

NET ZERO ENERGY

*Why and how to pursue net zero energy
for your new or existing building*

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Some Background

Introduction

Net Zero energy is newly minted industry shorthand that means that a building produces as much energy as it needs to operate. The term net zero can also apply to water and waste, but most commonly refers to energy.

While net zero is an easy concept to grasp, it can be complicated to design. In many cases, when the initial first-cost of the technologies comes into focus, the solar panels, fuel cells, wind turbines (and more) can overwhelm the project vision, and drown out the net zero goal.

The goal of sustainability and green building is to design buildings that can endure. Market adoption of LEED was a major milestone in the timeline of high performance buildings, but LEED is not the destination. Net Zero is the next milestone in that journey.

WorldGBC CEO Terri Wills thinks so. She believes that “the success of our ambitions to keep global warming to within 1.5 to 2 degrees will depend on our ability to advance net zero buildings.” Further, the DOE has been working under the Commercial Building Initiative (CBI) since 2008 to create marketable net zero buildings by 2025. There has been and continues to be vocal group of advocates who are making a powerful case for net zero.

This ebook explores the arguments for and against Net Zero energy; and lays out practical techniques to pursue Net Zero energy on both new and existing buildings.

Ideally building operators can increase efficiency and drive toward a net zero building stock in concert with cities driving toward 100% renewable energy.

The Why of Net Zero

The motivations for a net zero property are not static or singular

Companies that intend to lead their market or industry push boundaries to be the first of few. How they maintain leadership varies from one company to the next: some companies drive operations costs down; some companies articulate and live their commitment to protecting our climate from further damage; and still others are a shelter in the storm that continues to operate when an unforeseen climate event creates crisis in the community. These are just a few of the reasons that companies embrace net zero energy – and the list is growing all the time.

Understanding what motivates the net zero program within your business will clear the right path forward. When *the motivation* is clearly established, *the why* becomes the guiding light through the fog of implementation.

The motivation provides the rationale to change the standard pro forma and the context to evaluate the long-term return on investment; and it releases the innovation potential waiting within the project.





Consider how LEED was adopted more than a decade ago: Early adopters answered *the why* in a myriad of ways. They leveraged LEED's program challenges to differentiate projects, elevate performance expectations, and heighten awareness of climate change in the commercial real estate community. LEED generated excitement and spurred a radical change.

And like those who first took on the mantle of LEED by pushing to Platinum, internalizing building performance, and reveling in their status as a trailblazer, building designers, operators, and users that stretch for net zero will enjoy the same rush of leadership. In a field jammed with experts, nothing is more powerful than being the leader that overcomes the next challenge in green building.

Establishing clarity on the Why is a key step in pursuing a net zero performance goal.

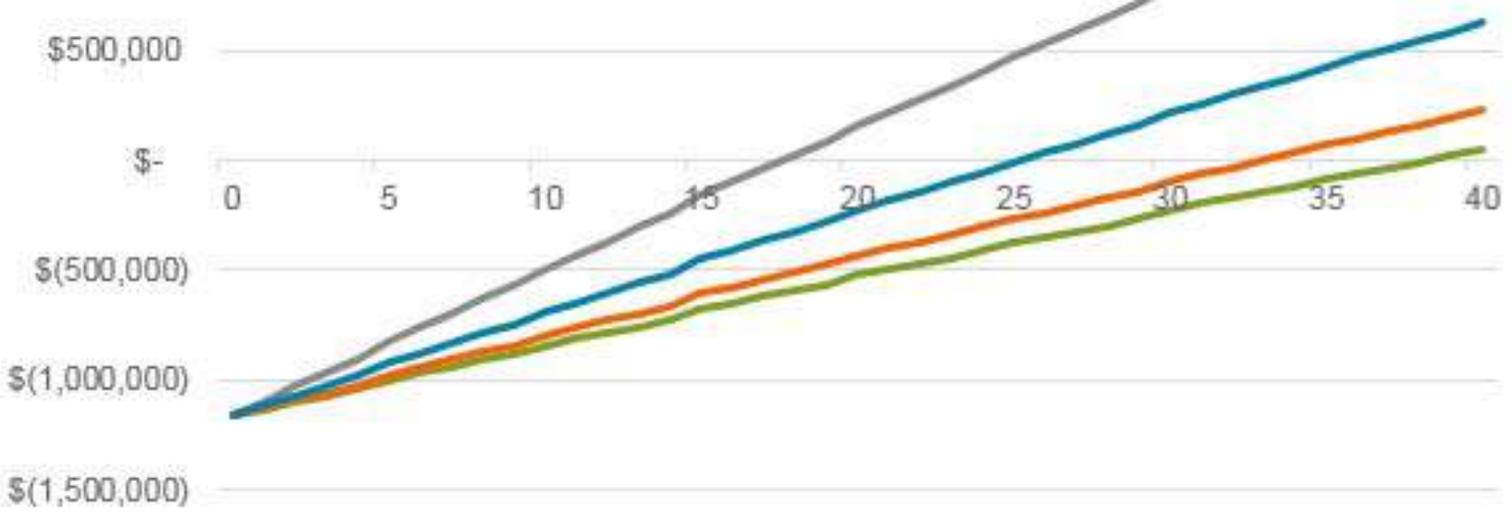
The net zero pro forma - Defining the benefits and results that matter most

The obvious challenge with net zero energy is that the building must produce enough energy to achieve net zero - and solar panels, fuel cells, wind turbines, etc. require significant capital to procure.

The first thing to know is that you cannot use the same conventional pro forma you've always used for a net zero project and expect the figures to pencil out. That's because a conventional pro forma ignores *the why* - and excludes the benefits that accrue to anyone other than the development manager entrusted with the base budget.

Only a Total Cost of Ownership pro forma will reveal how to properly financially assess and plan a net zero project.

You cannot use the same conventional pro forma you've always used for a net zero project.



The steps to create a Total Cost of Ownership pro forma are straight forward.

- First, break down the project scope into simple and digestible elements – horizontal and vertical development, core and tenant spaces, private and shared program. This allows you to understand how each component fits together, and it makes it possible to spot all the links in the chain. Then you can see where costs are hidden, which allows the team to get the preliminary net zero program directionally correct and defensible.
- Then you must establish key performance indicators, quantify all of the qualitative *why* factors, and sort on the value of each building feature including - and most importantly - energy performance.
- Once the KPIs are established, project modeling informs which design and operation programs will generate the best result – i.e. which program gets to the net zero goal. By changing the inputs, a myriad of scenarios can be evaluated until the team pinpoints

the intersection of their goals for their business, their design, and the environment. From there, the program is born and the goal of net zero is that much closer to being achieved.

Building this equation from scratch, ensuring that each element is captured and accounted for is complicated. Accounting for costs and benefits of net zero energy options, renewable power integration and purchases, and incentives is an unfamiliar task, and the iterative confirmations needed can be overwhelming. To make it easier for project teams to engage with the Total Cost of Ownership pro forma, Paladino and Company created a solution called UpShot™. This solution illuminates the financial interdependence of performance criteria, place-making, cost, and environmental impact, so that major design moves can easily be compared. Upshot allows the team to focus on the key performance indicators that matter most, enhancing cost-effective service and economic growth for a greater lifecycle analysis of the project.

Information about UpShot can be found here.

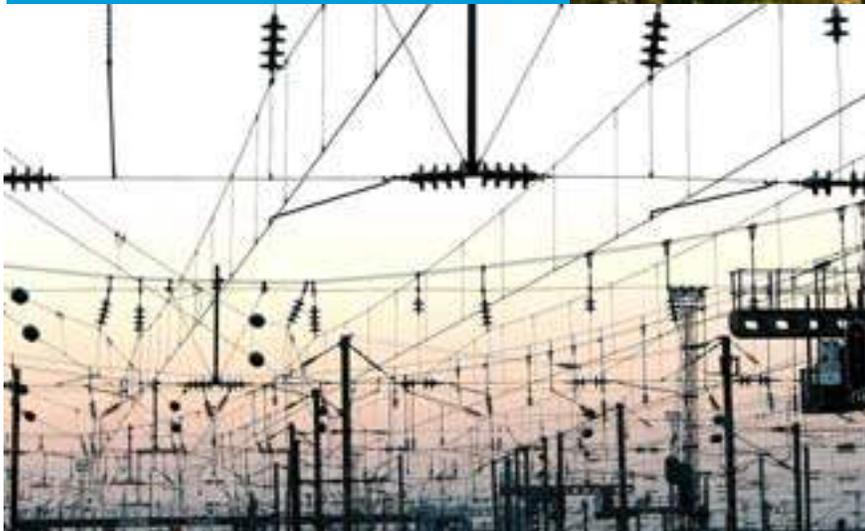
The How

Steps to achieve net zero in new and existing buildings

Climate change has - and will - impact both new and existing building operations. While it's easiest to achieve net zero energy on new construction, much of the U.S. building stock was built prior to 1980, so any broad scale strategy for net zero energy initiatives must address both new and existing buildings.

Source

According to the U.S. Energy Information Agency, 72% of floor stock in the U.S., or 46 billion square feet, belongs to buildings that are more than twenty years old. Source



For every unit of energy actually used by the building, many more units of energy are lost along the way due to inefficiencies in the delivery system - possibly ten units wasted for every unit used.



New Construction:

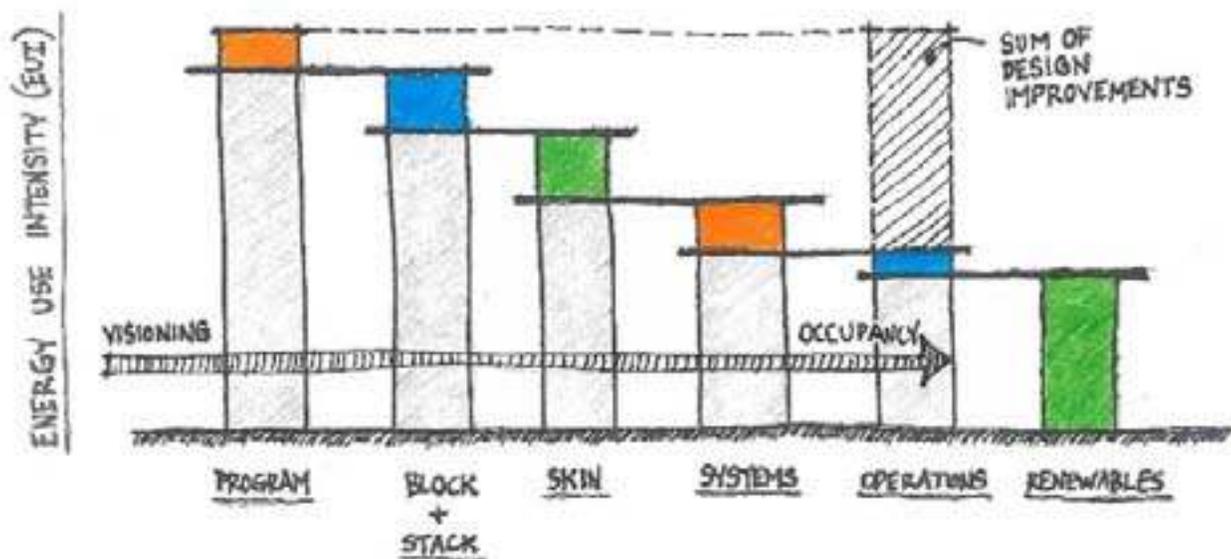
Once net zero energy has been established as the owner's value or priority, there is no removing that goal from the project. With a new construction project, the design and engineering teams are limited only by their imagination. We have worked with a variety of team structures and skillsets to produce this proven energy strategy.

When pursuing net zero energy for a new building, we follow an integrated, six-step process:

- 1. Set an energy budget based on comparable buildings in the same Koppen climate zone.** The Koppen system is best, as it opens the peer set to global design thinking. You must know what free energy from the geography and geometry is available to you if you are going to get the building to net zero energy. This energy budget can be accompanied by a market and building scan that highlights the strategies of buildings in similar markets and conditions.
- 2. Detail the criteria for access to air, daylight, and views to each space within the program.** Then shape the block and stack to its ideal orientation, depth, and height.
- 3. Develop a strawman envelope that covers the block and stack that houses the program.** Then run parametric energy simulations of use case, glass types, shading, U values, and technology loads. This is when Abundance thinking is most critical – take on the challenge to use exactly what you have to achieve exactly what you want.
- 4. Try two or three active system combinations of lighting, heating, and cooling.** Run the energy model again for parametric combinations of fan, pump, boiler, and chiller efficiencies. The models don't have to be perfect – but you will quickly understand how your choices move you closer or further from net zero energy. The parametric runs reveal the over-under on the energy budget.



5. **Size the PV, cooling tower, geo-thermal wells, or solar hot water to meet the operationally predicted over-under.** Whatever is left must be met with the grid.
6. **Go back to step one and repeat until you have achieved a net positive energy design.** This process is made infinitely more productive if you adhere to an integrated design approach.



The key to this process is that the owner values, Abundance thinking, and quality analytics come together under the integrated design process.

All teams need clarity on the goal, and must have solutions (like Upshot) to process the options that are available.



Existing Buildings

Because they are already built, existing buildings can be considered the greenest buildings in the city – and the organizations that push their energy management strategies closer to net zero achieve the best outcomes in terms of operational efficiency, market competitiveness, and sustainability impact.

Every building that Paladino has ever visited, audited, or inspected wastes

energy. And here's the one thing that you need to understand from this e-book: wasted energy represents the capital that existing building operators need to get to net zero. Every watt of energy saved through controls, occupant behavior changes, and upgrades is one less watt that needs to be generated on-site.

To move towards net zero, start with a plan to eliminate energy waste. The savings you accrue over time can be reinvested in your building and your business.

Abundance tells us that we must work with what we have, and we have a lot with existing buildings! Resources on a running property include an annual OpEx budget, time, utility bills, and knowledge of the building's operations.

There are three easy and cost-effective steps to start on the path to net zero energy



1. Find and fix your wasted energy

- Conduct an ASHRAE Level II or III audit. This will provide several energy conservation measures that span from no/low cost with an immediate payback, to more substantial upgrades that may take longer to return the investment.
- Implement no/low-cost measures immediately. Every building can tolerate adjustments to HVAC, lighting, and ventilation schedules so they run only when needed. Changes in set-points, time of use, occupant preferences, and other simple optimization measures often pay for the audit in the first or second year of the change.
- Consider how occupants impact the equation. Is the building kept cooler/warmer due to a few isolated complaints? Do occupants plug in unnecessary equipment? Do occupants understand how their behavior drives the building's energy usage? Don't be afraid to ask these questions to uncover the lowest cost options to save energy.
- Doggedly take advantage of every opportunity to reduce - and eventually eliminate - wasted energy. Roadblocks to implementation change year-to-year; so feel free to reconsider an idea that did not pan out the year before to see if barriers have been removed. Perceptions are rapidly changing, so take advantage of those shifts when they happen.
- If your building has a BAS system, use a real-time solution and analysis to find and fix energy waste before you get your bill. (click to learn about Clarity!)

It is estimated that the United States spend more than \$300 billion a year on energy that goes to drafty doors and windows, inefficient appliances and other energy wasters that could be easily remedied. This is more than the United States spends on its military every year.

Source



2. Use the savings from the first step to pay for improvements

- In the coming years, keep your CapEx budget for utilities consistent from year 1, and escalate annually in line with the rising cost of energy. The savings you realize through the incremental efficiencies in the first step becomes your budget to reinvest in the building year-on-year
- If you run out of efficiency options, there are clues to know if you have truly identified all possible wasted energy in your building. Look up your building type within the Commercial Buildings Energy Consumption Survey (CBECS) administered by the U.S. Energy Information Administration (EIA). If you are saving at least 50% more energy than the average building in your survey, chances are that it's time to invest in renewables instead of looking for further upgrades.
- Calculate the total cost per kWh produced for solar panels. This will be your baseline by which to compare every energy efficiency measure you identify. Any energy conservation measure that has a lower cost per kWh saved should be implemented before investing in solar panels.
- Each time you incur enough budget to implement the next energy efficiency measure, recalculate your budget on the cost per watt of renewable energy. The market is rapidly evolving, and the costs for renewable energy is steadily going down.

Approximately 30 percent of the energy used in most buildings today is either unnecessary or used inefficiently.

Source



3. When you reach the sweet spot where the cost of renewable energy is less than the cost of the next building upgrade, then and only then, is the right time to invest in power production through on-site renewables.

- Watch your efficiency gains and your property's performance. Before investing in the next phase or renewables, be sure that waste has not crept back into the building.

For some owners of existing buildings, the net zero goal could be achieved in 5-10 years. For others, the process may take longer.

Regardless of the timeframe of your journey, these steps will work on any building and for any owner or operations team that is 100% committed to a net zero energy goal.

According to Green Tech Media (GTM) research, the U.S. is now installing one photovoltaic system every four minutes. If the market continues to grow at this pace, by 2016 there will be a system installed every 20 seconds. This is huge growth since 2006, when one was installed every 80 minutes.

Conclusion

Do your values align to net zero energy?

You don't have to care about sustainability to understand that wasting energy is a terrible business strategy. What is waste? It's what is left after you buy something - and then figure out what you need. Every dollar wasted is a dollar that does not advance the purpose of the organization.

Pursuing net zero energy for your new or existing building can establish or strengthen a company's leadership position in the market place. Energy independence has reverberating advantages that cross economic and environmental values.

Understanding the motivation behind the goal of getting to zero is a key step to achieving success. And once the value of net zero energy has been built into a project, there is no giving up. If you're serious about the company's mission, get serious about net zero.

Do something amazing – get to Net Zero Energy!



Learn More:

About Paladino and Company

With offices in Seattle, Austin, and Washington DC, Paladino and Company is a green building consulting firm that sits at the intersection of business, design, and sustainability. This is achieved through rigorous analysis and abundance thinking as a driving force for change.

We help organizations to improve the design and operations of their buildings to minimize costs, increase profitability, and enhance employee satisfaction by operating under a three-part framework:

- Abundance drives us to identify resources that are readily at hand, and to employ them to the best possible effect.
- Attitude: Our team has the experience and instincts to create change, bring people into the journey, and challenge conventional thinking.
- Analytic rigor that delivers an industry-leading program of exemplary quality by raising the bar, in an implementable and cost effective manner.

With more than 2,000 green projects internationally, including more than 740 LEED certified buildings, Paladino serves architects, developers, and owners in industries including commercial real estate, higher education, hospitality, industrial, multifamily and mixed-use.

Contact us to make a difference in your business, buildings, and people through your real estate.

www.PaladinoandCo.com

[Learn More >](#)

Download our white paper about value-based sustainability
Sign up for our newsletter



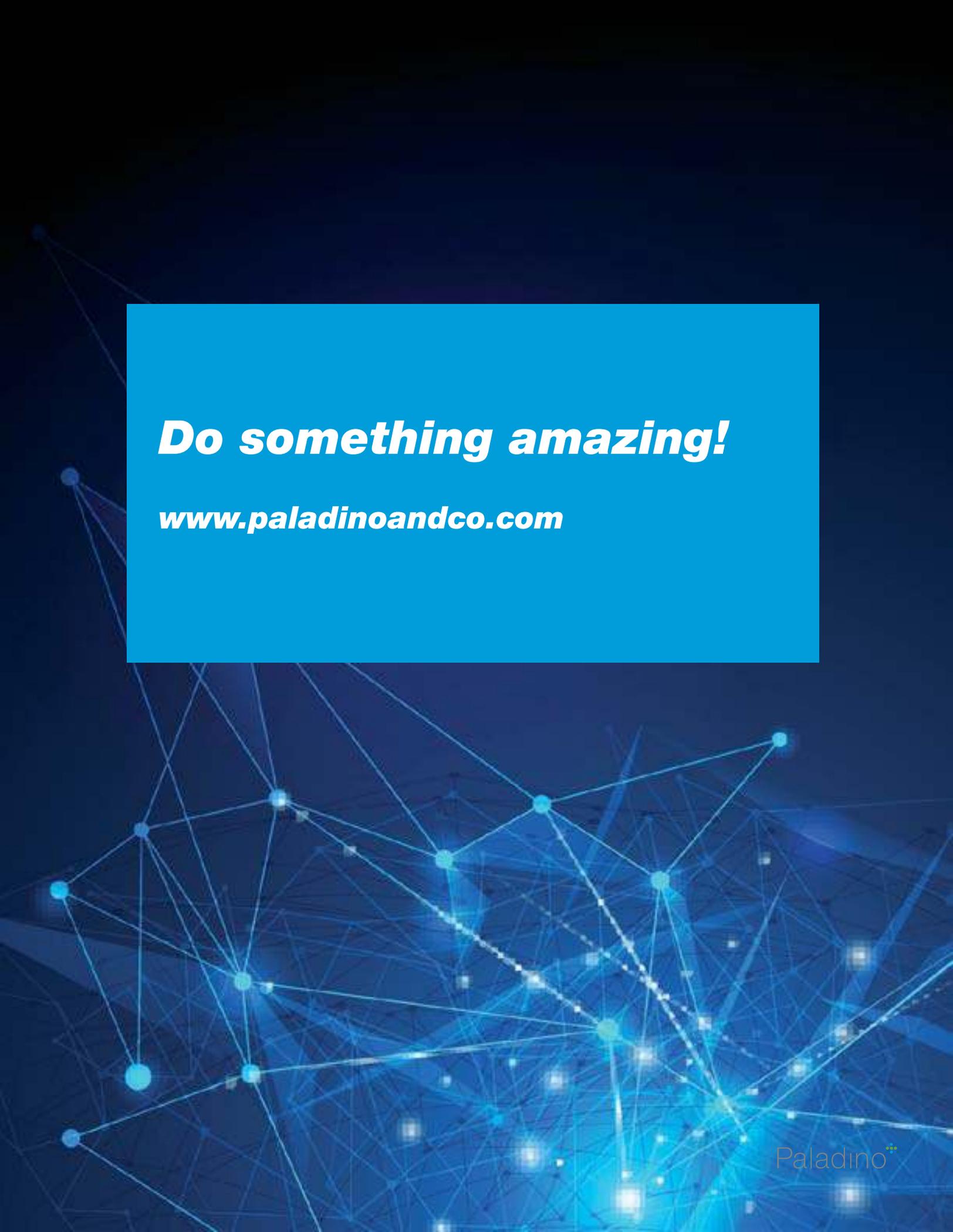


Resources:

- ***Getting to Zero Forum***
- ***2016 List of Net Zero Buildings***
- ***Net Zero Commercial Building Initiative***
- ***Solar Panel Efficiency Cost Over Time***

Here are some examples of how companies are using on-site renewable energy. Read, learn, then imagine something new for your buildings!

- The Brando Eco-Resort, Tetiaroa, Tahiti, LEED Platinum
- Hertz Headquarters, Estero, FL, LEED Gold
- PNC Bank Davies and Andrew Net Zero Energy Branch



Do something amazing!

www.paladinoandco.com