The Path to Net-Zero Energy

HOW DPR CONSTRUCTION'S PHOENIX REGIONAL OFFICE BECAME THE WORLD'S LARGEST OFFICE BUILDING TO ACHIEVE NET-ZERO ENERGY BUILDING CERTIFICATION FROM THE INTERNATIONAL LIVING FUTURE INSTITUTE

"This project is an excellent example of how to develop within existing infrastructure."

INTERNATIONAL LIVING FUTURE INSTITUTE AUDITOR REPORT, LIVING BUILDING CHALLENGE℠ 2.1

Introduction

In the ever-evolving sustainable design and construction arena, many owners and project teams are setting their sights on a goal that seemed improbable just a short time ago: creating commercial buildings that produce as much or more energy as they consume each year, known as net-zero energy buildings.

While this emerging trend is still gaining traction, DPR Construction has embraced the net-zero energy challenge in far more than just theory. Regional office projects in Phoenix, San Diego, Sacramento, Newport Beach and elsewhere demonstrate that one of the company's core values of "ever forward" is being fulfilled in spaces that benefit not only DPR's own employees but also the communities in which they work.

DPR's award-winning Phoenix regional office is a prime example of how the company is staying on the leading edge of the sustainability charge and helping pioneer a movement that many expect will ultimately make net-zero energy the "new norm." The LEED®-NC Platinum, 16,533-sq.-ft. structure is Arizona's first net-zero energy office building (NZEB), as certified by the International Living Future Institute's Living Building Challenge℠ 2.1. Producing as much or more energy than it consumes, DPR's Phoenix office is the largest building in the world with the NZEB certification; it's only the second office in the nation to receive it.

The building serves as a living laboratory that showcases the latest sustainable concepts. While demonstrating the viability of attaining net-zero energy operations within a desert environment—a lofty goal in itself—the project also illustrates how a highly collaborative, experienced team can effectively transform an aging, underutilized structure located in an area of urban blight into a model for sustainable development and urban renewal.

There were several factors that drove DPR's decision to create a net-zero energy office in Phoenix:

- **Living a Core Value.** DPR's "ever forward" focus is to always stay on the leading edge, building smarter, better and faster. So when it comes to creating its own workspaces, DPR embraces a highly collaborative approach that encourages innovation and demands the same adherence to tight schedule constraints—in this case a fast-tracked 10 months—as projects built for other clients. And finally, in planning for capital expenditures, DPR is committed to making smart decisions based on lower long-term facility operating costs versus short-term savings—a hallmark of net-zero energy buildings.
- **Leading in Green Building.** A DPR goal is to ultimately have every employee working within a highly sustainable space. This project provided the canvas on which DPR could illustrate its commitment to sustainability, not just as a leading national green builder but also one that "walks the walk" when operating in an owner's capacity.
- **Community Commitment.** DPR is focused on being integral and indispensable to the communities in which it works, a factor that helped drive the decision to renew and revitalize a once downtrodden area of Phoenix.
- **Employee Satisfaction.** From its accessible location that provides connectivity to public transportation sources, bike trails and the Phoenix airport, to a plethora of building amenities focused on employee comfort and enjoyment, the new Phoenix office reinforces DPR's commitment to its employees and its ranking as one of the nation's most desirable companies to work for.

TIMELINE

2003

DPR's LEED Silver Sacramento office was the first privately owned LEED certified building in California's Central Valley.

2010

DPR's San Diego office was the first commercial building to achieve both LEED-NC Platinum and net-zero energy status in San Diego.

2013

DPR's LEED-NC Platinum Phoenix office became the largest building in the world to achieve Net-Zero Energy Building certification from the International Living Future Institute's Living Building Challenge. There are four buildings with this certification to date.

Selecting the Right Site to Meet Lofty Sustainable Goals

DPR had maintained a presence in Phoenix's Camelback corridor since 1998. When it came time to renew its lease, the decision was made to find a new location that would bring the office into greater alignment with DPR's goals and sustainable mission. Leveraging previous experience, the company decided to pursue a net-zero energy goal for the new Phoenix regional office.

Selecting the site was the first major challenge. The overriding objective was to find an underutilized, existing building in a highly accessible redeveloping area of Phoenix, close to public transportation, that DPR could transform through cost-saving, sustainable strategies to reduce its carbon footprint and benefit the community's redevelopment efforts. In addition to showcasing the latest in sustainable and energy reduction features,

Selecting the right site was the first major challenge.

5 GREEN TIPS

Sustainability through Reuse

As a company that strives to be environmentally responsible in the way it does business, DPR sees an opportunity to transform buildings seemingly at the end of their lifecycles through reuse and renovation. The following are five green tips, which DPR used on its own office renovations:

1. **Monitor Energy**
Building occupants can track their electricity, water and natural gas usage savings in real-time through monitoring software. Four DPR offices use Lucid Building Dashboard® to track sustainability goals.

2. **Use outside air to cool the building**
Natural ventilation systems use outside air to keep buildings cool, reduce energy, and lower costs.

3. **Reduce use of artificial light**
Expansive windows and natural light through strategically-placed Solatubes® reduce the need for electric lighting and associated costs.

4. **Generate energy with photovoltaics**
Photovoltaics generate power from the sun to offset energy usage. Generating even one kilowatt-hour saves 300 pounds of carbon dioxide from being released into the atmosphere each month.

5. **Disconnect phantom-plug loads**
Install a vampire shut-off switch to disconnect phantom-plug loads every night, saving money and energy.

the intention of the project was to demonstrate the value and impact that revitalization has on an urban environment.

The team soon identified a property that may have seemed an unlikely prospect at first glance: an older retail building, seemingly at the end of its lifecycle. Beneath the surface, however, the building's potential was apparent. Most significant was its location in the heart of Phoenix's Discovery Triangle redevelopment district, minutes from the airport and in close proximity to a light rail stop that services the downtown core, West Phoenix and nearby cities.

The building's overall structure was sound and contributed to DPR's goal to maintain as much of the original structure as possible. Ultimately 93.7 percent of the original shell and structure remained in place.

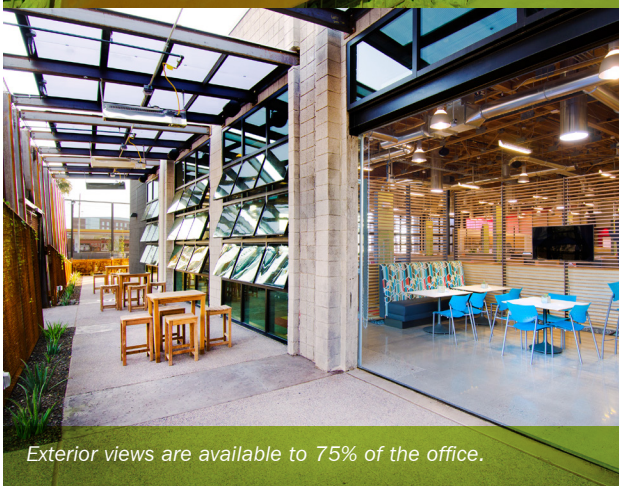
The Importance of a Highly Collaborative Team

DPR brought together the entire design and construction team, including architect SmithGroupJJR, sustainability consultant DNV KEMA Energy & Sustainability, mechanical contractor Bel-Aire Mechanical, Inc., DPR project team members, and various consultants and subcontractors, very early on to help identify and select potential sites and then provide input throughout design and construction.

Assembling the right team and then fostering a highly collaborative environment were key to the project's success. Every team member was hand-selected for the design-build project based on his or her talents and demonstrated expertise delivering high-performance sustainable buildings. Innovation was encouraged, and pushing the limits of conventional approaches expected. The integrated team cultivated a strong sense of trust and was united in working toward a common goal.

DPR's Phoenix office reflects a "workplace of the future" design.

NZEB can be achieved even in a a desert climate.



Exterior views are available to 75% of the office.

The extremely fast-track timeline—10 months from start of design to completion in October of 2011—meant that ideas had to be presented, discussed and decided on immediately. The high-functioning team involved in this transformative project development process ensured that the building's physical transformation was of the highest quality, and that the end product incorporated the most innovative sustainable features possible.

During the construction process, sustainability was always at the forefront as well, with 78 percent of the materials removed from the site ultimately recycled. A goal was to use sustainability strategies that yielded a 10-year return on investment.

Modern Design Fits a Progressive Company

The project's design reflects the "workplace of the future" with DPR's hallmark open office environment rather than traditional private offices.

The building's modern and innovative aesthetic also takes a "do more with less" approach with sustainability in both building form and function. For example, a green screen with biomass wrapping the facades creates a secure and inviting outdoor courtyard environment for employees while also providing shade for the building.

A CLOSER LOOK

DPR Project Milestones

- Arizona State University Polytechnic Academic Complex won Engineering News-Record's (ENR) **first ever Best of the Best awards** in the **Green** category in 2008.
- The Michael J. Homer Science and Student Life Center project for Sacred Heart Schools, Atherton was the **first ever to achieve LEED Platinum for Schools certification**.
- Digital Realty 1201 Comstock Web Hosting Facility was the **first data center in California** and one of the first in the nation to achieve **LEED-CI Platinum**.
- Selected as ENR's 2011 Editors' Choice & Green Project of the Year, the Facebook Prineville Data Center Complex has the world's **best energy efficiency rating**.
- The ground-up LEED Platinum David and Lucile Packard Foundation Headquarters was designed for net-zero energy consumption. It won the **2012 Best of the Best Project award in the Green category**.

The David and Lucile Packard Foundation headquarters

While the building's south and west elevations were largely left intact, large expanses of glass were added on the east and north facades to allow in natural lighting. Horizontal shading devices were used to minimize direct solar gain.

Inside the building, major design features include video conferencing rooms, a learning lab, a fitness room with shower facilities, a modern open kitchen and café area, and roll-up doors that lead to shaded patio areas.

Some of the other unique elements include:

- A "Zen" Room with plush sofa and chair;
- A conical Delta Room that represents DPR's continuous drive to push the status quo;
- An Innovation Room with sliding glass walls, whiteboard and bold colored reconfigurable furniture designed to inspire creativity; and
- A prominently located 18-ft. wine bar, used as an impromptu gathering space for meetings, celebrations and conversation with clients and staff.

Inspired geomorphic shapes found in nearby desert canyons are reflected in the building design. A wrapped sculptural enclosure--the Delta room--in the conference space expresses DPR's self-perform drywall expertise, utilized on this project, while the colors reflect the desert environment just outside. Strategically placed vertical green elements throughout the interior resemble a "landscape of saguaros" while functioning as message boards and power/data towers that break up the open space.

Overall, the project employed a variety of strategies to reduce energy while also creating a healthy environment for employees. A full 100 percent of spaces can have lights off during daylight hours and 75 percent have access to exterior views.

Some of the green materials incorporated include:

- 97 percent of wood from Forest Stewardship Council (FSC) sources;
- 32.76 percent of materials were of recycled content;
- Low or no-VOC content for all finishes; and
- Reuse of DPR's existing built-in work stations, requiring only 14 additional stations to be built.

MULTIMEDIA

Video Series

Check out DPR's video series from the DPR Phoenix regional office project team. They discuss lessons learned and the process behind the decisions that were made. Topics include:

- Evolution of Green Design at DPR
- Sustainability and Employee Satisfaction
- Return on Investment
- A Living Lab
- Low Tech Meets High Tech
- Reuse of Existing Buildings
- Walking in the Owner's Shoes
- Why Net-Zero?

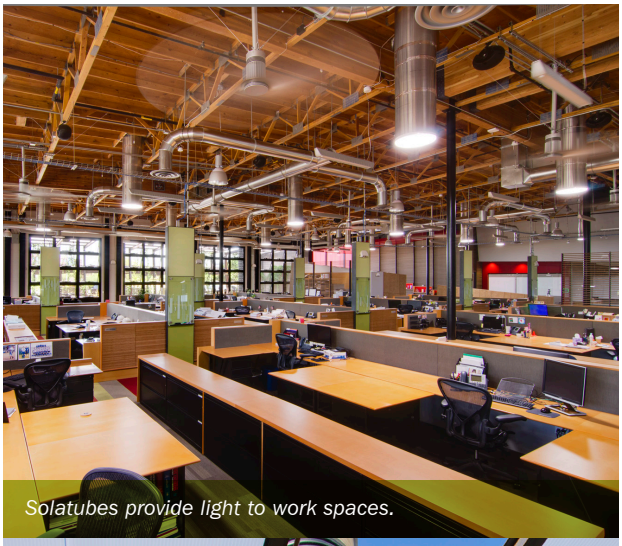
View all the videos at: http://www.dpr.com/construction/expertise/green-construction

Major Sustainable Components to Achieve Net-Zero

At the heart of the project are the many sustainable elements that help the building both conserve energy and produce power needed to offset that demand. Every design consideration impacts the building's overall performance, and every building component was carefully selected.

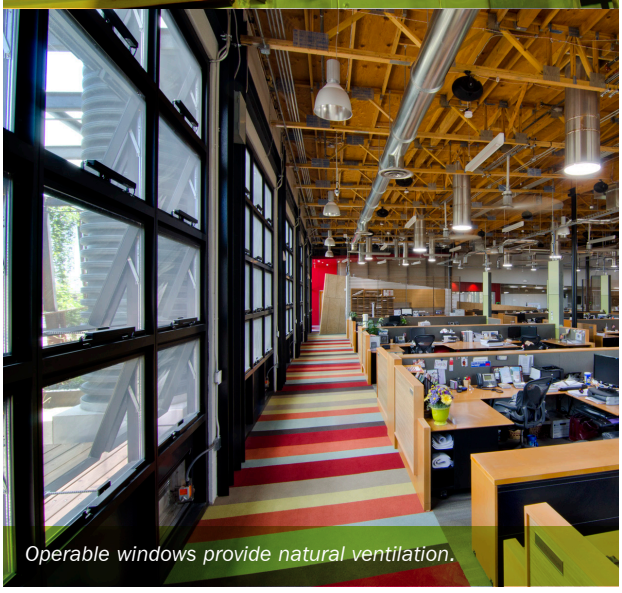
There were a number of primary sustainable features in this building that were integral to achieving the net-zero energy goal. They include:

- **Solatubes**® – The installation of 82 high-performance daylighting Solatubes, strategically positioned throughout the building, reduced artificial lighting usage by 90 percent.
- **LED Lighting** – Since the building's interior is lit by Solatubes during the day, a lifecycle cost analysis showed that interior LED lighting was not cost-effective for a 10 year return. LED lighting was deemed an ideal solution, however, for exterior site lighting that is programmed at night. By selecting LED fixtures for site lighting, the team was able to reduce the size of the building's photovoltaic system.
- **Shower Towers** – Four evaporative cooling-towers work in conjunction with the solar chimney to passively cool the building. The towers sense and respond to climatic changes including wind speed and temperature.
- **Solar Chimney** – An 87-foot long zinc-clad, roof-mounted solar chimney, said to be the largest of its kind in Arizona, supports the building's passive cooling system.
- **Operable windows and roll-up doors** – The project incorporated 87 operable windows along the building's east and north facades, providing access to fresh air and natural daylight. Controlled by outside climatic conditions, they open gradually to adjust to ventilation needs of the space.



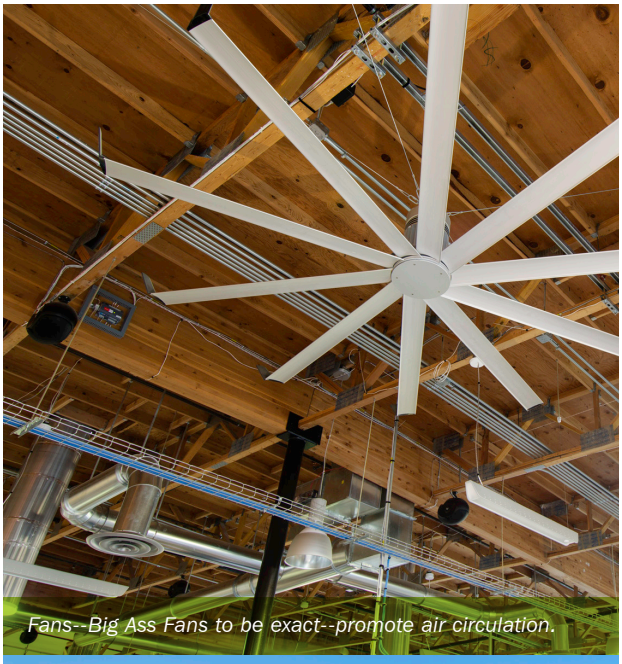
Solatubes provide light to work spaces.

Shower towers cool the building.



Operable windows provide natural ventilation.

- **"Big Ass Fans"** – Twelve eight-foot-diameter Isis® Big Ass Fans® promote air circulation and are integral to the building's cooling system. Air movement allows interior temperature set-points to be increased while still feeling comfortable for occupants.
- **Vampire Shut-Off Switch** – This particularly unique sustainable feature targets a reduction in energy consumption attributed to phantom loads – the energy consumed by a device even when it is turned off. This switch is designed to disconnect 90 percent of plug-loads at the end of each workday. The last person exiting the building is responsible for activating this switch. Nationally, phantom loads are estimated to account for nearly six percent of the nation's energy consumption.
- **Photovoltaics** – A key feature in net-zero energy buildings, photovoltaic systems are intended to make up the difference in energy needed to operate a building after all other measures to reduce the building's energy consumption are exhausted. In the Phoenix office building, a 78.96-kilowatt photovoltaic-covered parking canopy systems was designed to generate the 135,000 kilowatt-hours (kWh) of estimated total annual building electrical usage. During its first year in operation, it actually exceeded that goal and generated more than 140,000 kWh of electricity.
- **Lucid Building Dashboard system** – In the long run, the success of a net-zero energy building puts some responsibility on the shoulders of the building occupants to monitor and, if needed, modify their behavior in order to maximize building performance. The Lucid Building Dashboard® system incorporated in this project shows in real-time how the building is performing in terms of energy production versus usage. It provides a visible reminder to employees of the connection between their behavior and building performance. This helps create a "prius effect," in which employees become more motivated to meet goals.



Fans--Big Ass Fans to be exact--promote air circulation.

Photovoltaics generate energy for cost savings.

Lucid Dashboard monitors building performance.

Documentation Requirements for Net-Zero Energy Building Certification

In May of 2013, DPR Phoenix received Net-Zero Energy Building (NZEB) certification by the International Living Future Institute (ILFI) through its Living Building Challenge program. The following are the four key criteria for certification:

- **Site Imperative**: Limit to Growth. This imperative curbs a building's contribution to sprawl. Effectively, buildings may only be built on greyfield or brownfield sites.
- **Energy Imperative**: Net-Zero Energy. The primary focus of net-zero energy building certification, this imperative stipulates that 100 percent of the building's energy needs must be supplied by onsite renewable sources on a net annual basis. The energy usage for a building must be documented by completing an energy usage table with monthly info gathered from tracking systems, energy bills for continuous 12-month period, and other supporting materials. Net-zero compliance can only be awarded after the building has demonstrated its compliance for at least a full year.
- **Equity Imperative**: Rights to Nature. This imperative ensures that the building does not preclude another building from achieving net-zero energy operation as a result of excessive shading.
- **Beauty imperative**: Beauty + Spirit, Inspiration + Education. The building must contain design features intended solely for human delight and the celebration of culture spirit and place appropriate to its function.

Complete information on net-zero building certification is available at: http://living-future.org/netzero

RESULTS

Green by the Numbers

200

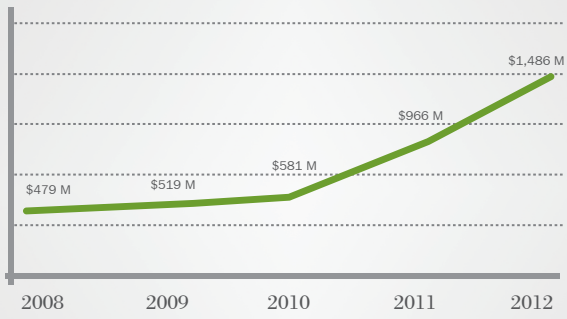
DPR has worked on more than 200 LEED certified projects.

$4 Billion

Over the last five years, DPR's revenue from green projects adds up to more than $4 billion.

x3

DPR's green project revenue has tripled in the last five years.



DPR revenue from green projects (last five years).

San Diego Office: Model for DPR's Net-Zero Energy Journey

For proof of how a net-zero energy building pays dividends over time when measuring both an owner's return on investment and the building occupants' satisfaction level, look no further than DPR's own San Diego regional office building.

Completed in 2010, the building served as the launching pad for DPR's net-zero initiatives and laid the groundwork for future high performance, sustainable projects, in Phoenix and beyond. While it has garnered plenty of recognition for its appealing sustainable design and status as both the first LEED Platinum certified and the first net-zero energy office of its size in San Diego, the biggest payoff for DPR has been the improved quality of life and high satisfaction rating of the employees who work there.

DPR purchased the 34,000-sq.-ft., 25-year-old industrial building office in 2008 and set to work transforming what was an ordinary suburban tilt-up office building into an extraordinary space that illustrates commitment to sustainability as well as employee health and welfare.

The project team had four primary criteria:

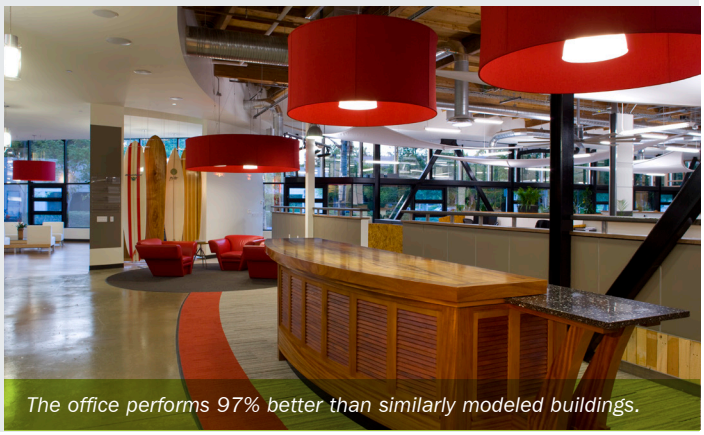
- Bring the outside in; take advantage of the climate and location by opening up the building to the outside;
- Create a net-zero energy office that serves as a model for DPR's goal to have all San Diego commercial building projects be net-zero energy by 2030;
- Maximize the building's existing features and only use strategies that yield a 10-year return on investment to serve as a market case for sustainability;
- Represent the company's core values and respect the individual (in this case, DPR employees).

Three years later, DPR is clearly meeting those goals and more. According to the Environmental Protection Agency's Energy Star rating system, the new building performs over 97 percent better than similarly modeled buildings in the area in both use and climate zone. The building's Energy Use Intensity or EUI (the unit of measurement that describes a building's energy use) is a low 16.3, two-thirds lower than Title 24 standards. The mixed-mode HVAC system operates 79 percent fewer hours compared to a mechanically ventilated building. Water consumption was reduced by nearly half.

Since its occupancy in 2010, the San Diego office has ended each year "net-positive" as the roof-mounted 64 kW-AC photovoltaic system has generated more than 12,000 kilowatt-hours more than the office consumed annually.

The building is also on track to return all of its premiums related to sustainable construction well ahead of DPR's 10-year goal.

DPR's San Diego office launched company net-zero initiatives.


The office performs 97% better than similarly modeled buildings.

So how did it achieve those results? DPR's primary strategy was to capitalize on San Diego's famous temperate climate to help deliver a majority of the building's cooling and ventilation requirements. They incorporated a system of motorized operable windows and roof monitors to benefit from prevailing breezes and to help achieve stack ventilation. The operable windows and monitors create the effect of a solar chimney within the structure, providing passive ventilation to the space.

To reduce dependence on artificial light, DPR enlisted a comprehensive natural daylighting strategy that incorporates 40 Solatubes, south-facing roof monitors, along with energy-efficient lighting fixtures and controls. Water savings are derived from high-efficiency fixtures, low-flow rate metered faucets, and climate controlled irrigation. Natural gas consumption decreased from on-site thermal water heating.

Breaking down any barriers to collaboration, the building's wide-open design and numerous amenities foster interaction and teamwork. There are 11 conference rooms that include the Big Kahuna with La Cantina segmented sliding doors that open to an outdoor patio; the audio-visual loaded training center, capable of hosting a sit-down event for 90 attendees; the circular Delta room; Pipeline, the 16-person video conference room; and Cave Rock, a space devoted to BIM technology, among other things.

The open office space features 14-ft.-high exposed ceilings accented by artistically designed material pieces that resemble the sails of boats and diffuse light, while the ocean-related theme is further reinforced with four custom surfboards in the lobby representing DPR's core values. A 14-foot wine bar in the heart of the office space is designed to bring guests and employees together.

Employees stay informed and engaged in helping facilitate the office's energy and water consumption with easy viewing of a Building Dashboard featuring data from 12 electrical sub-meters, photovoltaic system, natural gas meter and the indoor water meter.

DPR's San Diego regional office space has been the recipient of several awards, including a California Construction (now ENR California) 2010 "Best of the Best Green Project" award as well as San Diego Architectural Foundation "Orchid for Sustainable Design" award that same year. For DPR and its San Diego employees, the most valuable reward however has been in creating a highly successful, high performing net-zero energy model that has advanced the company's mission to be a leader both as a green builder and as a corporate citizen.

1st commercial building in SD to achieve LEED Platinum & net-zero.

The office produces 12,000 kWh more than it consumes annually.

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The first certified Net-Zero Energy Building in Arizona by the Living Building Institute and the largest in the world.

DPR CONSTRUCTION is a unique technical builder with a passion for results. Consistently ranked in the top 50 general contractors in the country over the last 15 years, DPR is a national commercial contractor and construction manager specializing in technically challenging and sustainable projects—of all sizes and complexities—for the advanced technology, healthcare, life science and corporate office markets.

For more information about DPR's expertise in sustainability, please visit http://www.dpr.com/construction/expertise/green-construction or contact Ted van der Linden at tedv@dpr.com or Whitney Dorn at whitneyd@dpr.com.

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