



# CASE STUDY

## NASA Jet Propulsion Laboratory, Phase I

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### About the Project

In 2011, CEG Solutions (formerly Clark Energy Group) (CEG) was awarded a \$10.8 million contract from NASA Jet Propulsion Laboratory (JPL) under the U.S. Department of Energy's Energy Savings Performance Contract. This comprehensive ESPC project involved a wide array of ECMs to drive deeper savings and improve overall building performance for 20 occupied, operationally dependent mission critical facilities. CEG worked closely with building owners, laboratory managers, facilities staff, IT support, CalTech administration, and NASA administration to complete upgrades in mission critical data centers, clean rooms, and laboratories. This project is now saving NASA over 3 million kWh of electricity and 9,000 MMBtu of natural gas annually, resulting in utility savings of over \$425,000 per year.

CEG explored a range of energy & water conservation measures to provide a comprehensive solution for NASA JPL. CEG used whole-building analyses to target the most beneficial HVAC upgrades, including building-specific reset schedules and variable flow control upgrades. These upgrades reduced the load of the central utility plants by 30%. Upgrades to the central utility plants included the installation of Turbocor magnetic-bearing chillers, replacement of electric motors and installation of VFDs, installation of a high efficiency condensing boiler, and implementation of temperature reset schedules. Other ECMs included the installation of direct digital controls (DDC), conversion of air handlers to variable air volume (VAV), daylighting control systems, occupancy & timer controls (installation and modification), spectrally enhanced lighting, resizing and reclassifying water utility infrastructure to leverage more favorable rate schedules, and installing time-of-use controls for electric vehicle charging stations.

#### CLIENT

NASA Jet Propulsion Laboratory

#### LOCATION

Pasadena, CA

#### YEAR

2011–2012

#### AWARD

2016 Federal Energy and Water Management Project Award by DOE FEMP

### FINANCIAL

Project Cost:  
\$10,805,538

Total Rebates/Incentives:  
\$317,640

Net Cost After Incentives:  
\$10,487,898

#### ESTIMATED SAVINGS:

**\$19,500,000**

Simple Payback:  
13.1 Years



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### CONTINUED

Because all work was performed in occupied facilities, CEG scheduled the implementation to minimize disruptions to occupants and the various mission-critical projects. Over 10,000 light fixture retrofits and control installations were performed after-hours. Central plant and HVAC upgrades were rapidly implemented over holiday weekends and seasons of reduced load, and work was coordinated to avoid impacting mission schedules. In addition to the directly measurable energy and water cost savings, other benefits of this project included improved lighting levels, reduced maintenance-related work, infrastructure renewal, and more reliable HVAC and central plant operation.

### ABOUT THE LOCATION

NASA JPL is a government-owned, contractor-operated (GOCO) facility that is managed by the California Institute of Technology (Caltech) for the National Aeronautics and Space Administration (NASA). The laboratory's primary function is the construction and operation of robotic planetary spacecraft, though it also conducts Earth-orbit and astronomy missions.

### ENERGY CONSERVATION MEASURES

- Boiler Replacement
- Chiller Replacements
- Variable Frequency Drives
- Spectrally Enhanced Lighting Upgrades
- Daylighting Controls and Advanced Lighting
- Water Meter Upgrades
- Load Shifting
- AHUs to VAV

## PROJECT HIGHLIGHTS

- **Annual Savings over \$425,000**
- **20 Buildings & Laboratory ECMs**
- **Electricity Savings of 3.2 million kWh/year**
- **Natural Gas Savings of 9.3 billion Btu/year**



# CASE STUDY

## NASA Jet Propulsion Laboratory, Phase II

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### About the Project

After the completion of CEG Solutions (formerly Clark Energy Group) (CEG) first ESPC project at NASA's Jet Propulsion Laboratory (JPL), NASA awarded CEG a \$25.7MM contract for a second ESPC project at the laboratory. The project's scope includes renewable energy, water conservation, and energy efficiency measures and involved upgrades to 128 buildings that housed data centers, laboratories, offices, command facilities, support services, cafeterias, shops, and testing facilities. Although NASA had previously performed a wide range of upgrades to its energy-consuming systems on campus, the measures that have been installed as part of CEG's Phase II project are expected to reduce water consumption by 18 million gallons per year, electricity consumption by 5.6 million kWh per year, and total energy consumption by 23.9 Billion Btu per year. Construction was completed in March 2015.

CEG took a comprehensive approach to the project and identified a wide array of ECMs to drive deeper savings and improve overall building performance. CEG upgraded building controls, implemented VFDs on pumps, replaced chillers, replaced inefficient light fixtures in areas requiring extensive containment of asbestos, upgraded irrigation across the entire 177-acre campus, improved the building envelope in over 100 buildings, retrofit domestic water fixtures, reduced electric load,



#### CLIENT

NASA Jet Propulsion Laboratory

#### LOCATION

Pasadena, CA

#### YEAR

2013-2015

#### AWARD

2016 Federal Energy and Water Management Project Award by DOE FEMP

#### FINANCIAL

Project Cost:  
\$24,570,439

Total Rebates/Incentives:  
\$544,195

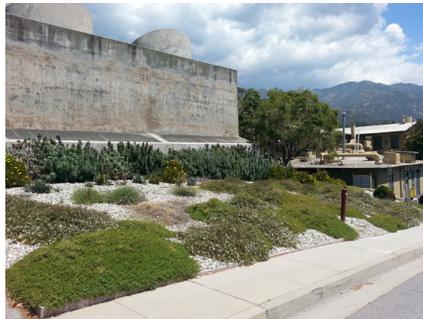
Net Cost After Incentives:  
\$24,026,244

**ESTIMATED SAVINGS:**  
**\$36,400,000**

Simple Payback:  
17.4 Years

## CONTINUED

and implemented mechanical upgrades to major central plants. The project was later expanded to include the installation of a 273 kW rooftop solar PV system. The project required CEG to perform upgrades to MEP systems serving mission critical data centers and laboratories. In some cases, CEG worked closely with JPL staff to provide backup temporary chillers and generators in situations where temporary disruptions or plant outages would have disrupted critical operations.



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## ENERGY CONSERVATION MEASURES

- Rooftop Solar Photovoltaic System
- Building Envelope & Weatherization
- Compressed Air System Optimization
- Domestic Water Upgrades
- LED Lighting Upgrades
- Spectrally Enhanced Lighting
- Chiller Replacements
- Night Setback and Controls Upgrades
- Variable Frequency Drives
- Pump Upgrades
- Retro-commissioning
- Irrigation Improvements
- Ground-Water Harvesting
- Upgrades to Reverse Osmosis (RO) Water System
- Plug Loads
- Window Film

## PROJECT HIGHLIGHTS

- Annual Savings over \$725,000
- Water Savings of 18 Million Gal./year
- Upgrades in 128 Bldgs. & Laboratory ECMs
- Electricity Savings of 5.6 Million kWh/year
- Gas Savings of 7.6 Billion Btu/year
- Energy Savings of 23.9 Billion Btu/year