THE ZERO CODE RENEWABLE ENERGY PROCUREMENT FRAMEWORK

THE PAYBACKS OF POWERING BUILDINGS WITH CLEAN ENERGY

PHOTO: U.S. DEPARTMENT OF ENERGY

By requiring more energy efficient construction practices and local renewable energy production, jurisdictions can help their communities reap the benefits of putting people back to work after more than a year of job losses due to COVID-19.

Cities and states looking to decarbonize new and existing construction in a way that pencils out for builders and spurs local job creation have a new tool in the toolbox.

The **Zero Code Renewable Energy Procurement Framework** provides a means for jurisdictions to encourage highly-efficient new and existing commercial and multifamily buildings powered by local renewable energy. It is well documented that energy efficiency and clean energy are the **biggest job-creators across America's energy sector**, supporting jobs in design, construction, electrical engineering, installation and more. By encouraging more energy efficient construction practices and local renewable energy production, jurisdictions can help their communities reap the benefits of putting people back to work after more than a year of job losses due to COVID-19.

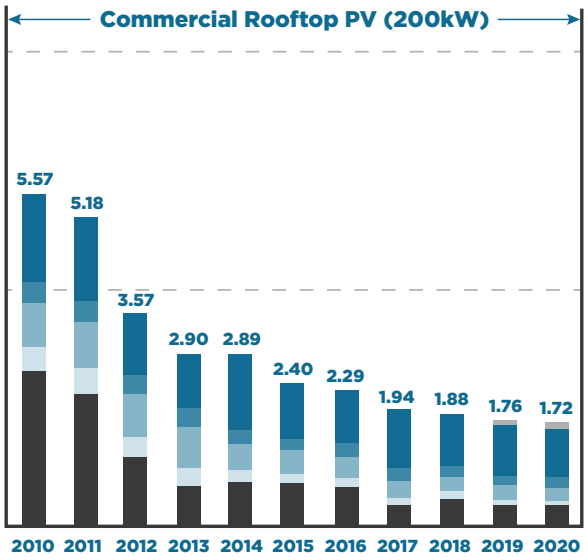
Learn about the paybacks of powering buildings with locally-produced renewable energy, and read through examples of real-world projects that demonstrate constructing an energy-efficient building powered by clean energy can be both achievable and cost-effective.

architecture 2030

KEY FACTS ABOUT THE COST-EFFECTIVENESS OF RENEWABLE ENERGY

- The cost to install solar energy systems on commercial buildings has dropped steadily over the past decade. A recent **NREL analysis** shows that the 2020 cost of a 200 kW system on a commercial building is only 30% of what it was in 2010, falling from $5.57/kW to $1.72/kW.
- When buildings do not have sufficient rooftop or carport space, arrays of solar panels mounted on the exterior south, east and west walls make on-site renewable generation a feasible goal for even the biggest of buildings. Also, solar shingles, solar windows and solar skylights can be cost-effective replacements for conventional products when the value of their energy benefits is included.*
- In states with favorable solar feed-in tariffs (the amount a utility will pay solar owners for the excess electricity produced and sent back to the grid), the payback on installing a solar PV system on a building can be as quick as four to eight years.*
- For developers of multi-story, multifamily residential buildings, adding solar is not only a good return on investment, but can also lower or stabilize utility bills for residents. Developers can provide this benefit to tenants if they raise the rent less than or equal to the monthly solar benefit, thus solving the "split incentive" issue and allowing the solar panels to rapidly repay the developer's investment.*

GRAPHIC: NREL SOLAR COST ANALYSIS



- For developers who do not have sufficient space for onsite solar or wish to procure energy off-site (for example through a power purchase agreement with a utility or from a community solar garden), the Zero Code Renewable Energy Procurement Framework provides the flexibility for developers to choose the option that works best for them and their bottom lines.
- A 2017 **University of California study** on the cost of constructing new all-electric buildings on campuses and powering them with renewable energy found that the university system could save 14% on energy costs for academic buildings and 8% for laboratory buildings over 20 years, and save 6% on construction costs for residential buildings.

Sources: Redwood Energy's Pocket Guide to Zero Carbon Commercial Buildings and Zero Emissions All-Electric Multifamily Construction Guide

EXAMPLES OF COMPLETED PROJECTS

> Too many people have a mindset stuck in the past back when PVs were expensive. They need to understand that today renewable energy is a very cost effective strategy for buildings and should just be a standard part of a building's MEP system—just like we provide heating and hot water in all of our buildings. And for projects that don't have the space to do 100% on-site solar, the Zero Code Renewable Energy Procurement Framework provides a way around that by allowing the purchase of off-site renewable energy."
>
> **—Scott Shell, Principal, EHDD**

PHOTO: BRUCE DAMONTE

Boulder Commons, Boulder, CO

10,000 sf mixed-use office building

Architect: EHDD

Mechanical, Electrical and Plumbing (MEP): Integral Group

Boulder Commons is an all-electric, zero carbon, and net-zero energy office building powered by solar photovoltaics (PVs) that cover the roof as well as the building's southeast-facing facade. Boulder's typically clear mornings and strong sunshine made the Commons a great site for solar PV and allowed building designers to get a four-story building in a cold climate zone to net-zero energy. The key to making this project cost-effective and feasible was a building "envelope"—windows, walls and roof—that does an excellent job at keeping the cold out in the winter and heat out in the summer, which reduced the need for a larger and more expensive HVAC system and enabled a smaller PV system. Plus, the southeast-facing wall PVs weren't an add-on, but were used as the exterior cladding material itself. By replacing the metal wall panels with solar panels, the builder found that on a net cost basis, the vertical PV wall cost less per unit of energy produced than roof-mounted PVs.

EXAMPLES OF COMPLETED PROJECTS

PHOTO: BR+A

Bristol Community College, Fall River, MA
John J. Sbrega Health and Science Building

50,600 sf classroom and laboratory space

Architect: Sasaki

Engineering: BR+A and Haley & Aldrich

The **John J. Sbrega Health and Science Building** is a three-story, 50,600 sf building completed in 2016 that houses medical classrooms, clinical space and numerous learning and diagnostic labs that traditionally are highly energy-intensive. To get this building to net-zero energy and zero carbon, the design and engineering team used a number of different strategies to reduce energy loads and effectively eliminate fossil fuel use, such as ground-source heat pumps, filtered fume hoods, enthalpy wheels, fan coil units, high efficiency lighting and natural ventilation in non-lab areas. The resulting Energy Use Intensity (EUI) of the building is 50 kBtu/sf per year, which is remarkable for a laboratory in a cold-climate zone. To meet its electricity needs, the building draws from rooftop solar panels and from the college's 3.2 MW on-site solar array. The array was developed for the campus through a **power purchase agreement**, which locks in lower electricity prices for the college for 20 years. The building was built for essentially the same cost as a standard high-performance LEED Silver building - a cost threshold that was non-negotiable because the construction budget had already been approved by the state, based on the original LEED Silver design criteria. The building achieved LEED Platinum certification and received the I2SL 2016 Go Beyond Award and an **AIA COTE 2017 Top Ten Award**.

"The Sbrega Health and Science Building at Bristol Community College achieved net-zero energy with a construction cost premium of less than 1% compared to the original high-performance design. The grants and incentives more than offset this cost premium, resulting in first-cost savings. In addition, the annual operating savings achieved by the net-zero building and the lower cost of electric rates from the solar power purchase agreement are equivalent to the tuition of 50 students every year. So, this was not just about the environment, it has an ongoing financial benefit that allows the college to better serve the community."

—Jacob Knowles, Director of Sustainable Design, BR+A

EXAMPLES OF COMPLETED PROJECTS

PHOTO: REI

REI Distribution Center, Goodyear, AZ

400,000 sf

Design/build team: REI, Butler Design Group, Rocky Mountain Institute (RMI), Merit Partners, Inc., The Renaissance Companies, DMW&H, KNAPP, CBRE and EDF Climate Corps

REI's LEED® Platinum distribution center in Goodyear, Arizona, which opened in July 2016, was designed to be a solar-powered, zero energy facility from the start. The 400,000 sf facility is located on 34 acres outside of Phoenix, Arizona. It employs more than 200 people and supports more than 40% of the co-op's sales. The building is powered by an on-site 2.2 megawatt solar system that powers the entire facility, providing about 25-30% more power than the building actually needs on an annual basis. The array is expected to pay for itself after 5 years through energy savings, and provide free power for 20 more years - the expected life span of the solar array. In 2019, the facility used 33% less energy and had 55% lower energy bills than similar distribution centers.

> The return on investment on this project—we're getting 20 years of free power—moves green building from being a moral issue to a business issue."
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> **—Rick Bingle, REI's Vice President of Supply Chain**
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> *(Excerpted from RMI article, "REI Takes Its Stewardship of the Outdoors to the Next Level: A Net-Zero-Energy Distribution Center", Feb. 1, 2017)*

EXAMPLES OF COMPLETED PROJECTS

PHOTO: LARA SWIMMER PHOTOGRAPHY

Inspire at the Russell W. Young Building, Seattle, WA

42-unit multifamily building

Architect: Public47 Architects

Developers: Shilshole Development, Russell's Fifth Avenue Inc.

Inspire at the Russell W. Young Building, located in Seattle's Fremont neighborhood, is a 42-unit apartment building and Seattle's first to be designed and built to be carbon-positive - meaning it produces more energy on-site from renewable resources than it uses in a year. The building features an iconic rooftop solar energy system, triple-pane windows, high-efficient plumbing, and a community garden. The 100 kW solar energy system generates 105% of electricity needs for the building, eliminating carbon emissions and supplying the all-electric building with all the power it needs. Additionally, to promote low-carbon transportation, the building has no on-site parking and is conveniently located walking and biking distance to shops, restaurants and public transportation, with a walking score of 94, biking score of 85 and transit score of 65. Inspire is the first residential building to pursue Seattle's Living Building Pilot Program, which challenges developers to create buildings that generate more renewable energy than they use. To encapsulate its achievements, Inspire was named NAIOP's 2020 Sustainable Multifamily Development of the Year.

> Inspire proves there is great market demand for carbon-positive buildings and that buildings like this can make financial sense for profit-oriented developers."
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> **—Brett Phillips, Board Member, Russell's Fifth Avenue Inc.**

EXAMPLES OF PROJECTS IN THE WORKS

ILLUSTRATION: TORTI GALLAS + PARTNERS

Hillandale Gateway, White Oak, MD

496-unit apartment complex plus 20,000 sf retail

Architect/Design Team: Torti Gallas + Partners, Duffie, Inc., NK Architects, MaGrann and Redwood Energy

The **Hillandale Gateway** is an 11-story tall, 500-unit, solar-powered, Passive House apartment complex planned for White Oak, Maryland. The project is being developed by Duffie Inc., Redwood Energy and NK Architects and will showcase zero-carbon design for the Washington DC Beltway. The apartments will serve low-income senior and market-rate households near Silver Spring. The proposed HVAC system employs highly efficient, whisper-quiet, cold-climate ducted mini-split heat pumps, located on apartment patios rather than in a "compressor garden" on the roof that would compromise green roof goals and double installation costs. To further reduce energy demand, every two to four apartments will share an 80-gallon heat pump tank—centralized, but without the energy losses and additional costs of a traditional system. All three building roofs and the entire nine-story, south-facing facade of the parking garage will be covered with solar arrays. The power generated by the arrays will cover the total energy demand of the building including residential energy use, and provide the owner free energy after less than eight years in operation.

> Solar arrays pay for themselves in four to eight years nationwide, and while pricing is still being estimated for this project, we expect this advanced array to have an eight-year payback or better."
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> **—Sean Armstrong, Managing Principal, Redwood Energy**

EXAMPLES OF PROJECTS IN THE WORKS

ILLUSTRATION: PAYETTE

Chelsea Soldiers' Home, Chelsea, MA

250,000 sf long-term care facility

Architect: Payette

Engineering: BR+A

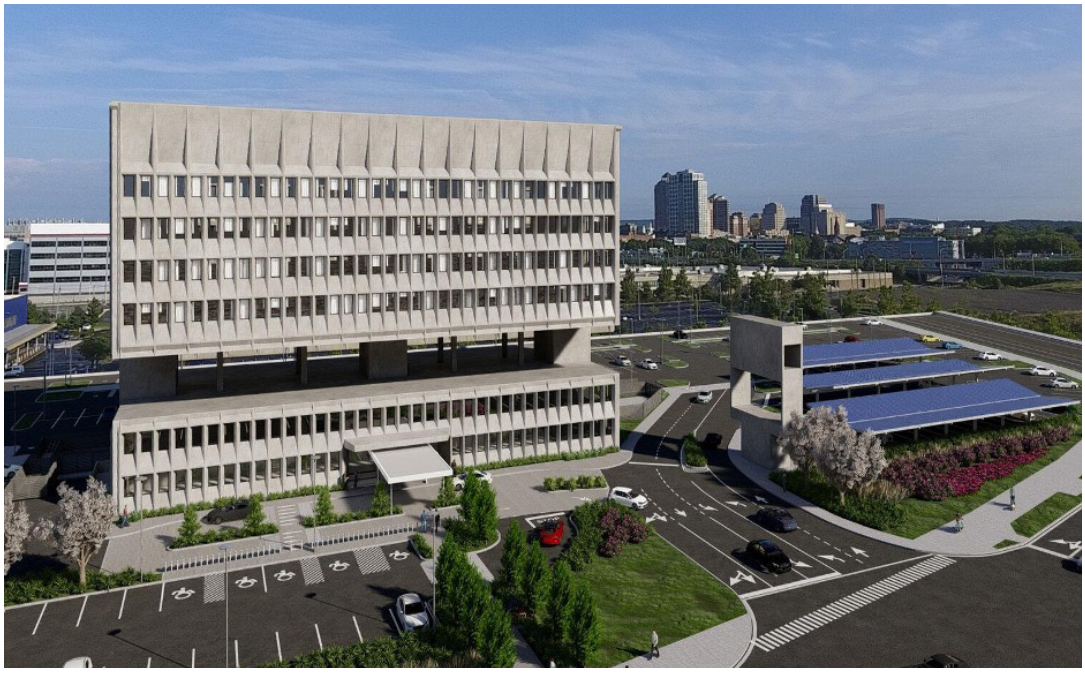
The **Chelsea Soldiers' Home** Community Living Center is a long-term care facility that will provide 154 private rooms, physical and occupational therapy services, community and activity spaces, a full commercial kitchen and more for Massachusetts veterans. The 250,000 sf building is designed to be a net-zero energy and zero-carbon building powered by solar energy. To achieve this goal, the building enclosure is well-insulated to nearly eliminate thermal bridging and uses triple-glazed windows. Both manual and automated natural ventilation, ground-source heat pumps, VRF air handlers, and dual enthalpy wheel ERV ventilation systems are used to heat and cool the building and keep fresh air flowing. Ground-source heat pumps also provide domestic hot water. To comply with local construction codes, the building also has fossil-fuel boilers for heating and hot water, but are designed to operate as back-up only. This building uses 70% less energy than those similar to it, and 50% less than the ASHRAE 90.1-2013 baseline. A 0.5 MW solar array will cover the roof and will be supplemented by off-site renewable energy to achieve net-zero energy and zero carbon. To get the building net-zero ready only cost $130,000 more for construction compared to a conventional high-performance building. This was verified through a detailed cost study as part of the local utility's net-zero pilot program. The utility incentive is anticipated to be $900,000, which will more than offset the $130,000 construction cost premium.

"The Chelsea Soldiers' Home Community Living Center achieved net-zero energy ready with a construction cost premium of less than $0.50 per square foot, compared to a conventional high-performance design. The utility incentive more than offset this cost premium, resulting in first-cost savings. Beyond eliminating greenhouse gas emissions, the building creates a home-like environment, with private, semi-private and communal living space. It will be quiet and comfortable, with beautiful views and optimal daylight for residents and staff."

—Jacob Knowles, Director of Sustainable Design, BR+A

EXAMPLES OF PROJECTS IN THE WORKS

ILLUSTRATION: BECKER & BECKER



Hotel Marcel, New Haven, CT

110,000 sf hotel

Architect & Developer: Becker & Becker

The former headquarters of Armstrong Rubber in New Haven, Connecticut, is being transformed into a net-zero energy and zero carbon building by Becker & Becker architects. The new **Hotel Marcel** will be a 165-room, 110,000 sf boutique hotel with a restaurant, gallery, and meeting spaces. A rooftop solar array and solar canopies over the parking lot supply all of the building's electricity. High-efficiency air-source heat pumps will be used for heating and cooling. Other efficiency measures will include triple-glazed windows, high-efficiency insulation, an all-electric heat pump HVAC system, and heat and energy recovery systems. These methods should help the hotel meet passive house standards, a set of design principles aimed at creating ultra-low-energy buildings.

> It will probably cost about $5 per square foot more, but we'll be saving about $1 per square foot every year on energy," Mr. Becker said. "So it really does make a lot of sense. It's an opportunity to create a new paradigm that the hotel industry can look at and study and learn from."
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> **—Bruce Becker, Principal, Becker & Becker**
> *[Excerpted from Nov. 2020 NYT article]*

For more information, visit **zero-code.org** or email **info@architecture2030.org**