San Diego as well.

OPTERRA

OpTerra Energy Services is proud to be a part of this incredible lifestyle city. We strive to preserve and protect its beauty and resources by supporting the City of San Diego's leadership in moving towards 100% renewable energy by 2035. We look forward to the opportunity to present our Three-Tiered Integrated Program in more detail to the City of San Diego. We are available to discuss in further detail with key members of our team at your earliest convenience. Please feel free to contact me any time to schedule.

Sincerely,

Crista Curtis
Senior Business Development Manager
OpTerra Energy Services
201 Lomas Santa Fe, Suite 480
Solana Beach, CA 92075
619.241.4673
Email: ccurtis@opterraenergy.com

Company Background

OpTerra Energy Services is the largest independent energy efficiency infrastructure and renewable power solutions provider for the public sector in the United States. With a 40+ year company legacy, OpTerra has implemented economically viable, comprehensive energy programs for over 500 public sector customers throughout the United States, including more than 100 energy programs for California public agencies. OpTerra has over 28 offices throughout the U.S. including one in San Diego County. The OpTerra portfolio has generated over $2.5 billion in utility savings for our public sector customers. Our proven results and diverse experience demonstrate our reliability and credibility to deliver various aspects of the City's Renewable Energy Goals.

Since 2001, OpTerra and its legacy companies have performed design-build energy projects on thousands of facilities. Over 90% of OpTerra projects include an alternative generation or energy storage system. Photovoltaic systems have become the generation system of choice for most cities in order to take advantage of parking lots, rooftops, and available land. Through the implementation of hundreds of solar arrays across the State of California, OpTerra has demonstrated extensive knowledge and understanding of the applicable codes, standards, and legal requirements for the successful implementation of renewable energy projects.

OpTerra is a part of ENGIE's North American sustainability portfolio of companies, one of the largest companies in the world. ENGIE operates in 70 countries, employs 152,900 people, and captured $4 billion in North American market value in 2015, ensuring that OpTerra will bring a position of financial strength for the entirety of the program. As an ENGIE backed company, OpTerra is empowered to build on the City's award-winning commitment to sustainability by seamlessly deploying the latest global technologies in energy efficiency, renewables, energy storage, and smart solutions for energy management to help the City achieve its Climate Action Plan goals.

OpTerra brings a local focus coupled with vast energy related experience, global access to extensive resources, and substantial financial backing to the City of San Diego, positioning us uniquely to meet your long-term Climate Action Plan goals.

The OpTerra solution incorporates unique aspects of offerings from our sister companies, Ecova and Green Charge Networks. Ecova is the nation's leader of data and technology based solutions for energy and sustainable management, with an identified client savings of over $1.6 billion over the past two years. Ecova offers technology-optimized solutions for sustainability management across sectors to dramatically streamline data analysis processes through advanced software platforms.

Green Charge Networks (GCN) is the country's leading developer of turnkey distributed energy storage solutions, with 50 MWh of Energy Storage Systems (ESS) under contract and 30 MWh enrolled and participating in 8 grid service programs. GCN delivers energy storage solutions to maintain demand reduction, conduct rate arbitrage, join demand response programs, and insulate against future load growth (and help the City generate revenues in energy markets). Their most notable recent San Diego area storage solution was recently deployed at Poway Unified School District and Grossmont Union High School District.

Accreditations

OpTerra goes beyond project implementation, demonstrating long-standing commitment to the energy industry through our involvement with top industry organizations like NAESCO. OpTerra Energy Services has achieved the highest level of accreditation, exceeding industry standard ESCO-level accreditation. We have completed the rigorous process that includes energy supply options — including development and implementation of build/own/operate distributed generation, cogeneration, renewable power supply, and combined heat and power projects. Only a select group of ESCOs have also achieved the Energy Services Provider (ESP) designation.

NAESCO accreditation recognizes a company's technical and managerial competence. Accreditation is granted after careful review by an independent panel of industry experts, none of whom is affiliated with the companies under consideration. Accreditation is granted for a specific time period after which companies must seek reaccreditation and undergo a renewal review.

Department of Energy and Department of Defense

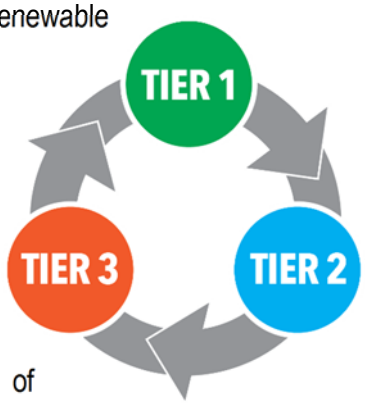
OpTerra is an approved performance contractor for the United States Department of Defense (DoD) and the Department of Energy (DOE). OpTerra has been on their approved list for 20 years and has developed over $60M in Energy Savings Performance Contracts, federal facility management contracts, Utility Energy Services subcontracts and a General Services Administration Federal Energy Supply Schedule contract.

Please visit our website to learn more: www.opterraenergy.com

1. Concept

Please provide a detailed description of the concept (project or program) you are submitting for consideration. Where not otherwise addressed below, please include discussions such as feasibility, impact/benefits, timeframe, costs, and examples of similar successes.

OpTerra offers for consideration a Three-Tiered Integrated Program to help fast track the City's goal of becoming a 100% renewable energy city by 2035. We focus primarily on addressing Strategies 1 and 2 of the City's CAP by first reducing the City's energy usage before generating clean and renewable energy.



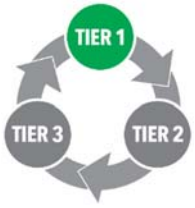
A Fast-Track to Renewable Energy: Three-Tiered Integrated Program

1. Analyze and Prioritize
2. Reduce and Conserve
3. Produce and Renew

To protect the City's environmental and financial assets and viability, reduction of overall energy usage is critical when planning how to meet renewable energy goals.

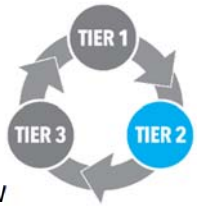
We operate our Three-Tiered Integrated Program under the premise that for the City to achieve 100% renewable energy by 2035, overall energy demand and usage must first be reduced in order to determine the right amount of renewable energy to generate.

Tier One: Analyze and Prioritize



Understanding how facilities use energy is the first step to identifying ways to conserve and how much renewable energy to generate. Using our exclusive data-analytics and Retroficiency software platform (Ecova) we will gain real-time visibility into the performance of facilities in granular detail, all the way down to the individual components in a system. We will provide fully segmented data, paired with actionable insight from our team of experts, to create a roadmap that determines our phasing plan to approach reduction and generation. This allows us to assess energy usage data for multiple buildings and sites simultaneously, identifying most-inefficient facilities to address first. Technologies such as Retroficiency are reshaping the way energy saving potential is identified, making time and labor-consuming, non-data-driven assessment methodologies obsolete.

Tier Two: Reduce and Conserve



Once facilities are prioritized we will determine which efficiency measures will maximize demand reduction. We will deploy a design-build approach to implement those measures. Following the 2003 California Energy Commission Load Order model, we will "decrease electricity demand by increasing energy efficiency and demand response, then meet new generation needs with renewable and distributed generation resources."

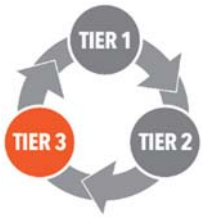
After developing an accurate baseline energy-use model and determining cost effective options for energy savings, our project team will prepare a report to review findings with the City. The report will include baseline

energy usage, proposed Energy Conservation Measure (ECM) savings, along with pertinent information, including utility rates, and Operation and Maintenance (O&M) savings. OpTerra will identify and implement the strategic, cost-effective, and appropriate energy action plan.

OpTerra recognizes that cities often have unique needs, including aesthetic concerns, a wide range of different purpose facilities, and need to consider space optimization. We will ensure these needs are addressed in the process.

ECMs are primarily intended to deliver operational savings to the end user that will reduce energy costs, increase maintenance savings, and improve operational effectiveness. The economic criteria used to evaluate the ECMs and ECM packages are tailored to individual customer needs and generally include simple payback, rebates and incentives, return on investment, and/or present value. As a result, we will identify and implement a cost-effective group of energy savings opportunities—those that provide a high degree of savings in relation to total cost investment.

Tier Three: Produce and Renew



Once we have quantified reduction in facility energy usage, we will then determine how much renewable energy is necessary to serve the decreased demand. We will deploy renewable energy solutions such as photovoltaics, storage, fuel cells, micro turbines, geothermal, wind, small hydroelectric, and biomass.

OpTerra will ensure that the City of San Diego installs the right-sized system so that it does not produce energy it does not need or use, maximizing savings while incorporating a holistic approach to the City facilities' energy use.

We have provided examples of similar success stories for various cities in the Appendix.

2. Alignment with Climate Action Plan

The City is interested in how recommendations will fit into CAP efforts. For each proposed project or program, identify which goals of the CAP and objectives referenced in section I.C will be achieved, and how they will be achieved.

We recognize the importance of being good fiscal stewards of taxpayer dollars as well as achieving environmental sustainability, as defined and outlined within both the CAP and RFI Objectives. By implementing our turnkey Three-Tiered Integrated Program, the City will meet its 100% renewable energy goals and succeed in reducing GHG emissions. This cohesive, streamlined solution emphasizing efficiency of process as well as results, correlates with the City of San Diego's short and long-term goals.

While our response focuses specifically on addressing Strategies 1 and 2 of the CAP, below we discuss how our competencies reach further to align with all of the City's goals. Our Three-Tiered Integrated Program thus serves as a building block towards a more resilient future, both environmentally and economically.

CAP Bold Strategies

1. OpTerra Focus: Energy and Water Efficient Buildings

   Tiers One and Two of our program include quantifying energy usage, identifying and prioritizing opportunities for reduction, designing a fitting solution and installing those solutions. We look for opportunities for reduction in both water and energy, understanding the amount of energy required to treat, transport, and heat water. We recognize that doing so is a critical, inseparable step from installing renewable energy generation on site. Further, by reducing first, there is a lower requirement for renewable energy, keeping project costs down.

2. OpTerra Focus: Clean and Renewable Energy

   OpTerra's Tier Three addresses implementation of clean and renewable energy production based on new demand at energy efficient facilities. We have the ability to install all types of renewable energy including photovoltaics, storage, fuel cells, micro turbines, geothermal, wind, small hydroelectric, and biomass. Solar installations are typically parking lot shade structures, but can also be ground mount or rooftop depending on location and optimal land use. Tier One data-driven results and facility assessments by our engineering team will determine which clean and renewable energy source is best suited for the specific project site.

3. Bicycling, Walking, Transit, Land Use

   With operational cost savings generated through efficiency and renewable projects, the City can apply their resources in other ways such as improving transportation options, including public transport, walkability, and bikeability, or land use optimization. OpTerra is also able to address this CAP strategy by installing EV charging stations, available to the public. Installation of smart-parking applications on streetlights can also optimize the parking process, decreasing the need for vehicles to circle and stall in search of parking.

4. Zero Waste - Gas and Waste Management

   Our portfolio of solutions includes a bill pay system that consolidates all utility bills, including gas and waste. It can find anomalies, identify inefficiencies, and suggest ways to reduce. We can help promote zero waste for city buildings, commercial buildings, and residents. Total waste management solutions can be provided through Ecova's multitude of analytics, including Waste Tonnage Reporting and Volume Analysis Reporting.

5. Climate Resiliency

   Renewable energy and battery storage helps create a more resilient climate by allowing less reliance on combustion of gas for electricity. Our capacity to install an array of ECMs and renewable energy generation technologies through our vendor neutral approach and commitment to use of best products and technologies regardless of affiliation enables us to apply best practices and products that support climate resiliency. OpTerra is able to address infrastructure improvement issues such as installation of purple pipe

or leak detection and pipe repair. This helps allow for a more resilient system, capable of withstanding climate changes or even natural disasters.

City Objectives

1.1 100% Renewable by 2035

OpTerra offers multiple solutions to help meet this goal. As part of our Three-Tiered Integrated Program, we will quantify energy usage in city sites and facilities and increase efficiencies. Renewable will then be sized to decreased demand, lowering the renewable energy requirement to meet this goal. OpTerra will contribute additional sustainability solutions like battery storage where applicable, to enhance usefulness renewable energy capture and increase efficacy of innovative renewable energy solutions provided by OpTerra during Tier Three of our Integrated Program. Through our family of solutions, OpTerra has capacity to reach beyond City Facilities and offer further solutions such as design of incentive programs through San Diego utilities, promoting conservation and renewable energy development in commercial buildings and residential communities.

1.2 Energy Portfolio with Lower Carbon Footprint than Current, Lower than SB350 Standard

Generating renewable energy reduces reliance on combustion of fossil fuels to produce electricity. SB350 standard requires 40% below 1990 CO2 levels by 2030. Through our Ecova partnership, we can help efficiently gather dispersed datasets, perform accurate and transparent GHG calculations, and organize your results to meet the diverse reporting needs of internal and external stakeholders. In addition, Ecova's Carbon Manager module houses powerful analytic tools for forecasting, scenario modeling, and project tracking. These tools are necessary to help the City of San Diego make the best possible investment decisions regarding how to mitigate current and future carbon cost and risk. By first increasing efficiencies then sizing renewable energy to the decreased demand, our Three-Tiered Integrated Program will allow San Diego to surpass this requirement and accurately report progress.

1.3 Identify New and Diverse Sources of Renewable Energy

Depending on our initial data-driven analyses, we will determine the best renewable energy source for each site. As an ENGIE family company, we have access to a wealth of new and diverse renewable resources. However, we are vendor neutral in our procurement, and therefore always looking for the best quality and most relevant product above brand name, also proactively exploring outside our immediate family of resources. Subcontracting, for instance, allows us to customize a best fit plan for the City's specific sites and facilities and also coauthor a scope of work that aligns with the City's interest.

1.4 Ensure Reliable and Sustainable Energy for Near and Long-term

Contracted OpTerra Energy Services come with a guarantee that the delivered technologies reduce and produce energy as promised. Our decades of experience, and trusted relationships with our subcontractors helps us to vet the products we install. We stand behind our work, providing a transparent and qualified measurement and verification program. By using a comprehensive approach and installing multiple technologies that reduce and produce, opportunity exists for energy demand

reduction through multiple sources. Battery storage also aids in this effort, storing energy for when it's needed. Energy demand reduction through multiple sources ensures near-future reliability and sustainability, while renewable production and technologies like battery storage (storing energy for when needed) ensures long-term reliability and sustainability.

1.5 Spur New Renewable Energy Development

A progressive city, San Diego is catalyzing the movement towards a more sustainable future. With OpTerra's holistic, Three-Tiered Integrated Program, we are confident that the City will generate renewable energy not only within San Diego, but also inspire other cities nationally and internationally to do the same. Through our participation in organizations like the World Business Council for Sustainable Development's Zero Emissions Cities Initiative, we aim to also influence business leaders in San Diego to reduce energy demand and produce renewable energy. Lastly, our partner companies have been successful in designing unique incentive programs for commercial buildings and residential communities that promote energy conservation and renewable energy development.

1.6 Energy Efficiency, Demand Response, Alternatives to Generation for City Sites and Facilities

OpTerra's Three-Tiered Integrated Program directly follows California's loading order by first addressing energy efficiency and reducing demand response before creating renewable energy production. However, OpTerra's use of exclusive data-driven technologies differentiates our program by combining our experience level with an accelerated overall time management system for the entire loading order process. OpTerra has decades of experience installing design-build projects that include energy conservation measures (ECMs) such as LED lighting replacement, HVAC retrofits and controls, battery storage, building insulation, and others that are effective as a prerequisite to renewable energy development. Retroficiency software as a tool for quantifying energy use and prioritizing project sites allows an efficient, streamlined process that enhances identification and prioritization of the ECMs to be installed.

1.7 Social Equity

OpTerra contributes to the City of San Diego's social equity in a variety of capacities. We are committed to hiring diversity on every level and have a proven track-record in our Equal Opportunity practices. OpTerra's Supplier Diversity/Small Business Program promotes an inclusive business environment for the benefit of the company and our suppliers. OpTerra uses best efforts to utilize local contractors and Small, Minority-Owned and Women Owned Business Enterprises (S/M/WBEs). In the past we have worked with the following business concerns to develop innovative, cost-effective solutions that fuel our mutual growth. This includes: Small Businesses, Small Disadvantaged Businesses, Small Woman-Owned Businesses, Historically Underutilized Business (HUB) Zone Businesses, Small Veteran-Owned Businesses, Small Service-Disabled Veteran-Owned Businesses, Certified Woman-Owned Businesses, Certified Minority-Owned Businesses, and Certified Lesbian Gay Bisexual Transgender-Owned Businesses.

1.8 Local Investment and Economic Development

We value good fiscal stewardship of taxpayer dollars. From experience, we know that local investment in energy efficiency and renewable energy is well received and enthusiastically supported by City residents who equally value our City's assertive efforts toward environmental sustainability. While our projects lead to a greener economy, they also result in operational cost savings for the City, promoting economic development. Whether through improving transportation options and walkability of the city, planting more trees to further offset carbon emissions and improving air quality for residents, or through job creation, our projects help residents see clearly how their tax dollars are spent. OpTerra knows the importance of visibility and transparency of such a project for a City. We aim to phase our projects to first produce quick wins for the City, followed by longer implementation-phased solutions. We work with the City to achieve goals for multiple stakeholders, including taxpayers. OpTerra's use of local workforce and projects that pay for themselves directly and intrinsically contribute to the City's overall economic development.

1.9 Green Jobs in San Diego

Jobs are created as a result of our turnkey projects, stimulating the local economy. Because of the nature of our efficiency and renewable projects, these jobs are considered "Green Jobs." The City's use of OpTerra's San Diego team and our subcontractors directly creates Green Jobs for San Diego. Additionally, it further inspires businesses and residents to implement similar measures, encouraging even more Green Job Creation. We actively pursue "Green-Job Seekers" or those committed to both the City's and OpTerra's mission of greater environmental stewardship and economic sustainability.

2.1 Cost-Effective for Businesses, Communities, Residents

Our projects pay for themselves through energy savings, guaranteed. We strive for good fiscal stewardship of taxpayer dollars. We demonstrate this by transparency of results to the community, and through creating quick wins for the City as a part of our phased project approach. Decreasing operational costs related to energy use, enables the City to free up finances for economic development projects that positively affect its businesses, communities, and residents.

2.2 Consider Effects on City's Communities, Businesses, Residents

OpTerra is vigilant in corresponding our projects with the City's timeline and we consider this in every Tier of our approach. The scope of work is coauthored by the City and takes into account the wellbeing of the City's communities, businesses, and residents by maintaining minimal-to-no disruption of the City's buildings, streets, or workforce. Our comprehensive, holistic, Three-Tiered approach, guarantees results and produces positive effects on its stakeholders by such possibilities as incentivizing efficiency and decreasing energy bills, while promotion of a cleaner city with reduced GHG and improved air quality increases the resiliency of a beautiful San Diego.

2.3 Innovation

While we use many innovative technologies in our projects, our guaranteed, turnkey project approach is most notable. Design-build procurement enhanced through smart-city data quantification

gives OpTerra an innovative advantage. The integrated process is designed to protect the City from risk, minimize City-staff workload, and establish a process where responsibility is clearly managed by the single entity that guarantees results from start-to-finish, from design-build to measurement and verification. Each Tier of our project is interdependent, all Tiers working together to ensure efficiency in both production and process.

2.4 Long-term Greenhouse Gas Reduction

Efficiency measures reduce electricity demand, and thus reduce dependence on combustion of fossil fuels. Installation of renewable energy such as solar, replaces fossil fuel combustion, offsetting GHG emission production and leading towards a long-term reduction. We provide monitoring and verification as well as a product and service guarantee following project completion to ensure long-term GHG reduction goals are met.

2.5 Minimize use of RECs

By first reducing overall energy demand, then installing renewable energy generation sized to fit the new, lowered demand, we reduce reliance on purchase of RECs to meet mandates set by State.

3. Participation with Renewable Energy Goals

Does the project or program support the City's renewable energy goals? How?

Our Three-Tiered Integrated Program directly accomplishes the City of San Diego's goal to reach 100% renewable energy by 2035 by first reducing the amount of energy demand and then building the right amount of renewable energy needed to serve this decreased demand. According to the EPA, approximately 67 percent of our electricity comes from burning fossil fuels, mostly coal and natural gas. The combustion of fossil fuels to generate electricity is the largest single source of CO_2 emissions in the nation. By offsetting the combustion of fossil fuels through energy efficiency and renewable energy generation, the City of San Diego will reduce GHG emissions in the most effective way possible. This empowers the City of San Diego to meet and exceed Governor Jerry Brown's SB350 order and stand out as a leader locally, nationally, and globally.

4. Implementation and Funding

What are the specific technologies and estimated costs required to implement recommendations, and what might be appropriate funding mechanisms? Identify parties that may incur costs.

<u>Specific Technologies:</u>

Through our parent company, ENGIE, we have access to a global array of advanced technologies and new discoveries to embrace and deploy. While not our primary focus for the purposes of this RFI, our family of solutions includes a diversity of tools and benefits that can contribute to fulfillment of the City's renewable

energy goals beyond our core capabilities. Access to these technologies make OpTerra a key-player in launching the City closer to its goals in the most time and cost-effective capacity. OpTerra is vendor neutral in order to provide the most cost-effective and best product options for our customers.

Tier One: Energy Measurement Technologies

Tier One uses a software platform that when paired with site and facility information, will evaluate and analyze existing energy usage and outputs. This platform will exponentially expedite the audit and data analysis process. At this critical stage, OpTerra will maximize process efficiency by not only identifying areas for energy efficiency and reduction, but simultaneously right-sizing the demand for renewable energy.

OpTerra brings unmatched technological developments through platforms and tools like Virtual Energy Assessment (VEA), a Retroficiency Analytics Platform. As a national leader in energy and sustainability management, our offerings are diverse and far-reaching. However, distinct from other utility management programs, VEA software is revolutionizing traditional audit methodology by remotely evaluating a building's energy consumption and potential for efficiency upgrades at an unmatched speed and scale. VEA provides a new way for municipalities, utilities and energy service providers to prioritize large numbers of facilities, properties and commercial customers for their efficiency programs and engage them with meaningful building insights. VEA helps customers to focus on the buildings with the greatest efficiency potential and significantly increases program participation.

Ecova's Retroficiency software is making headlines. Forbes reported on Ecova's Building Genome Project, which analyzed 30,000 buildings in New York City for potential energy savings factors within just a few days.

"As part of its Building Genome Project last year, for instance, the company looked at publicly available data on 30,000 commercial buildings in New York and determined that turning the thermostat by one degree more than normal could save $145 million."

We have included Ecova's New York City Building Genome Project Whitepaper in the Appendix.

Tier Two: Facility Efficiency Technologies

OpTerra has decades of experience working with municipalities on building efficiency upgrades. From traditional ECMs including HVAC retrofits and controls, lighting, and networking, to more innovative energy efficiency technologies, OpTerra is a leader in the ESCO industry at implementing performance-based energy efficiency and generation projects.

Lighting Technology

> New energy efficient lighting systems are one of the greatest energy-saving pieces of equipment that can be implemented. LED lighting upgrades improve the indoor working environment and reduce exterior lighting pollution, providing better visibility at night and lead to enhanced safety for residents, visitors, and staff.

HVAC Energy Retrofits

Heating and air conditioning system upgrades based on industry-standard life cycles are an integral part of energy efficiency. While upgrading HVAC generally has a lower return on investment than lighting, the overall payback within the life of the equipment reduces energy consumption and improves environmental impact and occupant comfort. Old and inefficient HVAC equipment impairs the quality of indoor air, uses excessive amounts of electricity, natural gas and water, and dramatically increases operation and maintenance costs.

Networked Lighting and HVAC Controls

Energy management and building control systems improve the overall efficiency of the way facilities are managed from lighting levels to climate comfort. They reduce energy use, extend the life of the equipment, and better utilize staff time. Multipurpose use of buildings can make it difficult to control the physical environment of the facilities, which in turn can strain its energy efficiency. State-of-the-art, computer-based energy management systems in every building will allow staff to meet this challenge from a central location. Facility staff will be able to program a facility's energy use for optimum efficiency and comfort, as well as make short-term adjustments to accommodate the scheduled use of the building.

Indoor Air Quality

We can also provide the City with technologies to ensure proper ventilation. We have conducted several projects that have used such technologies to actively assure good Indoor Air Quality (IAQ). Included in this is the use of demand-controlled ventilation.

Demand controlled ventilation provides for control of ventilation to a space based on active measurement of pollutants. One of the pollutants that can accurately be measured is carbon dioxide (CO2), which provides an indicator of occupancy. Typical project installations increase outdoor air to the space when space CO2 levels rise to 600-800 ppm. Outdoor air CO2 levels are normally about 350 ppm. Exposure to CO2 levels of 1,200 ppm for 15 minutes can cause nausea, fatigue, drowsiness, and headaches. This project measure has been implemented by OpTerra at military bases and a number of educational institutions around the country.

More Energy Conservation Measures/ Capabilities

OpTerra consistently seeks new ways to save energy for our clients. The list below contains a select list of just a few of the energy and water conservation measures we might deploy in a given project.

Traditional ECMs

- Lighting upgrades retrofits (interior/exterior)
- HVAC tuning / retro-commissioning
- Roof top retro-commissioning
- Steam system retro-commissioning
- Continuous commissioning
- EV charging stations
- Building envelope improvements
- Power factor correction
- Operating practices
- Facility maintenance (re-training)
- Vending machines "vendor misers"
- Air Side
- Outside air economizers
- Radiant heating
- Demand ventilation
- Heat reclamation
- Efficient fume exhaust hoods
- Heat recovery units (enthalpy wheels)
- Transformer Replacements

Controls

- Building automation controls
- Energy management systems
- Variable frequency drives
- HVAC set point optimization
- Central Plant / Mechanical Room
- Electric motor replacement
- Ultra-efficient chillers
- High-efficiency boilers
- Water heating systems
- Heat exchanger systems
- Water treatment systems
- Tower free cooling
- Boiler retrofits / optimization
- Waste heat recovery
- Energy recovery (air, steam etc.)

Water

- Water conservation and efficiency
- Low-flow water appliances
- Irrigation and landscaping

Tier Three: Renewable Technologies

We will deploy renewable energy production solutions sized to a decreased energy demand. Types of renewable energy endeavors include photovoltaics, storage, fuel cells, micro turbines, geothermal, wind, solar, small hydroelectric, and biomass cogeneration. Through data-based assessment we will be able to determine what is the most cost and environmentally effective option for the specific City site.

Our team is experienced with a variety of solar PV systems of all sizes – from as small as 50kw rooftop installations to 5 MW solar shade structures and large-scale ground mount projects.

Through the implementation of hundreds of solar arrays, OpTerra has demonstrated extensive knowledge and understanding of the applicable codes, standards, and legal requirements for the successful implementation of renewable energy projects. Interconnect requirements (Rule 21) employed by the local utility, will likely apply to the power generation projects developed under subsequent RFPs.

OpTerra will ensure that the City of San Diego installs the right-sized system so that it does not produce energy it does not need or use: a system that not only maximizes savings to the City, but takes a holistic look at city facilities' energy use while anticipating energy reduction.

Our process is designed specifically to incorporate both technical requirements and unique local considerations. Our team is highly practiced in considering the needs and future plans of each individual site, and we frequently conduct community outreach to ensure that employees and residents understand the benefits and construction impacts of our projects.

Storage

Through our sister company, Green Charge Networks, OpTerra can deliver battery storage solutions for select sites to maintain demand reduction, conduct rate arbitrage, join demand response programs, and insulate against future load growth. As an example, San Diego's Poway Unified School District has installed more than 6.3 MWh of energy storage. The Green Charge energy storage system is now deployed at 12 campuses including elementary, middle and high schools and is expected to save the district more than $1.6 million over the 10-year term of the contract with Green Charge. Other benefits of battery storage include load smoothing, which encourages customers to reduce their consumption at peak times in exchange for other benefits and also the ability to store energy from renewable sources to ensure a consistent flow of energy.

Costs

Our programs are specifically developed and designed to **self-fund** through energy savings and require **no up-front capital** from the City or any other parties. Energy savings can be enhanced by combining **multiple funding sources** and available financing mechanisms.

Equipment Procurement

OpTerra follows a strict policy of vendor neutrality in order to deliver the greatest overall project value. OpTerra negotiates master purchase agreements (MPAs) with a multitude of equipment manufacturers, consultants, and service providers. This purchasing power and market leverage typically results in favorable terms, pricing, and equipment lead times from competing vendors.

In addition to leveraging the benefit of pre-negotiated MPAs, OpTerra procurement managers and project personnel also drive down major equipment costs by employing well-constructed competitive bid processes for services and equipment.

Funding Mechanisms

OpTerra's in-house financing team is experienced in securing multiple funding sources for our customers. We will work with the City to leverage a variety of financing methods, including private sector loans, municipal tax-exempt leases with non-appropriation clauses, certificates of participation (COPs), standard capital leases, Private Activity Bonds, internal cash flow, and third party-ownership (including Power Purchase Agreements, Commodity Off-Take Agreements and Public/Private Partnerships). **As a result, most projects can be funded with no up-front capital, so the City can redirect its resources to other important strategic priorities.**

For renewable energy projects, we offer expertise in multiple forms of funding sources that allow that the City to leverage federal loan programs; for example, Certified Renewable Energy Bonds (CREBS), when structured as a Direct Subsidy Bond, where the bondholder receives federal tax credits in lieu of a portion of the traditional bond interest, result in a lower effective interest rate for the borrower (sometimes less than 1%) and often provide a better return on investment than traditional Power Purchase Agreements.

Familiarity with Local Utility Incentive Programs

Our San Diego County-based team has extensive experience with SDG&E incentive programs such as On-Bill-Financing, rebates and incentives, and will manage deadlines, applications, and reporting requirements. We maximize the funding amount the City of San Diego will receive for the duration of their projects.

Over the past five years we have helped secure more than $100 million in state and utility incentive or rebate funding on behalf of our California customers. Almost every project we build receives some type of utility rebate or incentive. For example, OpTerra assisted San Dieguito Unified High School District with funding through utility rebate programs. As a result, they have received nearly $6M through the California Solar Incentive. We managed the entire application process and verification process for them.

Private Grants

Leveraging connections to grant writing firms coupled with our in-house expertise, we offer a superior advantage by providing customers direct access to experts who can help craft a program scope to improve the likelihood of obtaining grant dollars.

5. Schedule

What is an estimated timeframe for implementation of projects or programs submitted, and what are the factors that may contribute to accelerating or slowing the implementation timeline?

OpTerra's proposed Three-Tiered Integrated Program will enable us to rapidly accelerate implementation when granted single-point-of-responsibility from start-to-finish. We anticipate a timeframe for our Program of 3-5 year increments over multiple phases. As a design-build firm, our built-in quality control measures and internal processes for implementation, along with extensive access to financial, legal and technological resources will expedite workflow with minimal disruption to the City of San Diego. We anticipate a maximum benefit to the City, defying the 2035 deadline by actualizing our contributions to the City's Renewable Energy Goals substantially earlier than 2035. The following best practices we use for implementation ensure that we meet schedule and accelerate delivery.

Project Management

OpTerra's goal is to provide a smooth, turnkey project that minimizes impact to facilities operations while saving as much energy as possible, as quickly as possible. Our collaborative approach includes the City in the process to the extent desired by the City, and has proven effective at eliminating unexpected obstacles while meeting operational goals. We will keep communication channels clear and open between OpTerra, its subcontractors, City staff, advisors and departments such as Environmental Services, Public Utilities, Planning and Economic Development.

Our approach to managing a project work flow is guided by OpTerra's Standard Operating Procedures, keeping our project management processes smooth and reliable. Using a disciplined approach to project planning and control, OpTerra will identify cost and schedule performance data, then compare the status of the project performance against a time duration and cost performance baseline. We will monitor the project time duration and cost-performance baseline by assessing inputs from our internal accounting (i.e., the actual dollars spent or committed), contract management, and project management (i.e., the actual delivery order performance). This will provide a timely and visible mechanism for project progress on variance analysis, forecasting, and corrective action as needed.

In addition to providing accurate project status, use of the project time duration and cost performance baseline facilitates systematic risk control and management. Consistent with our emphasis on low risk and optimal payback, we will identify, assess, manage, and reduce risks associated with project cost, schedule, and technical performance. We involve subcontractor team members in project planning and cost estimating to validate established goals and help to ensure low-risk project implementation.

OpTerra has developed an extensive document control system to help ensure the quality and timeliness of submittals to the City. Adequate internal controls and reviewing procedures help eliminate errors or omissions and ensure technical accuracy of our output. An in-house registered professional engineer reviews all OpTerra work plans before submittal to the City.

Schedule and Team Collaboration

OpTerra follows a number of standard operating procedures to help ensure projects are on schedule to meet construction deadlines. For example, a project manager uses our construction tracking tool to deliver detailed site installation lists to a construction manager. The construction manager then creates a Gant chart using Microsoft Project® for tracking weekly construction progress. The construction manager establishes construction start and completion dates for each energy conservation measure so that a project completion schedule/curve can be formulated. The construction manager compares the actual progress to the projected progress to anticipate delays or advances in construction.

Construction Management

OpTerra manages construction activities with our in-house construction managers. Depending upon the project size and complexity, a full time, on-site construction manager may be assigned to the project. The construction manager adheres to OpTerra's Standard Operating Procedures, necessary for project installation with all applicable codes and regulations. Careful attention to job safety, handling of hazardous materials, and coordination of construction activities ensure minimal disruption to the City and are also outlined in our operating procedures.

Coordination with Utilities, Subcontractors, and Facility Personnel

OpTerra will provide an on-site construction manager and assume responsibility for the proper installation of all equipment. The project manager works in conjunction with a construction manager with all construction activities. The on-site construction manager will provide a managed process to incorporate the City's stated inputs, goals, and needs into a successful energy savings project. The construction manager's regular presence on a job site provides the opportunity to develop a close working relationship with the City's staff.

The construction manager is responsible for construction scheduling, subcontractor and vendor coordination, safety programs, security issues, permits and licenses, and progress meetings with subcontractors and vendors. The construction manager inspects subcontractor work for fulfillment of design and performance specifications.

6. Potential Participants

Who are potential participants in the implementation and operation of the proposed projects or programs?

Potential participants in the implementation and operation of our proposed Three-Tiered Integrated Program include in-house OpTerra staff, engineers, project managers, finance team, key City staff, our sister companies Ecova and Green Charge Networks, along with our local subcontractors and workforce. OpTerra prides itself on communication, collaboration and cooperation of these project participants.

Local Workforce

OpTerra believes that supporting the local workforce promotes sustainability by creating jobs while simultaneously stimulating the local economy, thus benefiting the community, the City, and the families it serves. We have developed long-standing relationships with a large selection of qualified mechanical, electrical, controls, and

specialty subcontractors. We also welcome recommendations from staff for preferred vendors and contractors who have previously worked for the City and are in good standing.

In-house Equal Opportunity Practices

Achieving the full potential of a diverse workforce is a business priority that is fundamental to OpTerra's success. A key element in our workforce diversity programs is our long-standing commitment to equal opportunity and social equity. Business activities such as hiring, promotion, and compensation of employees, are conducted without regard to race, color, religion, gender, gender identity or expression, sexual orientation, national origin, genetics, disability, or age. These business activities and the design and administration of our benefit plans comply with all applicable laws, including those dealing with equal opportunity. This policy is based on sound business judgment and anchored in our values. Every manager is expected to abide by our policy, and all applicable laws on this subject, and to uphold our commitment to workforce diversity.

Subcontracting Practices

OpTerra's Supplier Diversity and Small Business Program is an important part of the corporation's Procurement function, and ensures all businesses are considered on the basis of merit, not just size and strength. These value-added small, minority- and women-owned businesses provide innovative solutions that fuel mutual growth for both their firms and our corporation.

We use an extensive pre-qualification process to select subcontractors and suppliers for our projects. Our pre-qualification process is based on our in-depth experience identifying subcontractor qualities that assure optimal contract completion and quality performance, service and products. To implement projects, we prefer to use local subcontractors with outstanding track records. OpTerra employs best efforts to utilize local contractors and small, minority-owned and women business enterprises (M/WBEs).

Our Supplier Diversity/Small Business Program consists of:

- Utilization - We integrate strategies to include competitive sourcing opportunities.
- Training and education - We offer training and support for small, minority and women-owned businesses on how to do business with OpTerra.
- Tracking - We monitor and report our progress towards achieving our program targets with emphasis on continuous improvement.
- Certification - We verify that businesses meet the criteria of ownership to qualify as a minority, woman-owned, small disadvantaged or HUB Zone certified firm. Certification workshops, training and partnerships with recognized certifying organizations help facilitate the process.
- Outreach - We seek out diverse suppliers through active involvement with small business and minority development organizations and participation in various trade shows.

City Staff

When deciding on our scope of work we work closely with City Staff to better understand the City's goals and challenges. Our collaborative process assures constant communication to guarantee desired outcomes for multiple stakeholders within the City.

7. Program Integration

How is the specific project or program new or different than what the City is currently doing, and how can it potentially be integrated with existing or future projects or programs?

Innovation through Integrated Fast Track Process

OpTerra proposes an integrative, holistic, comprehensive Program that is not disjointed, but streamlined and turnkey. Our seamless process fast tracks the City of San Diego to its 100% renewable energy goal. Our single-point-of-responsibility offerings eliminate redundancies, overlap and risk of critical pieces "falling through the cracks." We ensure that all design-build applied technologies such as lighting, controls, solar, and monitoring are cohesive, compatible and sync together to minimize production and service disruptions. Ongoing analysis focused on managed innovation and finding applicable solutions can be deployed in the right place at the right time, with faster response time to City schedules and infrastructural needs. We offer the most efficient *process* for achieving efficiency, avoiding redundancies and duplicities of work.

World Business Council for Sustainable Development

Our collaboration with the World Business Council for Sustainable Development enables us to gain and apply critical insight in sustainability, based on our involvement in engaging dialogue between the City of San Diego and the business and commercial sector.

The World Business Council for Sustainable Development (WBCSD) is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment. Through its members, the Council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action to drive business action on sustainability in the coming decade and beyond.

Beyond Energy into Community Outreach

Because OpTerra is not a "solar company," but a largescale energy services provider, we offer far more than building and production services. We are committed to our mission of environmental sustainability on multiple levels, and consistently incorporate community engagement and economic development programs as a part of our holistic approach.

OpTerra understands the importance of designing community outreach programs to ensure that City employees and residents understand the benefits and construction impacts of our projects. OpTerra's talented communications staff works with our customers to educate and engage local citizens about ongoing energy and community project

work, especially related to conservation efforts. This is done through press releases, case studies, brochures, web pages, presentations, multimedia and informational displays, and even strategic story development and speeches. The team also looks forward to planning groundbreakings, ribbon cuttings, dedication events, media interviews, press conferences, and project tours to showcase continued project success. We work closely with City staff to design a customized public outreach program that dovetails with the City's current outreach pathways and efforts.

Economic Development and The Capacity Project

We also recognize the City of San Diego's commitment to economic development. According to the International Economic Development Council, the main goal of economic development is "improving the economic wellbeing of a community through efforts that entail job creation, job retention, tax base enhancements, and quality of life." To address this goal, OpTerra offers a unique partnership with The Capacity Project (TCP,) designed to empower cities to help residents and businesses save energy and money while supporting local economic development. It is now also receiving recognition as a method low income communities can leverage to help students pay for college.

TCP engages residents, students, and businesses in energy saving activities, the rewards program showcases how dollars saved are spent locally, thus promoting economic development. The program provides web and mobile tools for residents to track energy use and identify savings opportunities. Students are trained and receive paid internships to help engage residents. TCP as a city offering inherently creates the need to build connections with local schools, including high schools, community colleges, and universities, increasing exposure to green careers, offering world application from OpTerra mentors, and opportunities for participation in council meetings to garner support and increase awareness. TCP is implemented via paid student interns, hired, trained and certified from local high schools, and measured through metrics such as number of students trained and number of residents reached.

Transparency through Technology

As evident in our technologies like Ecova, and Utilityvision (our usage and monitoring software), OpTerra is data-focused. We combine our competencies for acquiring and applying exhaustive energy data with strategic and effective implementation. Programs like Utilityvision leverage impact to all stakeholders by providing transparent, real-time usage and savings monitoring not only to technical users, but also to the general public, promoting positive community engagement for the City of San Diego and its residents.

Internships, Apprenticeships, Mentoring, and Community Projects

OpTerra believes that every energy program can and should provide lasting benefit to the communities where we work. Our offering to the City of San Diego includes public outreach campaigns, as well as educational opportunties through Cleantech San Diego, and some of our partners such as the San Diego County Office of Education, and the San Dieguito Unified School District to forge pathways to college and career readiness through job shadowing, internship programs, and opportunities for learning business alongside our talented personnel.

8. Potential Obstacles and Solutions

What are potential obstacles to implementation, including compliance requirements, regulatory barriers, technological or market feasibility, financing limitations and/or other parameters? Identify potential solutions for each.

Many cities utilize procurement policies that inadvertently create a compliance barrier and create risk for the City by removing single-points-of-responsibility. Traditional procurement processes such as design-bid-build create intrinsic obstacles to implementation by decelerating the entire production process and increasing risk to city by subdividing responsibility between multiple unrelated entities. It also creates more chance of errors and delay as a result.

These policies prevent a holistic approach and solution where a single entity can take responsibility for the project from analysis to implementation, and guarantee results. Such approaches also potentially create inefficient blame-shifting situations in a reactionary response to process errors and initiate change orders, undermining productivity and creating a bottleneck or standstill. If the builder and implementer is also the designer, there is less possibility for critical missteps with too many entities managing different parts of a program or project.

OpTerra's Three-Tiered Integrated Program using data and technology-driven solutions coupled with our extensive experience as a design-build firm maximizes our potential to help the City fulfill its energy goals effectively and efficiently. We offer a solid and reputable performance guarantee, absorbing technology efficacy risk for the City. Our Three-Tiered Integrated Program and design-build process promotes environmental and economic efficiency on very pragmatic levels by providing the City with early knowledge of a firm, fixed price, enhanced quality of products and services, value engineering practices, and maximized time efficiency.

Energy efficiency measures typically have few to no regulatory barriers. We foresee few financial limitations as our Program is easily funded by using the multiple options described in Section 4 above.

9. Expected Outcomes/Results

What are the estimated results of the proposed concept(s), including the potential for greenhouse gas emissions reductions, numbers of residents and/or businesses accessing the program, economic impacts, ...etc.?

OpTerra's Three-Tiered Integrated Program will have immediate and long-term critical impacts for the environment and economy of the City of San Diego and the people it serves. Tier One will accelerate the overall timeline and process to achieve these outcomes. Tier Two will reduce overall energy usage demand, while Tier Three will produce sustainable long-term renewable energy alternatives.

Upon completion of design-build, implementation and commissioning of retrofits within phased 3-year increments, OpTerra will guarantee renewable energy production, decreased REC dependence, and GHG emission reduction, helping the City achieve 100% renewable energy by 2035.

Savings and Guarantee

Ultimately, OpTerra guarantees financial and energy savings as an expected outcome and benefit for the City of San Diego through our Three-Tiered Integrated Program. OpTerra uses many proven engineering methods to

estimate energy savings, including computer modeling, graphical analysis, sub-metering and testing of facilities, spreadsheet analysis, and field measurement and verification. Before beginning construction, OpTerra offers the City a firm, fixed price for our scope work. We guarantee performance by establishing a baseline energy use, predicting the savings reduction by using industry established building modeling and calculations, and monitoring and verifying the energy reduction throughout the guarantee period.

Energy Management

OpTerra Energy Services has one of the largest, most experienced Energy Management Groups in the industry, solely dedicated to measurement and verification (M&V) of system savings. A professional engineer and Certified Measurement and Verification Professional (CMVP) with more than 20 years in performance contracting leads a team of over 15 full-time dedicated staff, with an average time in performance contracting of over 10 years each. Our EMG has overseen hundreds of guarantees and currently has more than 75 clients with ongoing guarantees that total over $500M with a 5-year, 98.8% success rate.

Measurement, Verification and Transparency

Our Measurement and Verification process fosters community engagement and transparency for City residents and businesses through our web-based renewable energy production and usage monitoring analytics tool, Utilityvision, and through Ecova's array of monitoring software platforms. Utilityvision can be set up for general users with community-facing dashboards to promote transparency and energy conservation to the public. This fosters transparency greater community involvement by providing dashboards for the general public to observe savings and performance metrics in real-time. Utilityvision provides access to real-time project performance, energy monitoring tools that enables users to visualize and analyze their energy consumption and solar production data from anywhere at any time using vivid engaging dashboards.

Achieving CAP Goals

OpTerra's Three-Tiered Integrated Program will have direct benefits and impacts by expediting the City's ability to meet its CAP goals, lowering costs, engaging the community of San Diego through mechanisms for transparency such as Utilityvision and Ecova's array of monitoring software platforms, and ultimately contributing to the City of San Diego's recognition as a global leader in spearheading aggressive action toward GHG emissions reduction and renewable energy. The Program will permit the City of San Diego to exceed the SB350 standard, verifying target emission reduction through Ecova's Carbon Manager module.

Economic Impact and Accessibility for Residents and Businesses

OpTerra's involvement with the local workforce will intrinsically create Green Jobs for the City of San Diego, stimulating economic growth for the City while alleviating unemployment and working to protect the environment. Through programs such as the Capacity Program, we leverage our energy project to engage students, businesses, and residents through outreach, education, and mentorship opportunities. In partnership with Ecova we can also create incentive programs through local utilities and/ or the City to encourage further fulfillment of CAP goals for residents and businesses.

10. Additional Comments

Include any other comments that you would like to offer that were not previously addressed.

OpTerra Energy Services brings a dynamic and energetic approach to meet the City of San Diego's bold move towards 100% renewable energy goals with our equally bold, and feasible approach defined by our Three-Tiered Integrated Program. Our process will guarantee not only long-term renewable energy benefits, but also the most efficient, time and cost-effective process from concept to completion.

Appendix

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Examples of Similar Successes

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City of Brea

The Opportunity

The City of Brea, nestled among the rolling foothills of the Chino Hills Range, prides itself on its small town atmosphere. Committed to sustainable development, the City provides a diverse range of services to its 40,000 residents with the goal of harnessing long-term benefits for a growing community. The City's innovative Green Life, Green Brea program underscores Brea's strong commitment to the environment by providing a forum for sharing green practices with residents and businesses.

The Partnership

In July 2010, Brea partnered with OpTerra Energy Services to design and implement a comprehensive, citywide program as part of its Green Life, Green Brea initiative. Created to meet the unique needs of Brea's community, the innovative program – complete with 1.8 MW solar power generating systems – will continue to generate savings for the City's General Fund by reducing overall utility consumption and mitigating costly water pumping fees. The long-term benefits the program has brought to the community are significant: creating over 100 new jobs, attracting businesses to headquarter in Brea, and improving workforce development and training. The energy efficiency and solar power program delivers significant, long-term benefits to the City of Brea – further crystalizing Brea's position as a leader in sustainability among California cities.

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Program Highlights

- $13MM in cost savings projected over the life of the project
- Reduced utility costs by as much as 40%
- Reduced 86,000 metric tons of CO_2 over 25 years through clean solar power generation – equivalent to removing 16,000 cars from the road

Technical Scope

- 1.8 MW solar PV system at three city sites (Civic Center, Reservoir Pump Yard and shade structures at the Community Center)
- Citywide streetlight retrofits to energy-efficient induction lights
- Interior and exterior lighting retrofits at 14 sites
- Major heating, ventilation and air-conditioning infrastructure upgrades and controls at six civic sites

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Water Scope

As the City considered options for savings, it became important to design a plan that would incorporate efficiencies for water operations, given significant electricity input to meet pumping demands. 4,914 roof-mounted photovoltaic (PV) panels with 1,154 kW capacity were installed over the main reservoir in the Public Works yard in order to help mitigate future pumping costs to the city. HVAC upgrades were also made at the City Yard Pump House to improve reliability and efficiency.

The Impact

As part of Brea's Green Life, Green Brea program, OpTerra helped transform vital city spaces with the community in mind. Outfitting the Brea Civic and Cultural Center with modern solar arrays, for example, not only offered shade during the day for visitors and passersby, but was coupled with upgraded energy efficient lighting on sight for improved lighting during night events. Helping the City save over $13 million over the lifetime of the project, the OpTerra program reduced Brea's utility costs by as much as 40 percent. In order to ensure the impact of these dramatic savings translated to long-term community education on sustainability, real-time solar production data at the Community Center was captured through an interactive, informational kiosk display and on the City's website.

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City of Dinuba

The Opportunity

The City of Dinuba, also known as "Raisin City USA," was looking for ways to save energy and money without incurring costs upfront. The wastewater treatment plant bore the City's heaviest electricity load but there was no typical way to install a solar system to take on that burden: the plant sat next to an inactive landfill, and regulations prohibited breaking ground there due to concerns about ground water contamination.

The Partnership

OpTerra Energy Services developed and installed a special, ballast-supported PV system that didn't penetrate the top of the landfill. A power purchase agreement financial structure was put in place so the City benefits from predictable electricity rates over 20 years, which helps offset increases in sewage fees.

The Impact

The new solar system decreases energy demand without increasing energy costs. In fact, the solar panels have been planned to generate all the electricity needed to run the facility. The landfill has become useful again. The long-term fiscal benefits of the energy savings program enable the City to pass savings on to its citizens, who also enjoy a healthier environment, thanks to a substantial reduction in greenhouse gas emissions.

Program Highlights

- Makes unusable land viable again
- Saves between $3MM to $6MM over the life of the project, with no upfront cost to the City
- Reduces greenhouse gas emissions equivalent to the carbon sequestered by 342 acres of U.S forest in one year

Technical Scope

- 1.15 MW solar photovoltaic (PV) system, which consists of 4,700 ground-mounted solar panels built on a seven-acre former landfill site

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City of Gonzales

"We initially set out to create a partnership that would not only advance our Gonzales Grows Green (G3) initiative, but do so in a way that would maximize savings to the City's general fund and save taxpayers' money. I am proud to report that over the lifetime of the project, we expect to generate $4.7 million in savings, allowing the City to maintain and enhance services to its more than 8,000 residents."

René Mendez, City Manager, City of Gonzales

The Opportunity

In 2008, the City of Gonzales launched a long-term sustainability initiative, Gonzales Grows Green (G3), seeking to improve the economy, environment, and social equity in the entire community. In November 2012, the City launched an energy efficiency and solar power program, marking a significant step toward these G3 efforts.

The Partnership

OpTerra Energy Services worked with the City to define a public-private partnership project that supported its carbon reduction, climate action and resource conservation goals, while achieving reductions in energy and maintenance costs. OpTerra then designed, engineered and constructed the project, which included retrofitting City-owned streetlights, installation of solar power systems at two sites, and upgrades to the City's water pumping stations. These improvements help conserve electricity and enable the City to control operation of its well pumps from a central location.

Partnering with Constellation Brands, whose Gonzales winery serves as one of two solar installation sites, the City of Gonzales was able to substantially offset electric utility purchases for its adjacent water pumping station. The second solar installation at the City's wastewater treatment plant provides all of the plant's current electricity needs.

The solar project was financed by a municipal lease that included construction financing and a customized payment structure that matched the public incentives for solar and avoided utility energy costs associated with the solar energy system – all planned to allow the project to pay for itself.

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Program Highlights

- Achieves $4.7MM in net savings over 20 years
- Generates clean, electric power and improves operational efficiency
- Reduces electric utility purchases by 49%
- Offsets greenhouse gas emissions by 324 metric tons, equivalent to the carbon sequestered annually by 974 acres of U.S. forests
- Supports Gonzales Grows Green initiative and creates a sustainable model for other communities

The Technical Scope

- Installed 426 kW of solar power at two sites
- Upgraded all City-owned streetlights
- Upgraded interior lighting at the Fire Station and interior/exterior lighting at the Corp Yard
- Upgraded all water pumping stations
- Installed remote supervisory control and data acquisition (SCADA) system providing better monitoring and well pumping control

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The Impact

The City of Gonzales project serves as a model of sustainability for other communities. It is a clear demonstration of how public and private entities can work together to achieve mutual benefits by finding innovative ways to save money, support their communities, and reduce their carbon footprint. This public-private partnership model offers a path that other cities can follow in their efforts to transform and strengthen community bonds and maintain and enhance municipal services for businesses and residents.

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City of Hanford

"These critical investments in clean renewable energy prepare Hanford for a more sustainable future while providing long-term savings that can be redirected to other community services."

Darrel Pyle, City Manager, City of Hanford

The Opportunity

The City of Hanford is in California's San Joaquin Valley, where most of California's produce is grown. In 2012, Hanford's leaders sought ways to improve the operation of their Wastewater Treatment Plant (WWTP), which treats over five million gallons of wastewater every day. City leaders moved to reduce the cost of the operation to directly translate into savings for residents and local farmers.

Another program goal was to address significant environmental issues including poor air quality from the combination of farming, industry, traffic and topography. This project bolstered the City's commitment to the community by reducing the pollution in the Central Valley, displacing fossil fuel energy with clean renewable solar energy.

The Partnership

Hanford partnered with OpTerra Energy Services to develop a solar program to save money on electricity costs. The 1.12-megawatt solar photovoltaic (PV) tracking system installed at the WWTP automatically angles the solar arrays toward the sun for maximum power production. After this program successfully offset 50 percent of the City's utility purchases at the Plant, City leaders were excited to explore a next phase of work with OpTerra. Phase Two encompassed additional solar installations and energy efficiency improvements, to capture more savings and realize further benefits.

With the second phase of work completed in the spring of 2016, Hanford now has sustainable energy solutions implemented across 16 high-traffic sites including City Hall, the WWTP, the Train Station, the Fire Station, the Airport, the Police Department, the City Auditorium and several parks. As part of the second phase of work, a

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Program Highlights

- Expected net savings of $23.7MM as a result of the two-phased project
- 45% reduction in annual electric utility purchases City-wide
- Offsets 5,521 metric tons of greenhouse gas emissions equivalent to removing 1,166 cars from the road annually

The Technical Scope

Implemented sustainable energy solutions across 16 sites including the Wastewater Treatment Plant (WWTP), City Hall, the Train Station, the Fire Station, the Airport, the Police Department, the City Auditorium and several parks.

Upgrades included:

- A total of 3.42 MW ground-mounted single-axis tracking solar photovoltaics (PV) adjacent to the WWTP
- LED lighting at most City buildings, parks, and traffic intersections

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2.3-megawatt ground-mounted solar system was installed adjacent to the WWTP to avoid electricity use at all City facilities. Additionally, LED lighting at most City buildings, parks and traffic intersections improved efficiency, performance, visibility, and nighttime roadway safety. This second phase of work reduced the City's overall electric utility cost by 35 percent.

To pay for the most recent project, which is valued at over $9.9 million, the City used a design-build approach to lower the overall cost. A combination of funding streams were leveraged including financing through a 15-year tax-exempt lease purchase at a low interest rate. In addition to this, the City captured more than $100,000 in utility rebates.

The Impact

Through working with OpTerra to design and implement two successful phases of solar and energy efficiency upgrades, the City of Hanford has cemented its role as a regional leader known for prioritizing both fiscal and environmental stewardship. On top of cutting the annual cost of powering the WWTP, a critical asset to the community, in half, the new solar systems reduce greenhouse gas emissions equivalent to removing 1,166 cars from the road every year.

By reducing the cost of energy demands at City facilities and at vital service sites, Hanford is better positioned to redirect their savings to attend to the community engagement needs of its residents. Local community members who support the farm economy and local industry are now able to access community services that are funded through energy savings achieved from this program.

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City of Lemoore

"With a combination of financing, grants and incentives, we were able to leverage a modest investment of taxpayer funds for the maximum benefit. This project will enable us to save significant amounts of money and energy."

William Siegel, Mayor (2012 – 2014), City of Lemoore

The Opportunity

The City of Lemoore, located in Kings County, California, supports a population of nearly 25,000 residents, with an economy fueled by the Lemoore Naval Air Station, the Tachi Palace Hotel & Casino, and many food and agricultural enterprises. Beginning in the fall of 2007, the City Council initiated a series of local stakeholder discussions on energy efficiency, conservation, and renewable solar generation. As a result of these planning meetings, the City asked OpTerra Energy Services to conduct a preliminary study of City facilities to determine if there were energy efficiency and solar photovoltaic (PV) solutions that made economic sense for the City to consider. In 2008, OpTerra launched the first phase of work on a three-phase program to save money and energy for the City, completed over the course of seven years.

The Partnership

The comprehensive program encompassed energy efficiency measures, an LED streetlight retrofit, and an expansive solar installation to power domestic water wells, a wastewater treatment plant, and several other facilities throughout the City. Between 2008 and 2015, OpTerra's team of expert engineers and project managers worked alongside City leaders to execute three phases of work.

Phase I: Lemoore Boosts Efficiency

Phase 1, completed in 2009, focused on energy efficiency and solar power. OpTerra provided a rooftop solar system at the Cinnamon Municipal Complex (CMC) and solar canopies at the Police Department, which generated power while also providing shade for police cars and staff vehicles. The solar projects are generating 10 percent more energy than initially estimated. In addition to replacing old infrastructure and reducing

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Program Highlights

- Expected to deliver $49MM in net savings over the life of the program
- Avoids 4,616 metric tons of carbon emissions per year, equivalent to annual emissions from 972 cars
- OpTerra helped the City manage new opportunity streams to obtain grants and incentives

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The Technical Scope

Phase I – Energy Efficiency and Solar Power Program, 2008–2009

- Installed 154 kW of solar PV power:
  - 106 kW rooftop solar system at CMC
  - 48 kW solar shade structure at Police Department
- Lighting retrofits at eight facilities
- Major HVAC upgrades at two facilities
- Roof replacement at CMC
- Installed wastewater circulation system and weather-based irrigation system

Phase II – Streetlight Retrofit Program, 2012

- Retrofitted more than 1,200 City-owned streetlights with LED fixtures

Phase III – Solar Power Program, 2013–2015

- 3.1 MW solar project for domestic water wells, wastewater treatment plant, CMC, Police Department, and other City facilities
- New parking lot at CMC
- Electrical infrastructure upgrades

energy costs, the City put water conservation at the forefront by completing a $3.9 million integrated energy and water conservation project in July 2009.

Phase II: Brighter Streets, Better Savings

In 2012, OpTerra launched an extensive LED streetlight retrofit program to trim the City's annual energy consumption and costs, reduce maintenance costs, and create brighter City streets. As part of Phase II, 1,200 City-owned streetlights were retrofitted with LED fixtures, made possible with funding by an Energy Efficiency and Conservation Block Grant. The streetlight replacement program resulted in more than $30,000 in annual net savings.

Phase III: Powering the City with the Sun

During the ambitious third phase of work, which was completed in 2015, OpTerra installed a solar power program, which now generates the majority of the electricity needed to power domestic water wells, wastewater treatment plant, the CMC, the Police Department, and other City facilities. This phase of the OpTerra/Lemoore partnership qualified for $1.9 million in incentives to support the cost of the program and provides a significant hedge against future electricity price increases. These upgrades not only provide relief to the City's General Fund, they also provide tangible benefits for Lemoore citizens, including local job stimulation associated with the project.

The Impact

The comprehensive program will generate more than 3.2 megawatts of electricity and reduce purchases from the electric utility by close to 100 percent for most of the facilities. Over the life of the project, the City of Lemoore is expected to save $49 million.

The groundbreaking ceremony took place on August 29, 2013, at the Lemoore Civic Auditorium, celebrating the start of construction of the third phase. The Lemoore community lauded the program for having a measurable impact on the local economy, stimulating jobs associated with the improvements. Throughout all phases of the project, OpTerra outreached to local contractors and approximately 75 percent of the total subcontracted work was performed by companies located within 50 miles of City Hall. The City firmly believes that community partnerships and cooperation greatly enhance the quality of life. This program, in partnership with OpTerra, embodies this sentiment and exemplifies Lemoore's leadership in sustainability and renewable energy in the region.

To learn more about OpTerra, visit **www.opterraenergy.com**

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City of Livermore

The Opportunity

Livermore wanted to do more than just become a champion of environmental stewardship – City leaders knew that they could create a program that would wholly improve the lives of its residents by creating jobs, engaging students, bolstering local business, and reducing taxpayer burden. Livermore sought out a partnership with OpTerra Energy Services to develop a holistic program focused on this big picture impact. Through a comprehensive set of energy and community engagement solutions, the Livermore-OpTerra Energy Services Live More, Save More program reflected Livermore's image as a pioneer of modern technology while providing a new source of funding through energy savings.

The Program

In 2013, OpTerra Energy Services designed and delivered a comprehensive energy savings program to meet the City of Livermore's needs. Solar facilities were built at the Municipal Airport, Civic Center, and Maintenance Service Center, offsetting almost 90 percent of energy costs at these facilities. Additionally, over 6,000 streetlights were retrofitted with LED lights to increase efficiency and improve street safety and visibility. The new lights were manufactured right in Livermore by a homegrown company, Bridgelux – not in a factory thousands of miles away – which directly benefitted this growing local business.

Understanding that creating a sustainable community requires teamwork from both the City and its residents, Livermore and OpTerra Energy Services created a paid internship program for local high school students to provide free energy consultations to local residents and small businesses. These popular education outreach events and engagement activities provided info to help the community at large reduce emissions and cut costs on energy bills.

The Impact

After installing 1.44 MW of solar PV capacity across city sites, Livermore was able to cut utility costs by nearly 90 percent – saving taxpayers $10M and creating 188 new jobs tied to the energy program. The city was focused on extending these impacts beyond energy savings though and leveraged the partnership with OpTerra to maximize community engagement around the

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Program Highlights

- Installed 1.44 MW of solar PV capacity at three locations, reducing utility costs by nearly 90 percent
- Retrofitted 6,000 streetlights with LED lights designed and manufactured by a local, Livermore business
- Will create 188 new jobs over the life of the program and save Livermore taxpayers $10 mm
- Hired 20 local student "Energy Ambassadors" to help city residents improve home energy efficiency

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new initiative. From working with local LED lighting company Bridgelux to retrofit over 6,000 streetlights, to hiring 20 local student "Energy Ambassadors" to help homeowners benefit from residential energy efficiency opportunities, Livermore demonstrated their leadership as a city committed to strengthening long-term impacts for local businesses and residents. As a result of the adoption of energy efficiency measures championed by the Livermore Energy Ambassadors, the city projects a $25M increase in household incomes over the life of the program.

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City of Simi Valley

Rendering of solar shade parking canopy to be installed.

The Opportunity

The City of Simi Valley, located in southeast Ventura County, is a thriving Southern California community with a population of more than 126,000 residents. The City has been a key leader in regional energy efficiency projects, adopting sustainable, energy saving programs long before other municipalities across California. Prior to state-wide mandated climate action goals initiated under AB32 in 2006, City staff pursued measures to save money and energy at the Water Quality Control Plant and pumping facilities. These early efforts in 2008 earned Simi Valley LEED Gold certification, with rebates from Southern California Edison for the expansion of its transit facility following in 2011. In 2012 and 2013, the City received Beacon Spotlight Awards through the Institute for Local Government for best practices in energy savings. In spite of all this great momentum, Simi Valley was still facing rising energy costs.

In 2016, building upon Simi Valley's strong legacy of championing sustainability efforts in a fiscally responsible way, the City Council unanimously decided to move forward with OpTerra Energy Services to develop a comprehensive renewable energy program. Despite many successful, stand-alone environmental initiatives the community had championed over the years, the City needed a formal strategy to address its energy challenges. In partnership with OpTerra, the City has developed a strategic energy program that is coupled with a meaningful sustainability program called The Capacity Project™ to further promote energy conservation amongst residents.

The Partnership

In March of 2016, the Simi Valley City Council approved an agreement with OpTerra to install solar power at vital City service centers across the community. A total of 2.2 MW of solar is projected to generate the equivalent to enough energy annually to power 282 homes. As part of program development, OpTerra conducted an energy analysis which provided insight into the solar production potential at all City sites, identifying the ideal locations for the PV modules. Solar shade parking canopies at several City locations will provide shaded daytime parking for more than 165 cars. OpTerra will manage all facets of solar sizing, design, and construction. Nearly 90 percent of the energy program is expected to be financed through more than $9.2 million in Clean

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Program Highlights

- Expected to achieve approximately $15MM in net savings over the 20-year program life
- Expected to avoid approximately 49,194 of metric tons of carbon emissions over the program life, equivalent to annual emissions from 10,391 cars
- Solar power is expected to cover one-third of the City's energy use
- Will provide up to 80 paid internships for Simi Valley high school students, giving them real-world experience in energy and environmental conservation

The Technical Scope

Develop and implement a significant 2.2 MW of solar photovoltaic (PV) power at five City sites:

Project Location	System Size
City Hall Solar (Rooftop)	194 kW
Police Department (Parking Lot & Rooftop Solar)	610 kW
Library (Parking Lot Solar)	127kW
Senior Center (Parking Lot Solar)	177kW
Wastewater Treatment Plant (Ground Mount Solar)	1118 kW

About The Capacity Project

OpTerra developed The Capacity Project in 2012 to support its partner cities after recognizing that economic and workforce development was a critical challenge, in addition to saving energy and conserving water. Through The Capacity Project, OpTerra has been helping to meet cities' Climate Action Plan goals and building the capacity of the future workforce through real-world working experiences. The Capacity Project name was inspired by a quote from Mayor Luis Molina of Patterson, CA, "Your programs are building our city's 'capacities,' educating our youth and preparing them for the workforce." The Capacity Project reaches multiple stakeholders – residents, youth and industry - advancing economic development, preparing local workforce for relevant careers, and engaging the community to enhance their quality of life.

The Capacity Project outputs:

- Paid student internships
- Digital tools
- Community outreach
- Free home & small business energy consultations
- Energy savings

Former interns through The Capacity Project engaged community members about the importance of energy conservation in the City of Livermore, CA.

Renewable Energy Bonds (CREB) with a tax-exempt lease purchase (TELP) covering the difference. Solar power will cover one-third of the City's energy use.

The Capacity Project: Bringing Energy Education and Savings to Simi Valley

The partnership between Simi Valley and OpTerra encompasses an energy conservation awareness program called The Capacity Project to help residents and business owners reduce their energy use by providing free energy consultations. The collaboration helps build workforce capacity in clean tech and energy by training and hiring Simi Valley Unified School District students as Energy Ambassadors as part of a paid internship program.

Simi Valley sophomore through senior high school students work alongside energy experts to perform home energy consultations. Energy Ambassadors gain valuable work experience in a STEM field, receive an introduction to energy conservation, and have opportunities to engage with their local community through a variety of community outreach efforts including attending a City Green Expo and speaking at community events and civic meetings. As Energy Ambassadors, student interns gain valuable customer service and communication skills while educating residents on energy-saving behavioral changes they can make at home. The free home energy consultations can reduce a household's energy usage by an average of ten percent per year, saving them money on their utility bills and creating more disposable income, stimulating the local economy.

The Impact

Through a successful, united partnership, the City of Simi Valley and OpTerra are about to kickoff the beginning of an advantageous program that will have long-term positive financial and environmental impact for residents. The City is expected to save more than $15 million over the 20-year program life, reduce its carbon footprint, and promote energy conservation and awareness amongst its residents and students. The City looks forward to student internships beginning in September 2016 and the solar panels going online in 2017.

To learn more about OpTerra, visit www.opterraenergy.com

Rendering of solar shade parking canopy to be installed.

Rendering of solar shade parking canopy to be installed.

Ecova Building Genome Project Whitepaper

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WHITE PAPER

Addressing the Greatest Energy-Saving Opportunity: Building Energy Efficiency

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EXECUTIVE SUMMARY

Buildings waste 30%–50% of their energy use today. Energy efficiency represents the most cost-effective way to reduce that waste and has unearthed a robust and growing market today. A report from the Advanced Energy Economy and Navigant Research estimates annual spending on energy efficiency-related technologies to be nearly $44 billion in the United States and $150 billion globally.

Building energy efficiency investment, however, could and should be much larger. Ecova estimates that there is $370 billion in annual energy savings worldwide that could be cost-effectively achieved through efficiency. Assuming the payback period required to achieve those savings is 2–3 years, the total market potential could exceed more than $1 trillion.

While several challenges exist, a major reason this opportunity has not been fully realized is the extreme difficulty, time and expense it takes to understand which buildings are ripe for energy efficiency projects, and to evaluating specific actions required to achieve these savings.

The traditional process relies heavily on manual, non-data-driven approaches to identify energy-saving opportunities. **Ecova estimates that using these methods, it would cost up to $50 billion and take up to 22 years to audit every building in the United States alone.**

Several forces, however, are enabling a fundamental shift in the way utilities, energy service providers, government organizations and building managers attack this problem: the growing availability of building data, the proliferation of cloud computing, and new advancements in analytics. Combined, these factors allow for rapid, mass-scale generation of data-driven insights and models that provide a sophisticated understanding of how a building uses energy and how it can improve. The energy efficiency industry has used various energy modeling techniques for decades, but until now, these models have been time - and cost-prohibitive to create for each and every building.

The starting point to create an energy model is data — typically, building asset and/or consumption data. When relevant data is aggregated, combined and centralized, building energy models can be created in minutes — as opposed to days, weeks or months — and important questions about a building portfolio can be asked and answered.

This is why Ecova has launched the Building Genome Project — the largest, most ambitious effort to mine, collect and organize publicly available building data for the purpose of gaining a deeper understanding of energy efficiency opportunities.

Through the Building Genome Project, Ecova will combine this publicly available data with its advanced software applications on the Retroficiency Analytics Platform to create unique energy models of commercial buildings in many of the largest cities throughout the United States.

The first city in the **Building Genome Project** is New York City. Using its Reroficiency Analytics Platform, Ecova developed physics-based energy models for more than 30,000 commercial buildings in just a few days. With these models, Ecova can demonstrate how both small and large changes can influence energy consumption and drive savings.

The ultimate goal of the **Building Genome Project** is to (1) identify and quantify preliminary portfolio-level efficiency opportunities that may exist and (2) accelerate the shift in how industry and policy leaders approach the world's energy efficiency challenge.

WHAT IS A BUILDING GENOME?

Much like the human genome, the building genome is a detailed mapping of hundreds of distinct markers that influence how a building consumes energy. These markers are composed of a variety of mechanical equipment, construction materials and configurations, energy fuel sources, and operational characteristics. Here are a few examples:

Lighting	HVAC	Envelope
Fixture type	Equipment type	Roof, wall and window type
Technology	Fuel type	Insulation performance
Building coverage	Building coverage	Panes of glass
Utilization	System performance	Floor type

Each building's occupancy, geometry, hot water system and many other types of equipment can contain numerous additional markers that impact energy usage.

ENERGY MODELS: TRANSFORMING MARKERS INTO INSIGHTS

Once a building's markers are properly understood and ordered — analogous to genome sequencing — they can be combined to create an energy model of each building. This energy model can help provide critical insight into how a building consumes energy — on an end-use level, every hour of every day — and determine the most effective equipment and operational changes to save energy. Importantly, physics-based energy models account for the interactions between building systems — such as how elements like window and wall performance or lighting systems affect the heating and cooling requirements for a space.

In addition to more accurately understanding building energy usage, a model enables key questions about how changes will impact that usage to be asked and answered. This is accomplished by simulating equipment or operational changes to the building and comparing the results to the building's current performance.

With an energy model of every building, utilities, policy makers, energy service companies and building owners can make better portfolio-wide and building-specific decisions about energy efficiency.

THE BUILDING GENOME: NEW YORK CITY

Ecova targeted New York City as the first city in the broader Building Genome Project. Using only publicly available data, combined with the advanced analytics of Ecova's Retroficiency Analytics Platform, Ecova mapped the genomic characteristics of New York's commercial portfolio to develop unique energy models for 30,000+ buildings.

Key public data sources that were available in New York City to inform these models included the following:

- Tax assessors' information, including basic building information
- Consumption data
  - Annual site energy use intensity (for most buildings > 50,000 square feet)
  - Zip code level consumption data for electricity, gas and steam
- Data on buildings with oil boilers

Ecova supplemented this information with privately sourced, hyper-local weather data and its statistical inference algorithms based on data from tens of thousands of previous audits.

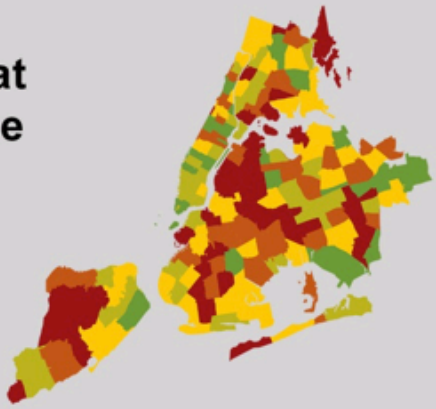
From there, Ecova ran three scenarios against these models to understand their relative impact on New York City's commercial building portfolio. The corresponding savings are provided on the following page.

Scenario 1

What if every building turned the thermostat up one degree in the summer and down one degree in the winter?

Financial Savings*: **$145M**

Portfolio Energy Savings (MBtu)*: **1.9%**

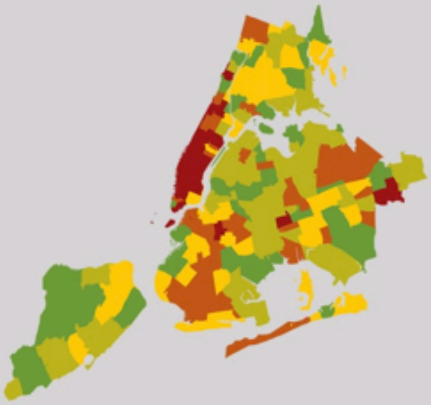


Scenario 2

What if every building with old windows installed new, efficient ones?

Financial Savings: **$227M**

Portfolio Energy Savings (MBtu): **4.5%**

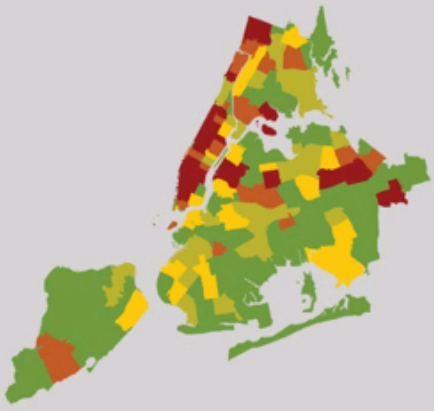


Scenario 3

What if every building with an oil boiler that burns #4 or #6 oil replaced it with a natural gas boiler?

Financial Savings: **$10M**

Portfolio Energy Savings (MBtu): **0.4%**



Zip codes ranked by percent savings

KEY

Lower savings %

Higher savings %

*Financial savings (in dollars) and energy savings (%) are not proportional across each scenario. This is because energy models account for changes in consumption by fuel type (electricity, gas, steam and oil). These fuels each have different associated unit costs.

NEW YORK CITY SCENARIO INSIGHTS

These scenarios are not intended to define the best or most important efficiency measures to implement. Instead, they provide representative guidance on the portfolio and zip-code-level impact of similar types of changes. Furthermore, they demonstrate to utilities, energy service providers and policy makers that city-scale scenario analyses built from the bottom up can be extremely powerful in developing energy efficiency strategies.

Here are a few learnings gleaned from the New York City scenario analyses.

The Same Solution Cannot Always Be Used on Buildings with Similar Energy Efficiency Opportunities

Buildings often have similar issues that result in inefficient energy use. But the most effective measure or treatment for a particular issue can vary from building to building.

For example, it's common for building set points to deviate from recommended ranges. And as Scenario #1 shows, New York City's commercial portfolio would reap substantial savings if thermostats were one degree higher in the summer and one degree lower in the winter.

There are several energy conservation measures that can help achieve these savings at scale. Behavioral and educational efforts can be employed to encourage building tenants to simply change the thermostat settings. This change generally can be implemented quickly and at no cost. In the commercial sector, however, more automated, controls-based measures are often necessary. These include recommissioning building management systems to improve HVAC operations, which may include aggressively changing thermostat settings during certain periods of the year or times of the day. In buildings or smaller spaces with no centralized controls, new advanced thermostats can be more easily programmed (and can even be self-learning) to ensure persistence.

Similarly, multiple types of conservation measures are often needed to address other major areas of inefficiency, such as lighting controls (e.g., occupancy sensors, timers and/or daylighting). To account for this, energy efficiency programs should support an expansive set of measures to drive the deepest savings possible.

Energy Efficiency Policies and Programs May Need to Differ in Smaller Geographic Areas

Efficiency mandates and utility incentives are generally set at a national, state or city level. While this helps support broad-scale market transformation, Scenario #2 demonstrates that the micro-regional impact of certain efficiency upgrades can vary greatly, even amongst clusters of buildings that are just miles away from each other.

In Scenario #2, Ecova modeled the effect of upgrading to new windows on New York City buildings that have old windows. This analysis revealed that the top 35 zip codes by savings potential had an estimated savings three times greater than the 35 zip codes with the lowest savings potential (on a percentage savings basis). Many of these high potential zip codes were located in Manhattan, with its dense population of tall, skinny, glass-laden buildings — the ideal target for high performance window upgrades from an energy savings perspective.

Should New York City more aggressively promote or incentivize window retrofit technologies in certain areas of the city?

There are other factors to consider before making such a decision. For example, in a dense area like Manhattan, a full building window retrofit may be disruptive (particularly, if it were done across many buildings) and may or may not yield attractive paybacks for a specific building. As such, alternative complementary technologies like window film could also be evaluated for each building.

Efficiency program regulators, utilities and policy makers should evaluate their own geographical areas to determine whether more tailored solutions could drive a greater impact.

It's Important to Quantify Both the Economic and Environmental Benefits of Efficiency

In 2011, New York announced it would take the positive step of phasing out oil boilers that burn grades Numbers 4 and 6 oil, the dirtiest heating oil types available in New York. At the time of the City's announcement for this plan, it noted "only one percent of City buildings still burn Numbers 4 and 6 heating oil but they account for more soot pollution than all the cars and trucks in New York City combined."

In addition to the environmental impact of this regulation, buildings will also benefit economically. Scenario #3 estimates the impact of replacing the remaining oil boilers in New York City buildings with high efficiency gas boilers. While this scenario offers the lowest absolute dollar savings across the portfolio among the three scenarios analyzed — because it applies to a small subset of buildings — the energy savings for those buildings are significant. The estimated average energy savings for each applicable building is approximately 10%.

When considering the impact of environmentally focused regulations, the economic impact should also be understood. Doing so can help make the case for such changes and assist in gaining support amongst multiple stakeholders.

ENHANCING THE GENOME WITH SUPPLEMENTAL DATA

Ecova's Retroficiency Analytics Platform can combine many types of data — public information, consumption data and more detailed building asset data — to create and improve already existing energy models of buildings. The more data that is provided about a particular building, the more accurate the building energy model becomes.

This means that it is important to understand how to leverage the insights from the Building Genome Project models, given the level of data inputs. For example, with the addition of energy consumption data, these models, which are based on public data, could be used to more specifically evaluate the savings potential of an individual building.

For the purposes of the Building Genome Project, Ecova will only leverage publicly available data (or private data supplied to the project) to drive its analytics-based insights. The information contained in public data varies by geographic location, but typically it offers high-level data points about a building. Given the limited data used to inform these energy models, the Building Genome Project focuses on portfolio-level and zip code level insights.

Ecova hopes that, as the benefits of public data are better understood, more of it will be released in an appropriate manner. For example, New York City's annual energy benchmarking data was helpful for this first analysis. Greater availability of public data could support further innovations from companies like Ecova and enable the efficiency market to reach its full potential.

CONCLUDING THOUGHTS ON LEVERAGING THE GENOME

Mapping the building genome and enhancing it with data analytics and rapid energy modeling provide new possibilities to drive energy efficiency at scale. The applications Ecova is most excited about are as follows:

- Target buildings, engage customers, convert projects and track opportunities. With an energy model of a building, utilities and energy service providers can identify the highest potential customers, increase interest with specific insights about their building, more quickly and comprehensively evaluate measure and projects, and constantly scan for new opportunities.
- Improve network management and optimize capital deployment. Macro factors, such as economic growth and climate change, as well as grid-level dynamics, including distributed generation and storage, are constantly impacting end-user energy needs. The Building Genome can help government agencies, utilities, and building owners and managers more easily deploy energy efficiency solutions to geo-target constrained areas instead of increasing capacity, and better forecast load requirements moving forward.
- Understand market potential and strategic planning more effectively. Energy efficiency policy, programs and services are guided by portfolio and segment estimates of market and technology potential. While robust approaches have been developed over time to support these efforts, the Building Genome can help us ask and answer more questions and consider more scenarios better, faster and cheaper.

Ecova looks forward to sharing more insights as the Building Genome Project expands across the country. Likewise, we would like your feedback: What would you like to know about a city's energy efficiency potential? What city would you like to see included in the Building Genome Project? Do you have data sets you would like to see incorporated into the project? Contact us at info@ecova.com.

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201 Lomas Santa Fe Drive, Suite 480
Solana Beach, CA 92075