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EDGE: Sustainable Real Estate in the Digital Age

The real estate industry faces significant challenges and opportunities to reduce greenhouse gas (GHG) emissions, while providing health benefits to building occupiers. In addition, innovations in digital technologies are transforming the real estate sector in the way that buildings are constructed, developed, managed, leased and operated with sensors. One real estate company that is leading innovation in both smart buildings and sustainability is Dutch developer EDGE (formerly OVG Projectontwikkeling BV). EDGE also expanded development projects to other countries: Unilever USA HQ in New Jersey, Boston, Germany, and London. EDGE's CEO and founder Coen van Oostrom was able to create some of the most sustainable buildings in the world, but the company met challenges along the way.

OVG's Transformation to Sustainable Real Estate

When Coen van Oostrom founded OVG Real Estate in 1997, it fit the mold of a more traditional real estate company. He did not intend for his company to challenge the status quo of the building business. In 2006, after a chance meeting with Al Gore, Van Oostrom committed to transforming OVG from "just an old school developer" to a producer of sustainable and technologically advanced buildings. As he stated in a recent interview that "there's no way we don't do anything that is not close to net zero [emissions]." Van Oostrom has since made a name for his company with its groundbreaking use of digital technologies to advance green building. In June 2018, OVG Real Estate officially transitioned to become EDGE (see **Exhibit 1** company timeline; **Exhibit 2** financial statement).

In recent years, the team at EDGE has formed a "smart office" category by transforming the way technology is used in office building design, construction, and operation. EDGE integrates four pillars — wellbeing, sustainability, design, and technology — to create workplaces that reduce greenhouse gas emissions and material waste, while providing spaces that enhance employee health and engagement. Van Oostrom attributes his success to making a product that is less expensive and of better quality than that of his competitors. He says, "In the real estate industry, many people think that if I buy a plot of land, I have a monopoly on that land and whatever I build. That is enough to make some money. But I believe if you want to grow and build a brand, then you should outperform that market. That is not so difficult, because the market has been underperforming for so long." His journey to outperform the market began over 20 years ago when he saw opportunities to develop greener buildings.

In 2007, van Oostrom's company built their first energy-neutral office building, Las Palmas, in Rotterdam. In 2014, OVG developed the Edge building in Amsterdam, which received the highest rating for sustainability in office buildings (98.4%) under the Building Research Establishment Environmental

Assessment Method (BREEAM). The Edge building uses 28,000 sensors to regulate heating, cooling and air quality. It enables users to control their workspace heating and lighting preferences through a smartphone app. The company expanded its work with the building of EDGE Olympic (2018), which pioneered a new generation of healthy and smart buildings. It was the first Dutch building to meet pre-certified Platinum ratings in the WELL Core & Shell standards and is energy-neutral at the city level. This certification is impressive considering the building is a retrofitted 1970s office block, not a new build. The building uses one-third of the energy ($72kWh/m^2$) of a typical non-residential building (which consumes 223 kWh/m^2). Some features that contribute to this sustainable building process include reused materials that met Cradle-to-Cradle certifications and the use of solar energy and geothermal storage.

The Edge, Amsterdam

Development Partners

The idea for the first Edge building was initiated by the building's main tenant, Deloitte. The company wanted to display its commitment to advancing a data-driven future by exemplifying these principles in its office building. Deloitte sought to make a statement with its new office building that would parallel its role in championing IT and big data usage in office environments. Deloitte initiated a competition for its new office. OVG and PLP Architects won the competition in 2007 and worked closely with Deloitte to meet the company's desires for a workplace that showcased sustainability and the user experience (see Exhibit 3 for the Edge factsheet). OVG developed the building as a "build to suit" (BTS) for Deloitte. Deloitte pre-leased 100% of the building from the developer. The project was fortunate that Deloitte's philosophy supported timeframes for returns on investment in under 10 years. The digital ceilings alone, which contributed significantly to the sustainability of the building, would take an estimated 8.3 years to earn a profit. After the concept design had been completed, the 2008 financial downturn hit and Deloitte could no longer serve as the main tenant. The project invited Vrije Universiteit to rent part of the building, which would contribute the financing necessary for the building to continue but would require changes to the architectural design. The architects added flexibility to accommodate extra tenants, subdividing the core office space and creating a second entrance. The initial project had not accounted for factors such as additional solar, but main investor ABN AMRO had a strong interest in sustainability and agreed to continue financing the project despite the economic downturn.

By focusing on the BREEAM rating system as its practical guide, the team took a holistic view of the building and assessed the tradeoffs of testing new technologies against the sustainability potential. The building's energy consumption was net negative — an estimated -0.3 kWH/m^2/year versus +40.7kWH/m2/year for a traditional office building. The Edge building set new standards in 2007 for sustainability and flexible workspace, while keeping operation and maintenance costs and environmental impact to a minimum. Office buildings are notoriously expensive to operate and maintain, but the Edge manages to reduce costs while creating an office that value well-being and sustainability. A combination of design and data amplify the sustainability and well-being features of this building. Sandra Gritti, product excellence director at EDGE Next, says: "We are fighting two problems — global warming and the need for better workplaces — and we approach these through the technology and the design of our buildings." She makes it clear that a smart platform is a tool rather than the solution.

Design

In order to achieve its net-zero energy goals, the architects of the Edge installed solar panels not

just on the its rooftop, but on the rented roofs of neighboring buildings as well. The building employs aquifer thermal energy storage systems (ATES) to meet its energy needs, and collects rainwater to flush toilets and irrigate garden areas. The atrium draws in northern sunlight and provides a social space to meet energy-efficiency and well-being needs. The layout might initially seem wasteful — the atrium and socializing areas account for 25% of the building space, compared to just 10% in conventional office buildings — but it encourages productive interaction and dialogue between colleagues (and does not create extra cost as it does not need to be specifically conditioned). Coming as a surprise for OVG and the architect, the atrium and cafeteria are actually the most popular work areas in the building, despite lacking specific sound insulation, and controlled temperature, lighting, and air movement, as required for typical workspaces. It is actually economical per employee: the flexible set-up and smart data system allows for accurate hot-desking, so much so that the building's 1,100 workplaces now serve more than 2,500 employees, even though it was originally intended for 1,700. At the time Deloitte had five buildings in the Netherlands. The Edge is the most expensive one if calculated by per square meter as it is in the CBD of Amsterdam. But in terms of the price per person working in the building, it is the cheapest building to maintain among the five. One reason for this is because Deloitte has a lot of consultants and accountants that go to customers. Therefore, the switching of desks and hot desking are more critical and productive compared to a bank's workforce where people may sit at a desk all day. Deloitte uses the building much more diversely and the building is always full.

Smart Buildings: Using Data to Pursue Sustainability wit

Van Oostrom says that although sustainability has historically been achieved through design, it could be improved with data. For example, if you put a staircase in the middle of a building, people may automatically be drawn up the staircase, making a healthy decision to not take an elevator. That design does not require sensory input. However, it is very difficult to achieve sustainability and improve health outcomes at the next level without data. With sensory input and data, a landlord can measure what is happening in a building and where to make improvements. Digital technologies can monitor a building and adjust factors such as air quality and ventilation based on the number of people in the building.

The sustainability performance of the Edge building cannot be achieved without digital technology. A Cambridge University report described the Edge as the smartest building in the world, referring to it as a "computer with a roof." The Edge building contains a highly integrated network of IoT devices, bridging building and tenant systems into a seamless experience. This network measures all systems, such as energy, occupancy, user experience, and maintenance, using data to keep them operating efficiently. Data analytics and machine learning facilitate continuous systems monitoring and adjustments for energy proficiency, occupancy, and user productivity. Historical data are used to predict and recommend system adjustments in specific scenarios and automate these functions to react spontaneously when such scenarios arise. Data can also be used when updating the systems throughout the lifespan of the building. Key components of all EDGE buildings include the infrastructure, interactive user facilities, and central data platform. One vision of EDGE is that each of its buildings will be built and operated on the same technology platform and offer consistent user-centered design to serve the needs of the fast-changing and demanding workforce (see **Exhibit 4**). The first Edge building achieved profits and sustainability through digital technology, and paved a path for future innovations.

EDGE Olympic, Amsterdam

The Edge became a prototype of a new generation of smart office buildings, and the EDGE

Olympic learned from all the data coming out of the Edge building. One of the biggest lessons from the Edge building (2014) was that even in a building designed to be sustainable, occupants do not always align with green practices. When the Edge first opened in 2014, only 20% of employees checked in with the building app. By 2016, this number had dropped to 1%. As a consequence, meeting rooms were overrun. Some employees did not bother booking rooms online, while others booked multiple rooms as extra workspaces that they might or might not use. These examples illustrate how user behavior impacts building performance. Van Oostrom wondered if behavioral solutions may be an area for future innovations?

EDGE teams learned many lessons from the first Edge building that informed the design of EDGE Olympic (**Exhibit 5**). First, they improved the sensors that measure key indoor climate parameters, such as temperature, humidity, light intensity, and noise. EDGE Olympic uses a single cloud platform to monitor the building's systems. This flexible digital infrastructure allows building operators to plug and play with extra services. Secondly, a smartphone app lets users personalize their workspace, including the lighting and temperature. This same technology facilitates building access, people location, and identification of available meeting rooms or workspaces. Extra services can be easily added to meet the needs of tenants and users. This enables EDGE Olympic to continuously update its systems to contribute to user comfort, productivity, and creativity. The building was designed to keep its residents healthy by nudging them to move and interact with others.

After moving its headquarter to EDGE Olympic, the EDGE company employed Leesman to conduct employee experience surveys of its spaces in the spring of 2019. Leesman offers a standardized and independent measurement of the employee workplace experience. The Leesman Office Survey is a employee experience benchmark. It allows organizations to assess how well their workplaces are supporting employees, benchmarked against the Leesman Index — the world's largest independent database on workplace experience with more than 480,000 responses globally (as at December 2018). Leesman conducted pre- and post-occupancy surveys with EDGE staff, while all other occupants completed a post-occupancy survey. The results were emphatic. EDGE's HQ scored an Leesman Index (LMI) of 81.7, earning it a Leesman+ certificate. Respondents agreed almost unanimously that the building is a place where they are proud to bring visitors (97.8%), and it is an enjoyable work environment as well (96.7%). This achievement adds to the project's WELL V2 Platinum certification, which scores workplaces on areas including water, nourishment, light, movement, thermal comfort, sound, materials, mind, and community.

EDGE used the Leesman Office Survey to re-evaluate its own workspace and what its people need to feel supported in their roles. Armed with that data, the company was able to make the right design choices for its new space at EDGE Olympic — and scores across these particular areas improved. In the Leesman post-occupancy survey, 97.1% of respondents reported satisfaction with the variety on offer in the new space, a 61.4% increase in percentage points. Likewise, satisfaction with small meeting rooms jumped by 65.5 percentage points to 85.5%. Florijn Vriend, wellbeing innovation manager at EDGE, believes this is a vindication of the organization's efforts to boost social interaction. "We truly believe that interaction in the workplace is of extensive value, but only when it occurs at the right time and place," she explains. "Today's office worker needs to get focused work done, alone. Research shows that it takes around 25 minutes to reach deep concentration, yet in an open office the average worker is distracted at least every 10 minutes." The solution for EDGE was to provide a solid variety of spaces so that people can find a quiet workspace when they need to focus. Satisfaction with "individual focused work, desk based" climbed from 26.7% to 96.5% from the old office to EDGE Olympic. Meanwhile, employees' sense of both personal wellbeing and productivity improved approximately 50 percentage points after the move.

Vriend explains: "With our smart building technology we are able to measure the performance of our building in real-time and on an objective level. For example, we can see the level of air quality in every space. Comparing that to the subjective data from Leesman allows us to see where the overlap is, but also where the differences lie." Ultimately, EDGE makes increasingly accurate evidence-based improvements to the design of its spaces. EDGE plans to share that ability with all of its future tenants, through a pre- and post-occupancy sensor-test and survey, in what it calls a Workplace Performance Check. "This offers valuable insights for tenants regarding fit-out decisions such as what to take to their new office but also what to improve on," says Vriend.

Digital technology enabled EDGE's team to quickly adapt its physical spaces to user needs during the COVID-19 pandemic. During the pandemic, Van Oostrom observed that employees wanted a hybrid way of working, with shared hot desks. Their data predicted that these changes could reduce space demand by 25%, which would save companies a lot on rent. The value proposition of the first Edge building's hotdesking for Deloitte is becoming relevant for many companies that are now thinking about a hybrid model of working from home and working in the office. In order to make such a change possible, tenants would need a flawless booking system that would understand the space use pattern by employees and predict the busyness of the office. The data would then need to identify how many services would be required for that day, such as for cleaning the meeting rooms. The maintenance service or occupant service will be correlated with the data building operators have. Other potential cost savings would come from energy use, as a sophisticated booking platform could enable a company to keep one floor empty on Fridays if predicted employee numbers would be low. Agile response to the tenant's demand and satisfaction highlights the increasing importance of data. This can also harness opportunities for tenant savings and energy reduction due to the changing preferences or landlords. The technology itself is getting cheaper with most packages costing about 50 cents per square foot per year.

In 2018, EDGE sold 90% equity ownership of EDGE Olympic to Nuveen Real Estate. Nuveen bought two offices totaling €200 million with EDGE: EDGE Olympic (Amsterdam) and EDGE Grand Central (Berlin). Upon exit, EDGE signed a master lease with Nuveen to continue operating the property and monetizing the building's superb performance in sustainability, wellness, and digital platform (see **Exhibit 6**). Van Oostrom commented on Nuveen's acquisition: "I believe investors nowadays want to have buildings that are at the top level of the sustainability. They also tick the box when it comes to health and smartness. Sustainability is at the moment the most important factor. However, we are not the only one doing it. There are other big-name developers, such as Tishman Speyer and Hines also develop very sustainable buildings. I think what makes us unique at the moment is the holistic view of health, sustainability, design, and smartness. We are more advanced in bringing all these four pillars together in one building."

Development Process: Vertical Integration and Horizontal Learning

Coen van Oostrom's commitment to sustainability met challenges upon implementation. He described the old OVG company as "traditional and money-focused." After discussing climate change with Al Gore, he declared changes at the office. "From now on, we are only going to build sustainable buildings. We are going to get rid of all of our terrible BMWs and everyone is going to drive a Prius." Forcing a cultural shift within the company was challenging. Employees left, while others were unhappy with unconventional approaches. Van Oostrom acknowledged that innovation in the real estate industry is very difficult. Culture, complicated value chains, and industry conservatism all impede innovation.

Even if a developer commits to innovation, external factors such as city permitting procedures or

construction companies can cause delays. Under such circumstances, the project team's top priority was to fight to keep development on time and on budget, and they won't be bothered by innovation, which often adds extra complexity to projects. Van Oostrom says, "Innovation very often only deals with relatively small parts of the building. The whole building development or management contractual structure can undermine that innovation."

To standardize its development product and process, EDGE created an instruction manual "Blueprint" to guide different stages of the development projects. Most projects might take four years to build. Within the four years, there are a lot of new opportunities in the built environment. It became very complicated to change. They started by making a blueprint that was the same for all regions, only to find out that there are differences in legislation across regions. In the U.S., for example, technologies such as ceiling units, lighting, and sensors cannot exist together in one unit. If a ceiling unit contains plumbing, lighting, and sensors, the unions will object as this may take away work for people that normally will do that on a construction site. A standard manual blueprint cannot cover repeated challenges with legislation that differed by country.

Pitching innovation to a firm's executive level may be easy. But when it comes to implementation, experienced people are used to doing things in a certain way and many are afraid of change. Investors at the CEO level might be supportive of innovations for net-zero or healthy buildings, but the due diligence process might require a year to analyze doubts about building performance measurement, tenant interest in healthy buildings, and the value of upfront costs. This lengthy process may jeopardize the project financing and construction schedule. "Investors tend to be risk-averse when it comes to the implementation of new technology," states Ruitenburg, EDGE's chief operating officer. "They don't want to end up with a complex product that they cannot operate and maintain over its lifecycle, when the aim is to have a first-class investment that will be up-to-date for the next 20 to 30 years."[1] This has required the EDGE team to explain the new paradigm to institutional investors considering whether to allocate capital to develop or own such an asset. "In the beginning, many were really afraid of what they would need to do with the computer, because computers need updates and specific knowledge to operate," said Ruitenburg.

During construction, a building will be rented out, sold, or financed. If the developer makes changes to the project, it has to go back to all parties to change the contracts. It not only creates a lot of work for all parties involved, but often may be taken advantage of by counterparties to get their own interest. A general contractor may agree to use different glass, in exchange for three months delay to deliver the building. Innovation is important. However, when stakeholders see a change as something different than what was agreed upon, they can be difficult, especially if they want to take advantage of the change.

Landlords deal with the tenant's facility teams, who are often the procurement people. Procurement people may not like innovation as they are trained in a contractual way. If the landlord wants to adopt new products/services/features in the building for sustainability, tenants might agree to that, but would put all risk on the landlord. For instance, the building owner wants to change to a smarter glass and there's only a 1% chance that the glass cannot be installed on time. Tenants would protect themselves from the delay risk with a penalty clause or walk away from the contract if the delay is more than six months. In a standard contract, if the building is not ready, tenants do not have to come anymore. A bank will never accept innovation that can lead to the loss of a tenant. The question remains: How should the landlord handle the uncertainty and risk with their tenants and the bank? Van Oostrom worried that employees,

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[1] Christopher O'Dea, "Future of Offices: Smart Buildings, Intelligent by Design, IPE Real Estate Magazine, December 2019.

tenants, and banks would resist too much change without clear proof of benefits. He devised a process for dealing with all the inertia in the system.

Innovation Team

In 2007, Van Oostrom created an innovation team in the company and chaired the innovation board. The innovation team engages regularly with development project teams as early as in the project feasibility stage, assisting with ideation and calculating sustainability and health outcomes. The feasibility phase is the phase of the striking amount of innovation. There are fixed date meetings between the innovation team and development team from preliminary design to final design. In the meetings, they discuss sustainability scores, healthy building features etc. The innovation team came up with solutions or ideas, such as a new generation of solar panels with battery tags. It may be difficult to test new offerings in the building and determine whether or not they fulfill what tenants are looking for. It is the overlapping of these decisions and outcomes that determine whether they end up in the design of the building. The innovation team helps design the blueprints, complete with technical descriptions down to the level of concrete type and energy system. These blueprints serve as step-by-step instructions before a build can begin. The team builds flexibility into the process, with different timescales for different parts of the building. They consider regulations for each country, and partner with suppliers when possible to acquire regulatory approvals. For example, they partnered with Philips Lighting to get its light systems approved in the U.S. and other places.

The EDGE design team creates an individualized blueprint for each building. For different countries, they will do a deep dive and make a customized technical description. To create the technical description, a list of items will be determined, such as the energy system, concrete type, etc., that cannot be changed afterwards. There is another list of items that can be more flexible, until later in the process. For example, the sensor package can still change up to roughly nine months before the delivery of the building.

Once a project enters the construction phase, the interaction between the innovation team and development team becomes less formal. Van Oostrom and his management team learned that too many formal meetings after the planning stages limited productivity. It turns out that many creative ideas and innovations arise from discussions at the coffee machine. And this is where serendipity helps.

The innovation team holds monthly meetings to share innovations across different development project teams, as well as across the company. In the monthly meeting, the innovation team discusses the recent innovations or new products offerings. All project leads, in various development phases from feasibility to asset management, attend these meetings. The innovation team creates dialogue and allows flexibility with projects across the company's portfolio. Van Oostrom learned that this mechanism works better to encourage innovation than a top-down mandate. The innovation team carries lessons from project to project. This continuous inter-project learning builds the developer's capability to deliver a better building while managing the risks. They use a multi-level approach to facilitate potential innovation opportunities. Van Oostrom tries to get top-level commitment first, such as the CEO of the tenant firms or investors, and explains the potential delay or risk.

Vertical Integration and Ecosystem Partnership

Ann-Marie Aguilar, senior vice president of the International WELL Building Institute, attributes much of EDGE Olympics' environmental and business success to its remarkable partnerships with

suppliers. Aguilar described in an interview that "instead of going to multiple parties to get the right light fixture, EDGE went directly to the light fixture designer and manufacturer and had them design something specific for them. And I think that process has saved them a lot of money and a lot of time. They have superb stakeholder communication at bringing the end-user to really identify their point of view, along with their supply chain companionship to get the best out of the people that work in their spaces."

In order to deliver on its sustainability pledge with the development of the first Edge building, OVG brought in three technology firms to build specialized energy-efficient features into the design. Philips (now called Signify), MAPIQ and Schneider Electric were engaged early into the process to integrate their technologies into the architects' requirements. A shared commitment and co-invested partnership to sustainability and healthy buildings enabled these innovations to succeed. However, working with both startups like MAPIQ and big companies like Philips and Schneider Electric can be challenging. While startups bring amazing innovation energy, they can pivot quickly. Van Oostrom learned that to avoid potential pitfalls of working with startups, the contracting process needs to flexible so that if a startup pivots their business, the developer can quickly adjust. Deloitte, Philips, and OVG co-invested towards the research and development of light fixtures connected to the Internet. They each made a small investment to test out the new product within limited time and budget. The more important benefit of co-investing is building a partnership. A partnership would facilitate changes in contracts they had signed with Deloitte, the construction company, the bank, etc. This is especially important late in the development process during construction. OVG decided to work with Philips when the building was already topped out, which was nine months before its opening. This process of transparent collaboration from the beginning enabled a smooth and innovative partnership. Philips provided the lighting panels that users could access with their phones. The lighting system was designed to remember their users lighting and heating preferences. These features required investment from multiple parties. As a result, 21 new innovations were introduced in Edge that had never been applied before.

To continuously push the limit of sustainability, EDGE is actively engaging with external partners to keep up with technological advancements and align with these firms so that it is feasible to meet regulatory requirement. For example, building codes in the Netherlands require a minimum 500 lux while the Edge building plans for 200 lux with improved lighting technology to further push energy saving. Philips lighting set the default level to 200 lux on APP with the option to switch it to 500 lux to comply with the regulations. On the day of delivery, EDGE put the whole building on 500 lux to pass city inspection. The next day, they could adjust it to the optimum level of 200 lux.

In 2016, OVG formed a partnership with Delft-based solar startup PHYSEE PowerWindows to test energy-producing windows in an actual environment. The windows doubled as solar panels and were used in the EDGE Olympic building. In 2017, OVG announced that it would be the first customer of ThyssenKrupp, a company that sought to produce the world's first cable-less elevator. The elevator debuted at ThyssenKrupp's test tower in 2017, and boasted to reduce peak power demand by up to 60% and require 25% less space than conventional elevators.

In 2017, OVG became a member of Madaster, an online platform that documents the materials used in the built environment. Similar to registries for land ownership, the publicly available database generates a materials passport containing information on the quality and origin of materials, providing insights into the circularity of materials. "It's possible to eliminate 100% of waste by assigning a documented identity to materials using material passports…By assigning a financial worth to documented materials and monitoring their movements, the act of identification itself will generate monetary value in the short and long term as well," said Madaster board member.

In 2018, Delos and EDGE created a platform to advance health and well-being by acquiring data through sensors to optimize air, light, acoustics, and other factors that impact the well-being of a building's occupants. While EDGE is creating a culture to establish in-house expertise across areas, its past approach of partnering with suppliers has shown that both approaches can be successful if a company can find or develop people who embrace its vision for innovation.

The pursuit of sustainable development and operation pushes both greater vertical integration and horizontal learning as a way of minimizing the risk related to new products, materials, and methods. As a result, the developer has more control over projects in the long run by building in-house expertise that can manage the increased complexity directly.

Ongoing Challenges

In 2020, EDGE launched a spin-off company: EDGE Next. The new startup draws on their expertise in the field of intelligent building design and sustainable real estate. Build on Azure's Digital Twin, the EDGE Next platform collects and analyzes data from building management systems, mobile sensors, and a variety of other data sources. The data are combined into a dashboard, offering an overview of actionable insights into sustainability metrics, space efficiency, and health and well-being measures. Reports can be generated for stakeholders and building users can be informed with narrowcasting solutions. EDGE Next is a fully operational platform on Azure's new Digital Twin. "We think we can be the Uber of buildings," said van Oostrom. "We connect them, we make them more efficient, and in the end, we will actually need fewer buildings in the world." With the digital capability enabled by EDGE Next, EDGE envisions a new business model, which is to form partnerships with major real estate firms. That way, EDGE would handle operational work and, via a master lease, continue to operate the building and maintain its green and smart features. A model they have tested with EDGE Olympic Amsterdam's "redevelopment - sale-master lease-asset management" deal.

Coen van Oostrom advocates that all new developments should be net-zero. With the current advancement in design and technologies, a net-zero new building development is mostly doable and economically viable. However, converting existing buildings to become net-zero is not widely financially feasible even though the technology exits. Working with existing buildings is significantly more complex than building from the ground up. In an existing building, the homogeneity of the composition of the elements making up the structure and building envelope can be difficult to ascertain with 100% accuracy. The technologies and methods used at the time of original construction can be incompatible with newly developed technologies and strategies that would significantly improve energy performance, or reduce water consumption. For the global climate change goals, the battleground is in the retrofitting of existing buildings. More and more owners are now demanding that the buildings they occupy be net-zero by a certain time, and the need for innovation is high. It remains to be seen how EDGE's lessons can apply widely to existing buildings beyond Europe.

Exhibits

Exhibit 1: Key Company Timeline

1997 – 27-year-old Coen van Oostrom founded OVG Real Estate.

2007 – First energy neutral office building, Las Palmas, Rotterdam.

2014 – The Edge, Amsterdam, is officially announced as the most sustainable and smartest office building in the world.

2016 – Sustainability > technology > health, a clear path to health and wellbeing; profit moved up to pre-crisis level.

2018 – Introduced EDGE, a real estate technology company. OVG Real Estate is still in the background; and acts as EDGE' holding company.

2019 - Introducing a new generation of smart buildings. EDGE Olympic, the EDGE HQ, is the first Dutch project to be certified WELL V2 Core & Shell Platinum.

Content courtesy of EDGE. Used with permission.

Exhibit 2: EDGE Financial Report

Consolidated Income Statement (x1,000 euros)	2019	2018	2017	2016	2015	2014	2013	2012
Revenue	336.646	222.177	194.611	218.453	101.659	191.709	146.252	134.784
Operating result	45.998	20.514	26.419	27.027	10.315	28.921	(1.399)	5.831
Financial expenses	1.527	1.116	834	1.861	2.359	5.139	4.215	1.208
Earnings before tax	43.910	23.756	27.079	26.340	17.265	13.401	(12.654)	2.685
Net earnings	24.514	15.446	13.105	18.820	13.770	11.929	(8.259)	1.650

Exhibit 3: The Edge Fact sheet

Location: Gustav Mahlerlaan 2970, 1081 LA Amsterdam, Netherlands Gross
floor area: 40.000 sq m; Completion date: Q4 2014; Parking spaces: 372
Architect: PLP Architecture
Local Architect: OeverZaaijer
Interior Architects: Fokkema & Partners
Structural Engineer: Van Rossum Consulting Engineers
MEP Consultant: Deerns

Sustainability Consultant: C2N Bouwmanagement
Building Physics: LBP Sight
Landscape Design: Delta Vorm Groep
Contractor: G&S Bouw
Facade Contractor: Rollecate
Glass Roof: Brakel Atmos
Advisors: Deerns, HC Groep
Partners: Philips & MAPIQ
Sustainability: BREEAM Outstanding, World's most sustainable office building from 2014-2016
Tenants: Deloitte, AKD, Henkel, Sandvik, Edelman

Video about the Edge building: https://www.breeam.com/case-studies/offices/the-edge-amsterdam/

Exhibit 4: Next Generation of Smart Building

	Smart Building	**EDGE Focus – Next Generation**
Focus	Devices and systems	User experience
Technology	Various individual solutions / building automation	All systems integrated
Main Activity	Reporting of systems	Continuous improvement – user experience & productivity
Reason to Invest	Operational cost savings	Increased property value By making buildings "wanted" by tenants and owners – higher value / lower cost

Exhibit 5: the EDGE Olympic Building

Fact Sheet of EDGE Olympic: https://edge.tech/developments/edge-olympic-amsterdam

Virtual Tour of EDGE Olympic: https://my.matterport.com/show/?m=3PXdQfhK6WV&help=1&hl=1

Exhibit 6: EDGE Olympic Financials

(Notes: All numbers are rounded for the educational purpose.)

Development

Asset Information

Location	Amsterdam, NL
Type	Redevelopment
GFA (Gross Floor Area) in sqm	12,000
LFA (Leasable Floor Area) in sqr	10,000
ERV (Estimated Rental Value)	€ 325.00
GIY (Gross Initial Yield)	5.00%

Hold

EDGE Workspaces – Tenants

EDGE Workspaces		50.00%
LFA (excl. common space)		3,500.00
ERV	€	600.00
Direct Leases		50.00%
LFA		5,000.00
ERV	€	325.00
Add-On / Service Charges	€	90.00

EDGE Next

Service costs	4.80 /psm

Other Tenant Efficiencies / Cost Savings

Energy Savings	10%	1.30 /psm
Pro-active Maintenance	50%	1.90 /psm
Reduced office costs per FTE	10%	81.30 /psm
External meeting room costs	25%	4.90 /psm
Saved retention costs	1%	5.00 /psm
Reduce staff costs	1%	2.00 /psm

Units: Euro per person per sq meters annual
FTE: Full Time Employee

			EDGE Real Estate								EDGE Workspaces / EDGE Next
			Acquisition		Pre-Development Phase		Construction Phase		Practical Completion		Hold Phase (annually)
Revenues											
Sales Revenues	€	65,000,000							€	65,000,000	
Total Development Revenues	€	65,000,000	€	-	€	-	€	-	€	65,000,000	
Development Costs											
Location Costs	€	(20,000,000)	€	(20,000,000)							
Construction Costs	€	(18,500,000)			€	(1,000,000)	€	(17,500,000)			
Fees	€	(2,000,000)			€	(2,000,000)					
Connection Charges	€	(200,000)					€	(200,000)			
Permits	€	(500,000)			€	(500,000)					
Direct Sales Costs	€	(1,500,000)							€	(1,500,000)	
Indirect Sales Costs	€	(8,000,000)							€	(8,000,000)	
Sundry Costs	€	(300,000)					€	(300,000)			
Internal Costs	€	(3,000,000)			€	(1,000,000)	€	(2,000,000)			
Total Development Costs	€	(54,000,000)	€	(20,000,000)	€	(4,500,000)	€	(20,000,000)	€	(9,500,000)	
Unlevered Return	€	11,000,000	€	(20,000,000)	€	(4,500,000)	€	(20,000,000)	€	55,500,000	
Financing Costs	€	(900,000)					€	(900,000)			
Levered Return	€	10,100,000	€	(20,000,000)	€	(4,500,000)	€	(20,900,000)	€	55,500,000	
Gross Margin/Yield		15.54%									
Rental Income											
EDGE Workspaces	€	4,175,000									€ 4,175,000
EDGE Workspaces	€	2,100,000									€ 2,100,000
Direct Leases	€	2,075,000									€ 2,075,000
Total Revenues	€	4,175,000									€ 4,175,000
Exploitation Costs											
Exploitation Costs	€	(3,400,000)									€ (3,400,000)
EDGE Next	€	(48,000)									€ (48,000)
Total Exploitation Costs	€	(3,448,000)									€ (3,448,000)
Annual Return	€	727,000									€ 727,000

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