

PMNetwork®

AUGUST 2018 VOLUME 32, NUMBER 8

ZERO
MEANS

ZERO

ELEVATING ENERGY EFFICIENCY PAGE 54

**PATHS TO PROJECT
LEADER**

PAGE 42

**NEXT-LEVEL
DRONES**

PAGE 8

**MINING DIGS INTO
HIGH-TECH**

PAGE 34

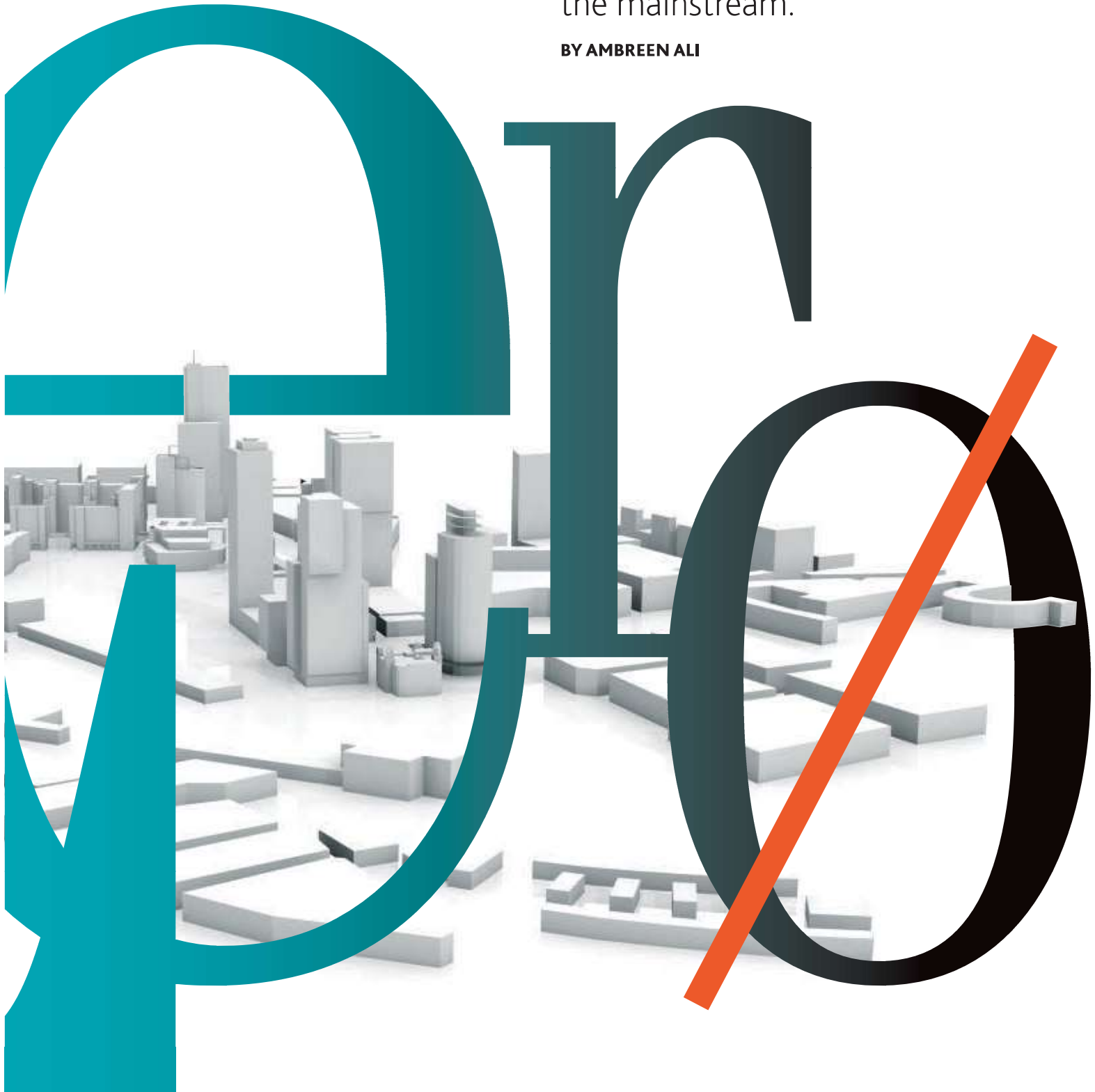
Svart Hotel
project in Norway

The image features a bold, abstract composition. A large, black, rounded shape dominates the left and top portions of the frame. A vibrant teal color fills the right and bottom areas, with a diagonal line separating the black and teal sections. In the bottom right corner, a 3D rendering of a white computer keyboard is visible, partially obscured by the teal shape. The word "ABSOLUTE" is printed in a clean, white, sans-serif font across the black area.

ABSOLUTE

Teams are tracking new metrics and ramping up collaboration to bring net-zero buildings to the mainstream.

BY AMBREEN ALI





“On a net-zero project, a project manager needs to get everybody to the table early and on the same page. You spend more time upfront in the planning stages.”

—Murray Guy, Integrated Designs, Saskatoon, Saskatchewan, Canada

The energy efficiency bar keeps rising. For many organizations, the future of building construction is net-zero energy. It's a tall order, and one that some governments are beginning to mandate. To achieve net-zero status, all energy consumed annually by a building must be completely offset by energy renewably produced on-site—no carbon offset purchases allowed.

The pursuit of that overarching requirement shapes every net-zero project from kickoff. Nearly every planning decision impacts a structure's ultimate energy footprint—from the direction the building faces to the types of windows and insulation used. So project managers must ensure close collaboration between design and construction teams while keeping one key performance metric top of mind: the building's energy balance. Any energy consumed must be offset by energy generated.

“It's no longer good enough to say your building is greener than another building because of the way it is built,” says Victoria Burrows, project manager of the World Green Building Council's Advancing Net Zero global project, Anliac, France. “We want you to know how it performs—how much energy you are using and wasting, and where the energy comes from.”

The number of projects seeking net-zero status in the United States and Canada increased nearly 50 percent from 2016 to 2017, according to the New Buildings Institute. It's a trend that one day could



The Energy Lab at Hawaii Preparatory Academy in Kamuela, Hawaii, USA, functions as a net-zero-energy, fully sustainable building.

be standard practice on construction projects around the world. The U.S. state of California wants all new residential construction to be net zero by 2020; commercial construction projects need to hit the same target by 2030. The European Union requires all new buildings to be “nearly net zero” by 2021—except for new public buildings, which had to reach that target this year.

HIGHLY COORDINATED

The central task facing any net-zero building project team is tracking the energy balance. That challenge makes these projects intensely collaborative. The design team cannot simply pass blueprints off to the construction team; they must work together to ensure they meet the energy bottom line.

“On a net-zero project, a project manager needs to get everybody to the table early and on the same page. You spend more time upfront in the planning stages,” says Murray Guy, CEO, Integrated Designs, Saskatoon, Saskatchewan, Canada. His organization worked on a project to build the first privately developed commercial net-zero building in Edmonton,

Alberta, Canada. To deliver buildings that hit the net-zero mark, his teams use a “target value” design process that keeps the core efficiency requirement front and center and breaks down silos between teams. Also, proactive commissioning “should be in every project manager’s toolbox,” Mr. Guy says. It involves testing building systems as early as possible to confirm performance targets and holding weekly meetings to ensure teams deliver on planned work.

Done right, the benefits of net-zero projects can go beyond the environment. Mr. Guy says they can cost less than traditional builds because lean and integrated practices lead to smarter designs. Heat pumps might be installed to reduce dependency on electric heat, for example, or high-efficiency appliances might be installed to reduce the number of solar panels the structure requires on top.

With so many systems and components affecting a building’s energy balance, getting to zero is a formidable process, says César Ulises Treviño, CEO, Bioconstrucción y Energía Alternativa, Mexico City, Mexico. The organization is overseeing construction of a three-floor commercial building in Mon-



“For a net-zero project, we start the design process by studying the site and determining the building footprint and location that will maximize solar capacity.”

—Andrew Schuster, Ashley McGraw, Syracuse, New York, USA

Net-zero chemistry laboratory at the University of Nottingham in Nottingham, England



PHOTOS COURTESY OF GLAXOSMITHKLINE

terrey, Mexico that seeks net-zero certification from the International Living Future Institute. It is the first building of its kind to do so in the country.

“In contrast to any regular building project, we are highly dependent on the integrity of our energy models,” Mr. Treviño says. To be able to trust the models—which predict the performance of HVAC and lighting systems, among other things—his team had to be very precise. “It was a big learning challenge for the whole team. We had to be very critical with all the inputs in the models.”

All major stakeholders in the two-year project, slated for completion at the end of 2019, have

had to work in an integrative software program to track the building’s overall energy budget. That has required an unprecedented level of coordination among designers, engineers, construction crews and facilities managers, Mr. Treviño says. “Most engaged parties are used to working in our respective fields of expertise, so it has taken us more effort and masterminding than we had expected,” he says.

But the project’s biggest hurdle to achieving net-zero energy consumption was Monterrey’s climate: During the warmest months, the average high temperature reaches 94 degrees Fahrenheit (34 Celsius). The team took a two-pronged approach to prevent

the building’s HVAC system energy consumption from pushing the building off balance. It included a high-performance facade, maximized airflow throughout the building, and designed the HVAC system to run as efficiently as possible.

Finding the right multifaceted approach for cooling the building lengthened the design process a bit. But because the team padded the schedule in anticipation of design challenges, the project is still expected to close on time. “It may cost us some extra resources compared to current best practice, but we are committed to doing whatever it takes to complete this project,” Mr. Treviño says.

LINES OF SITE

For the project in Monterrey, the team took a long look at on-site renewable



“It’s no longer good enough to say your building is greener than another building because of the way it is built. We want you to know how it performs.”

—Victoria Burrows, World Green Building Council, Anlhiac, France



energy generation options for the building. It ultimately settled on photovoltaic arrays and thermal solar systems after discarding other clean energy technology options as infeasible. The right mix for any project depends on the building's site and energy needs—but in the United States, most net-zero buildings rely exclusively on solar, says Andrew Schuster, principal, Ashley McGraw, Syracuse, New York, USA.

He is managing a US\$4.3 million project to erect an office building in Allentown, Pennsylvania, USA. Slated for completion by the second quarter of 2019, the project is expected to produce 130 percent of its estimated energy use entirely through rooftop solar arrays. For Mr. Schuster and his team, the project plan was grounded firmly on the building site. "For a net-zero project, we start the design process by studying the site and determining the building footprint and location that will maximize solar capacity," he says. "Then we can identify what the available energy will be and set that as an energy budget."

To ensure the project stays within that budget, the team settled on the building envelope design much earlier than a typical construction project. Then it tracked the structure's energy bud-

Building in Balance

2020

Year by which the U.S. state of California wants **all** new residential building construction projects to be net zero

2025

Year by which California wants **50 percent** of state building renovation projects to be net zero

2030

Year by which California wants **all** new commercial building construction projects to be net zero

Start of 2021

Deadline for when **all** new buildings in the European Union must be nearly net zero

Number of net-zero commercial building construction projects in the United States and Canada underway in

2016

2018

279

415

700%

Increase in the number of certified, verified and emerging net-zero projects in the United States and Canada between 2012 and 2018

Sources: California Public Utilities Commission; "2018 Getting to Zero Status Update and List of Zero Energy Projects," New Buildings Institute

get similarly to how it tracked the traditional budget—reviewing it at major milestones to ensure the choice of heating and cooling systems, for example, didn't require more energy annually than was available. Adding to the project's complexity is its accelerated schedule, which requires creating multiple procurement packages in accordance with the critical path, Mr. Schuster says. "These multiple packages allow us to continue to overlap the design, bid and build phases to save time."

Due to the energy-intensive nature of the science processes in the building, the net-zero chemistry laboratory at the University of Nottingham in Nottingham, England needs more than solar panels to produce enough energy, says Rick Sharp, executive associate, The Fairhursts Design Group, Manchester, England. The organization designed the building, which features both solar arrays and a biofuel heating system. The four-year, £15.8 million GlaxoSmith-Kline Carbon Neutral Laboratories for Sustainable Chemistry project was completed in June 2016. Mr. Sharp's team did more than track the building's projected annual energy usage. The project also had a goal to offset all carbon emissions generated from construction activity (including production of raw materials) and operation within 25 years.

To reach this requirement, the team designed the building with a vibration pile foundation to minimize the use of concrete. Through the use of timber, it kept the building frame as lightweight as possible. As part of its "carbon-accounting" approach, the team also surveyed the entire construction process to minimize waste and closely monitored all waste produced and fuel consumed by construction and transportation equipment.

"Sustainability extended to every aspect, from material selection to construction and through building function and operation," Mr. Sharp says.

READY TO CHANGE

New government mandates notwithstanding, construction teams might find themselves grappling

with the reality that net-zero energy footprints cannot be achieved on every project.

"You need a site that actually has the ability to capture energy," Mr. Schuster says. "It's very difficult with tall buildings on narrow sites where you don't have a large footprint for solar panels. And there are challenges with shady sites that can't get a lot of solar access."

Sometimes regulatory barriers limit the amount of on-site renewables that a property can have, says Jorge Chapa, head of market transformation, Green Building Council of Australia, Sydney, Australia. Commercial net-zero energy projects are

uncommon in Australia, where the sustainability focus has been more on switching to renewables off-site and at scale, he adds.

Nonetheless, most new buildings around the world ultimately can reach the net-zero goal if project stakeholders are able to adapt design approaches to a region's respective climate and available carbon-free energy solutions, Ms. Burrows says. Some flexibility is necessary: If renewable energy generation options aren't cost-effective today, some Green Building Council programs allow buildings seeking net-zero certification to develop a plan for eliminating a fossil-fuel footprint over time to encourage resilience and cost effectiveness.

California's looming net-zero rule isn't so lenient—although it applies only to electricity consumption and

not natural gas. Still, "most building developers are a bit behind the curve on net-zero energy design and construction practices," says Brandon De Young, executive vice president of De Young Properties in Fresno, California, USA.

Mr. De Young says his firm, which specializes in energy-efficient home construction, plans to provide in-depth training to all of its stakeholders, including construction management teams, so they are prepared for the new rule. "It's important to stay ahead of the curve when it comes to building science and technology. Then we can more easily adapt to future code requirements when they go into effect." **PM**



"It's important to stay ahead of the curve when it comes to building science and technology. Then we can more easily adapt to future code requirements."

—Brandon De Young, De Young Properties, Fresno, California, USA



Svart Hotel
project in
Norway



Positive Thinking

Some project teams aim to push past net zero: They want their buildings to generate a surplus of energy. For its Svart Hotel project, Arctic Adventures of Norway is leveraging the site's location above the Arctic Circle to reach that goal.

The area receives up to 20 hours of sunlight during the longest days of year, so a team at the architecture firm Snøhetta adjusted the building's design to harvest as much of this resource as possible. Svart's rooftop solar panels, which will span 51,000 square feet (4,738 square meters), will provide more than enough energy for the hotel's day-to-day use.

To keep sustainability front and center, the project team has sourced construction materials locally. And the hotel's design includes features like recessed terraces to provide shade in the summer and geothermal wells for environmentally friendly heat in the winter months. Thanks to features like these, the structure's energy usage will be 85 percent lower than typical hotels. Arctic Adventures hopes that once completed in 2021, the hotel project should allow tourists to minimize their environmental impact while visiting the pristine and remote region.