CAPITAL
ENGINEERING CONSULTANTS, INC.

Capital Engineering Consultants (Capital) has provided accurate and informative energy modeling for projects from complex central utility plants to hospitals, government buildings, high and low-rise office building, schools and university facilities. Capital has the expertise and experience necessary to design and model traditional HVAC systems as well as High Performance low energy systems including passive solar, radiant chilled slabs, natural ventilation and displacement ventilation.

Why Net Zero?

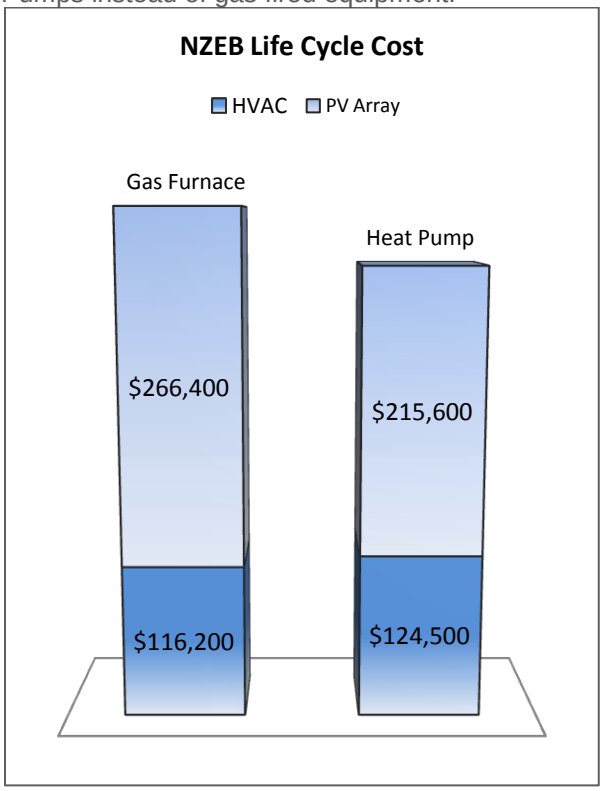
A Net-Zero Energy Building (NZEB) is a building which consumes less energy annually than it generates. The accounting of energy may be done in more than one way. The most common is a Site NZEB, one that produces more energy than it uses in a year when measured at the site. Net-Zero Energy buildings represent a significant advance over the current state of commercial buildings and Regulatory agencies are embracing the idea. The California Energy Commission has stated that they wish all new non-residential buildings to be NZEBs by 2030.Federal Policy, as stated in Executive Order 13514, directs that all new federal buildings shall be designed, constructed, and operated to achieve net zero by 2030.

How?

To be cost effective NZEBs must focus heavily on conservation because all energy consumption must be offset, most commonly by a Photovoltaic (PV) Array. Energy simulations are critical for identifying effective conservation strategies. Combining annual energy simulations with a life cycle cost analysis can answer questions like: “Is it cheaper to install some LED lighting than to add more PV?” or “Is extreme performance glass more cost effective than additional insulation?” or “Can the cost of a high efficiency air conditioning system be less expensive than adding more PV?”

New Solutions

The design of a reasonably priced NZEB requires different solutions than traditional buildings. Traditionally only the cost of fuel, not the energy consumed is considered. But NZEBs must consider the cost of generating energy that offsets their consumption. Minimizing generation costs will drive the design decisions of NZEBs. For example, a recent simulation of a school Multipurpose Building, performed by Capital, showed that Heat Pump technology, because of its higher heating efficiency, consumed fewer energy units than gas equipment. Annual Operating costs for the gas equipment was lower **but**, due to the need to install offsetting PV generation, the Heat Pump technology had a lower 20 year Life Cycle Cost. See the figure below. Capital showed that the owner could save $42,500 in on-site generation equipment by choosing Heat Pumps instead of gas fired equipment.



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New Tools

The advanced low energy systems being investigated for NZEBs are often difficult or impossible to simulate using conventional energy modeling tools. New simulation tools that can model systems such as natural ventilation, radiant heating and cooling, and passive solar are available and Capital has the knowledge and experience to employ them successfully. Recently we performed the mechanical design and whole building simulation of a 21,000 SF Religious campus that had a NZEB goal. The conservation strategies relied on innovative low energy HVAC systems that traditional modeling tools are not equipped to simulate. By utilizing Energy Plus, Capital was able to capture savings that could not be modeled in other programs. The result was a reduction in the necessary size of the PV array, and an owner savings of over $1,000,000.

Project Experience

Guru Nanak Sikh Society of Yuba City, Sikh Temple

Architect: Indigo | Hammond + Playle Architects

A harmonious man-nature relationship is a central tenet of the Sikh religion. This dedication to coexistence with the natural environment redefines the building system opportunities. Low energy radiant heating and cooling systems will provide for occupant comfort. Fan forced air systems are not utilized. A natural “Night Sky Cooling” process provides chilled water while using zero refrigerants and zero compressor energy. The electric lighting system is designed with energy efficiency as a primary goal and daylight is utilized as the sole light source during the day. The super-insulated building shell features natural straw bales and an R-40 insulation rating.

Modeling these low energy features requires the newest software and techniques. Driving Net Zero Energy design through the use of advanced energy modeling ensures that the energy saving features are cost effective. Comparing the cost of a proposed feature to the potential PV offset cost allows the design team to prioritize net zero features.

LeyVa Middle School Administration Building

Architect: Aedis

Early in the process, the design team (including Capital Engineering Consultants, Inc.) determined it could actually eliminate purchased energy costs, carbon emissions, and achieve NZEB through use of photovoltaic and other sustainable technologies. The building is 41% more energy efficient than Title 24 requirements, maximizes daylighting and uses new VRF Heat Pump technology to reduce power demands. Designed toward LEED® Gold certification, the building is the 1st Net Zero Energy/Net Zero Emissions public school building in California and will produce up to 108% of its own energy. It is projected to save the District more than $9,000 annually in utility costs.