



MANIFESTO 2022

RESILIENCE

●
● **START IT *RIGHT***

●
INTERVENTION

PEOPLE

●
INNOVATION ●



ABOUT

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FOREWORD

The world faces a continuing and evolving challenge of deploying energy resources to maintain healthy and productive built environments in an environmentally sensitive way.

The business of designing, operation and optimizing energy resources is a challenge on top of a challenge. Let's face it – energy efficiency may be important, even renewable. But it is invisible. "Savings" is a concept, not a directly measurable parameter. And the product of better design can be difficult to quantify and prove. The effective commercialization of energy services requires an understanding of the interplay between the domains of laws/regulation, engineering/technical, financial/commercial and information technology. And all of these domains are constantly evolving.

Any firm wishing (attempting) to operate in this field, let alone be a leader, must possess a combination of qualities. They must possess a wide array of skills. They must have a commitment to communication, education and transparency in methods and processes. But most importantly, they must be able to engender trust in all parties/participants.

In my short time working with **grfn** I have been tremendously impressed with their understanding of these requirements and their commitment to being leader in actualizing a robust energy services marketplace.

In this manifesto you will read many specific examples that demonstrate **grfn's** acute awareness of the nature of the challenge and the skill and imagination they bring to innovate solutions. This combination of skills, vision and emphasis on measured results are the perfect foundation for a trustful business environment.

The region is fortunate to have a firm like **grfn**. The world could use many more firms with these qualities. **grfn** will be fun to watch in 2022, and beyond.

Steve Kromer

Steve Kromer is an energy engineer in Berkeley, California, who is versed in Measurement and Verification, Financial Engineering and Risk Management. Through his work at Lawrence Berkeley National Lab (LBNL), he assisted in the creation of the International Performance Measurement and Verification Protocol (IPMVP), and for the past 20 years has travelled the globe sharing and gaining knowledge in the pursuit of transparent and efficient methods to determine savings in energy efficiency projects and programs.

jskromer@mac.com

REACH US

United Arab Emirates
Dubai | Abu Dhabi

Egypt
Zamalek, Cairo

Lebanon

India

info@grfn.global

Instagram: @grfn.global

LinkedIn: grfn-global

Twitter:@grfn_global

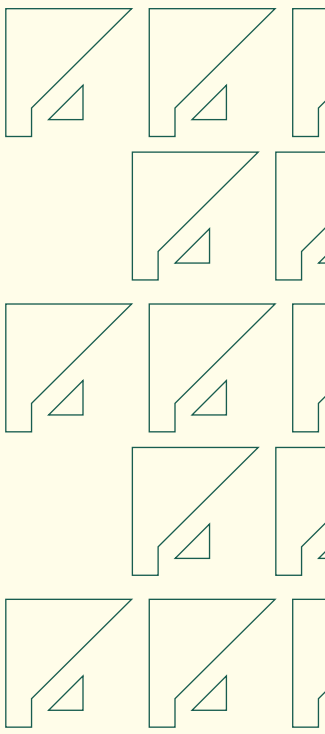
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ABOUT GRFN

We are a **progressive independent multi-disciplinary** consultancy that delivers energy-efficient and sustainable engineering, design solutions, and advisory services that best serve our clients and the well-being of their local communities.

Our expert team of designers, engineers and technical consultants are committed to providing you with solutions and advisory services that remit tangible and quantifiable value throughout the lifecycle of your project.

Our proven track record and portfolio of projects ranges from **new construction, intervention and policy & advisory services**. No matter the sector, size or type of the built environment, we embrace your needs and complexity with our unique skillset, and promise to provide efficient, functional, future-proof solutions and sound technical advice that drives transformative outcomes.



OMNIA HALAWANI Co-CEO & Founder

The period between our last Manifesto and this one was like no other. It is hard to recall the pre-COVID-19 times. It is also certain that the pandemic has highlighted and magnified many issues and opportunities across industries; and the construction industry is no different. I'm proud of how **grfn**'s team reacted with increased collaboration and adaptation.

Over the past period, and with further expansions in line, we have managed to expand our team across borders and have, now, full-fledged teams based out of Egypt and Lebanon and a growing team in India. We've also expanded our geographical reach through our projects and have now successfully completed projects across Saudi Arabia, Oman, Kuwait, Bahrain, Tanzania, Pakistan, and London.

In each market in which we operate, we are viewed as local players with international capabilities; a unique standing that we work hard to earn. We have acted as main consultants for some projects and worked as an integrated part of larger teams on other projects.

The next two United Nations Climate Change Conferences take place in Egypt and the UAE. With established offices in both countries, we are ready to help our clients remain competitive and well-prepared with better sustainable practices and management.

Our plans for 2022 are ambitious, big, and challenging. We're empowered by strong leadership and an aspiring team and we look forward to kickstarting the new year building up to our 10-year anniversary in 2023.

HASSAN YOUNES Co-CEO & Founder

I am pleased to present the 2022 Manifesto.

With offices across three different countries, **grfn** continues to grow and actively seeks out new and better ways of advancing its methods of delivering services to the different sectors of the built environment.

As you read this version of the manifesto, you will find many examples of how we use our capabilities to serve our clients and contribute to making our world more sustainable. Our highly diversified team focuses on strategies to drive more agile, responsive and innovative services that enable us and our clients to make the most optimum decisions.

In an era of accelerating change it is always good to pause and reflect on past experiences and share them with like-minded peers. I hope that you will enjoy reading this year's manifesto and share with us your comments and observations.

As a final note, I would like to thank our team who have contributed and put together this publication, and I wish our readers a safe and productive year ahead.

AYAH HALWANI Head of Design & Partner

As the world witnessed an unprecedented rate of change over the past months, resilience and adaptability are what triumphed and pulled the stayers through. COVID propelled our collective growth and drove us to think, work and live in the ways of the future today. If the past year has taught us anything it is that people's wellbeing is anything but secondary, and while our strategy has always placed human-centricity at the forefront, we aim to harness the global acceleration toward digitization and digital solutions to achieve more on that within our projects and workplaces.

The past period for **grfn** was one of retrospection and finesse. And as we expanded our operation across the region, powered by the dedication and resilience of our team, I am inspired by the level of seamlessness that we have arrived at allowing us to serve our clients more efficiently and enabling our growth.

This manifesto highlights our thoughts and work in the past extraordinary year, and we are all geared up for more growth and transformation in the coming one.

MOHAMED DIAB

Associate Director

Sustainability, Climate Change, Environment, Renewable Energy, Energy Efficiency and SDGs are words we come through on a daily basis. The mass diffusion of these keywords is not merely for commercial purposes, it is out of necessity and responsibility. A necessity, since we wake up daily to the news of a new unprecedented extreme weather event hitting somewhere around the globe. A responsibility, for our choices today affect those who do not have a choice or not even born yet.

For all of the above, the world is pacing itself with this urgency and these principles. However, not all are experts and not all have the means, whether on private or public level. Therefore, the easiest way forward is acquiring the advice through an advisory service that will help your entity get on the right path. As much as this seems to be the solution this is equally a problem in itself. A problem that **grfn** is set to solve on a daily basis. At **grfn**, besides setting our partners on the right path, we walk the talk, and join them on the problem-solving path. An approach that is not suitable for everyone, for the needed solutions are predominantly technical with increasingly science-based targets. Our approach and commitment have always been to find and draft the best solution, "Su misura", and to never opt for a one size fits all solution and our technical dedication and expertise allows us to endeavor such path whatever the constraints. Our second commitment on this level is to make solutions profitable against the common belief that responsible projects end up with negative cashflows. Overcoming the suitability and profitability challenges is not just

about the information, which is easily accessible to everyone nowadays. Therefore, finding a solution that is science based, practical, feasible, tailor made and profitable, requires a firsthand technical experience with best practices knowledge, a package that **grfn** has mastered throughout the years.

With an ever-growing multidisciplinary background, experience, and team. **grfn** puts its track record, as a market leader of ingenious built environment, into action at every project. With a continuous involvement in building systems, energy efficiency, MEP systems, sustainability, and the list goes on. An experience complimented by a continuous growth culture that **grfn** embeds within its structure makes it a Go To reference for everyone looking to develop a responsible and sustainable project from conception and design till testing and commissioning.

Energy and sustainability are the change drivers locally and globally, where **grfn** has already accompanied this change in UAE and the region and is ready to attend the expanding market in the UAE, the region and up to the global challenge.

MOHAMED ANEES

Country Director - Egypt

During the past few years, Egypt's development sector has been steadily recovering from the impacts of the 2016 currency float, as well as COVID 19. With a magnitude of new investments within the sector and a range of new projects of different scales, a significant emphasis on commercial development has emerged.

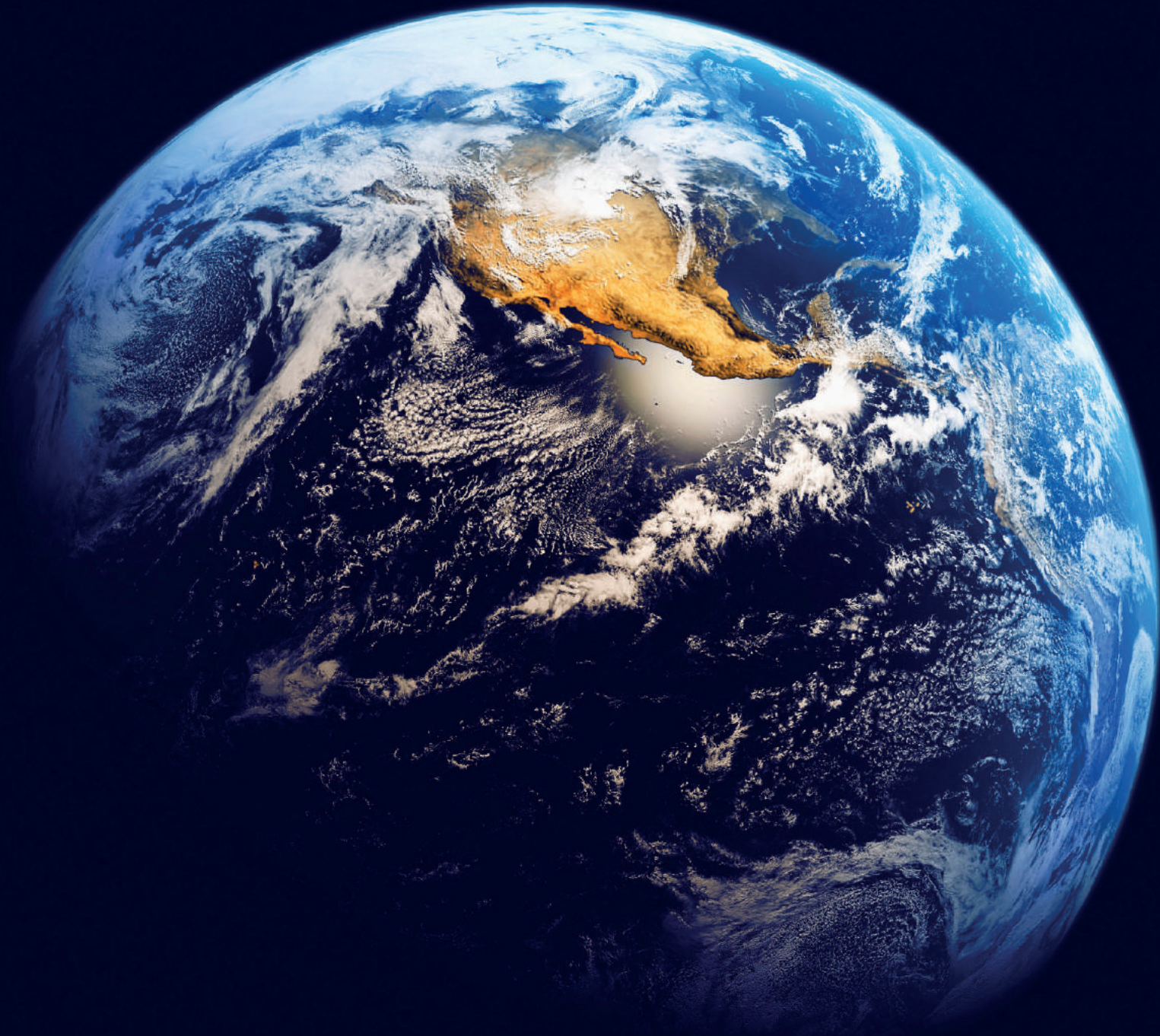
According to a December 2019 MarketLine report, commercial projects accounted for 61% of the real estate market value in Egypt. However, with the recent decline in residential real estate sectors sales, this percentage is estimated to have increased significantly during 2020 and 2021.

In general, end clients in Egypt have focused merely on the market value and aesthetics of buildings they either invest in or occupy, which led to giving less attention to creating well-performing buildings, as they provided no significant monetary value to the dynamics of the market. With the recent events, and because of the quarantines imposed by COVID-19, end users have started interacting with their built environments in a different manner than they used to. This led to a change in needs and selection criteria for their chosen spaces, which not only changes how a development's value is assessed by the market, but also impacting how developers select their designs and how the architecture and design professionals approach their work, adding an extra layer of complexity and new disciplines within the practice.

The focus on human-centric design and building performance is not new and has been heavily studied and developed within

the academic sector for years. Yet, adopting these studies and guidelines has always been recognized within the Egyptian market as a luxury, rather than a necessity. Now, the change is imminent, and a well-performing, human-centric and healthy building will be essential, since it will be among the end user's selection criteria. This gives a significant value to well-designed buildings and spaces, which in response pushes architects and design professionals to adapt accordingly by starting to implement international high performance building standards. The challenge will not only be adopting said practices, but will also be in integrating them within design processes and workflows applied to create a new norm.

A paradigm shift is happening within the architecture practice in Egypt, and that was one of the fundamental reasons for **grfn's** expansion in the Egyptian market. For years, **grfn** has aimed to bridge the gap between academia and practice in the areas of sustainable design and building performance, as well as establishing a critical practice that positively contributes to the community and adds value to the market. With our recent presence in Egypt, we plan to apply our design methodologies and global experience developed over the years to provide market-tailored services that responds to the newly emerging development needs, as well as having a positive impact on Architecture, Engineering, Construction and Owner-operated (AEEO) practices in Egypt.



UN Global Compact Signatory

The UN Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals (SDGs).

Launched in 2000, the UN Global Compact is the largest corporate sustainability initiative in the world, with more than 9,500 companies and 3,000 non-business signatories based in over 160 countries, and more than 70 Local Networks.

grfn has joined the United Nations Global Compact initiative — a voluntary leadership platform for the development, implementation and disclosure of responsible business practices in line with:

- A set of principles that they have set forth under four broad topics: Human Rights, Labour, Environment, and Anti Corruption.
- The UN SDGs that we align our projects to:



With this announcement, **grfn** participates in taking responsible business action to create the world we all want. ■



United Nations
Global Compact

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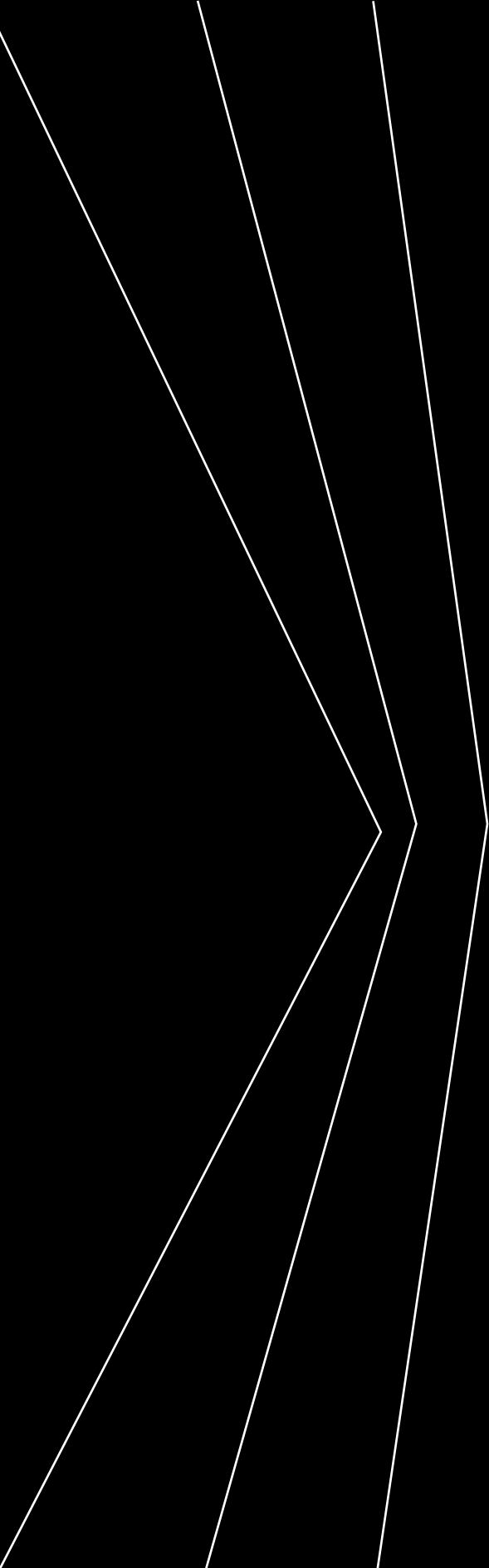
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RESILIENCE

Planning for expected shocks and efficiently reacting to unexpected ones.



The COVID-19 pandemic has been a major shock to the world as a whole. And as countries are racing to address immediate issues, others (businesses, governments, individuals) are continuously thinking of a post COVID-19 world.

We have asked our team at grfn to share their thoughts whether big or small; focused or general, based on their skills, experiences & domains. We asked them:

How do you see the post COVID-19 era?

Abdullah Alchakouch

Due to this crisis, I think that hospitals designs will evolve. We may see more adoption of solutions that minimize air recycling across the full hospital to minimize and avoid contamination and spread of disease.

We are also witnessing many companies realizing that remote working could be used on part of their business-as-usual. This will lead to less traffic leading to less investment in roads infrastructure and transportation. It will also lead to less CO2 production. From a personal perspective, this will also lead to increased productivity considering the total time wasted by the population in traffic. As a result, people will start to favor apartments with bigger rooms and better views, possibly changing how the buildings are currently designed to focus on aspects like the mental health and wellbeing of the residents.

Althaf PK

I believe that COVID-19 will lead the Introduction of new clauses in construction future contracts to set out clear guidelines for action, remedies, and dispute settlement for similar extreme conditions. It may also lead to amendments in international and local standards/regulations. I also see that this crisis will encourage, and help prosper, modular construction technologies to minimise the labor strength on site. It will also lead to a holistic improvement in health and safety norms of workers.

While investment in hospitals and healthcare in general is expected to increase, I think that new malls and large shopping centers will take a hit with reduced investments.

Ayah Halawani

I see technology developing in favour of reducing the need of physical meetings on sites and in offices. Designers and architects may begin designing these virtual spaces to make them more enhanced and personalized. VR technology might help with this. I think the construction industry in general didn't do so well in terms of resilience. 3D printed building construction, automated construction and robotics, and modular construction may offer a solution. Another angle is looking at automation/contactless operation such as opening doors, operating elevators (maybe by voice?), automated sanitary ware fixtures - these are common but maybe they become a requirement for public spaces in the future?

Harilal Kutty

Financial impacts would lead developers and buildings operators to highly consider operating cost reduction, eyes specifically for energy and utility bills. And their focus to optimize the consumption will give a clear opening to sustainability and energy management sectors. I also believe that technology advancements and Artificial Intelligence-based building automation will gain traction to help with man-less operation of facilities as well as to reduce operational costs.

Omnia Halawani

We are definitely going to witness a lot of changes during and after this pandemic. From real estate and construction investment patterns, to how buildings are designed, constructed and operated, and to how building occupants behaviours will affect the construction industry as a whole.

Shifting the focus to the current day, in the midst of the pandemic, while the drop of oil prices may affect the feasibility of energy retrofits from the perspective of governments, this slowdown is an opportunity for deep retrofits that are, otherwise, harder to implement in highly occupied buildings. Entities should also be considering energy retrofits as a main enabler of reductions in OPEX.

*"I also believe that **technology advancements and Artificial Intelligence-based building automation** will gain traction to help with man-less operation of facilities as well as to reduce operational costs."* Harilal Kutty

Syed Ashraf

The current day lockdown has seen abrupt halt to outdoor activity and industrial output. Lower than factual active air pollutant molecules in atmosphere are already showing signs of cleaner air, but the resulting effects on micro-climate temperatures, weather patterns and global warming are yet to be studied and understood. It is essential for scientific bodies, AHJs/ governments, OEMs, green businesses, professionals and property owners alike who really care for the environment to take proactive measures in their full authority to promote good practices worldwide. This would provide greater insights on how the triple bottom line (people, planet, profit) could be effectively balanced without jeopardizing the concept of sustainability in view of profit only, which has become a norm these days. A holistic approach questioning the current priorities and requirements of businesses may lead to fruitful outcomes.

Ayesha Nabeela

Reliance on building monitoring system via BMS, SCADA, and even BIM 7D might increase and owners would consider investing on proper integration and IOT as a lot of the property owners would have found it difficult to manually run their building systems and physically identify system errors due to limited response and dependency on FM teams, all leading to system failures. I'm also hoping that Buildings Operators would exert more focus on trainings and resources on how to efficiently manage their building services; what to do with FAHU in such cases, what conditions to adopt for chillers, what to expect from District Cooling providers, etc., basically how to optimally supply with the increased demand coupled with increased risks since everyone is at home and most people run their AC systems through the day. ■

*"...the resulting effects on **micro-climate temperatures, weather patterns and global warming** are yet to be studied and understood"* Syed Ashraf



COVID shook our world



AMCA inmotion magazine
October 2020
By Hassan Younes

“I believe the retrofit sector will keep on growing year on year. The renewable energy sector will also see growth as we approach 2030 which is a major milestone for demand side management for many cities around the GCC.”

COVID-19 has shook the very foundation of the way we do every single thing in our life and it has presumably effected all humans around the globe. The Middle East is no exception to that.

As businesses reopen in the region, there is a shift within the built environment industry to focus on indoor air quality. Until recently, the WHO had not considered airborne transmission of SARS COV 2 as one of the main routes of transmission. After an open letter, from 239 experts around the world, was sent to the WHO, it is being reconsidered and investigated if the SARS COV 2 is indeed transmitted airborne. Since WHO has not announced any measures to tackle such transmission, we have not seen any regulations or guidelines from government entities that cover airborne transmission requirements. However, we have seen an increase of projects that require the upgrade of filtration, addition of UV and installation of portable filters. All these measures are used to reduce the possibility of airborne transmission.

I believe in the near future there will be guidelines and recommendations for buildings and HVAC systems from the government entities to tackle the airborne transmission of the corona virus. This will depend highly on the direction that WHO will take and whether they will change their stance on that matter.

We have unfortunately seen in this period some energy efficiency projects being put on hold due to closure of many buildings. However as buildings open again, I believe that we will see a comeback for such projects.

I do think that there will be a focus on the residential sector since it is one where consumption has increased and rents have decreased; which is the best formula for energy efficiency projects.

The governments around the GCC are still pushing their energy efficiency and demand side management agendas. With the launch of the Abu Dhabi Energy Services Company and the perseverance of the Dubai and Saudi Super ESCOs, I believe the retrofit sector will keep on growing year on year. The renewable energy sector will also see growth as we approach 2030 which is a major milestone for demand side management for many cities around the GCC.

We also see that building regulations are being revised and updated to increase the efficiency of new construction, with building codes being a major program and pillar for many DSM strategies for the GCC cities. The need for net zero energy buildings is increasing with the first net zero governmental building already being constructed in Dubai. The behemoth 105,000 m² gross floor area DEWA new HQ Al-Shera'a will be the largest net zero energy building in the world.

Finally, whether projects fall under the new construction or the retrofit category, the well being of occupants, resiliency and energy efficiency will be looked at in future projects almost equally with maybe an extra focus on well being. To make sure buildings operate within those three factors, there will be more focus in the GCC countries on regulations for operating buildings; since we spend most of our times in buildings; through operation and maintenance personnel trainings, certification and applying minimum qualifications requirements. ■

FM & COVID-19

Reuters via ZAWYA
August 2020
By Hassan Younes

Considering that coronavirus (and other pathogens) might be airborne as per the WHO's recent acknowledgement, what according to you should building owners and FM Managers do to address existing ventilation and other AC approaches?

I have been an advocator of taking the worst case scenario by considering that SARS COV 2 could be transmitted airborne and taking necessary precautions to reduce airborne transmission. My opinion is based on ASHRAE guidance that considered SARS COV 2 likely to be airborne. The main recommendations from ASHRAE are to focus on increasing ventilation that would lead to diluting the viral load and filtration which would lead to capturing particles the virus is attached to. In general FM managers need to make sure that the ventilation systems are running with no obstructions and ventilation air is reaching occupied spaces. It is also recommended to keep the ventilation systems running 24/7 or at least turn them on 2 hours prior to occupancy and keep them running 2 hours after occupants leave the building. In terms of filtration it is recommended to have MERV 13 or better filters on AHUs. UVGI is also being considered to be applied to deactivate the virus.

Will there be a long-term change in the operations of built assets or do you feel the current COVID-19 scenario is only a disruption in the mid-term for the workings in the FM/building operators sector?

As businesses reopen in the region, there is a shift within the built environment industry to focus on indoor air quality and I anticipate that this will become permanent. We have seen an increase of projects that require the upgrade of filtration, addition of UV and installation of portable filters. All these measures are used to reduce the possibility of airborne transmission.

“The main recommendations from ASHRAE are to focus on increasing ventilation that would lead to diluting the viral load and filtration which would lead to capturing particles the virus is attached to.”

As you know split air conditioning units that do not have a dedicated source of outside air supply into a room, it could be responsible for recirculating and spreading airborne viral particles into the path of socially distanced users. Do you foresee a change in HVAC design for buildings in the future? Should there be more demand for dedicated outdoor air systems (DOAS)? How does the region fare when it comes to such systems? Should new regulations be in place?

Most new buildings in the region employ DOASs and this trend will continue to grow due to concern over viruses, indoor air quality and occupants wellbeing. Regulations are already in place when it comes to ventilation requirement for new construction, mostly older buildings need to be revisited and upgraded. Having no ventilation will lead to poor productivity of the occupants in addition to the potential of airborne viruses spread.

Experts believe now that it may go against conventional wisdom and be more expensive, but opening a window while operating air conditioners that do not have DOAS systems will be the best way to mitigate risk? Shouldn't occupant's health trump energy efficiency. Will there be a compromise between the two? What should be the thought process?

Whether projects fall under the new construction or the retrofit category, the wellbeing of occupants, resiliency and energy efficiency will be looked at in future projects almost equally with maybe an extra focus on wellbeing. Health and safety are always a top priority and till the pandemic subsides it is advisable to increase the ventilation through windows or any other means. Wherever we can use mechanical ventilation with heat recovery ventilation the impact of increase in energy would be minimal. However, care should be taken that any leakage happening in the heat recovery system, happens from the fresh air side to the exhaust side and not the other way around.

The thought process is to focus on wellbeing by using systems and control systems that have minimum impact on increase of energy. ■

“As businesses reopen in the region, there is a shift within the built environment industry to focus on indoor air quality and I anticipate that this will become permanent.”



Low Carbon Cities

By Omnia Halawani

Sustainable cities are a norm; a necessity. It is no longer a luxury to have sustainability as one of the main driving principles in planning of new cities. The selection of geographical location, designs that facilitate living in an efficient conduct, promotion of resilience, focusing on inhabitant well-being, and setting targets for carbon reduction, efficient energy use, and renewable energy utilization are all essential factors in achieving a truly sustainable city.

City outdoor air quality is significantly affected by the amount of emissions from human activity and the city facilities. A zero-carbon neighbourhood naturally boosts improved air quality for its occupants by offering alternative transportation, low energy-use buildings, ultra-efficient building services and infrastructure, and low carbon power generation options.

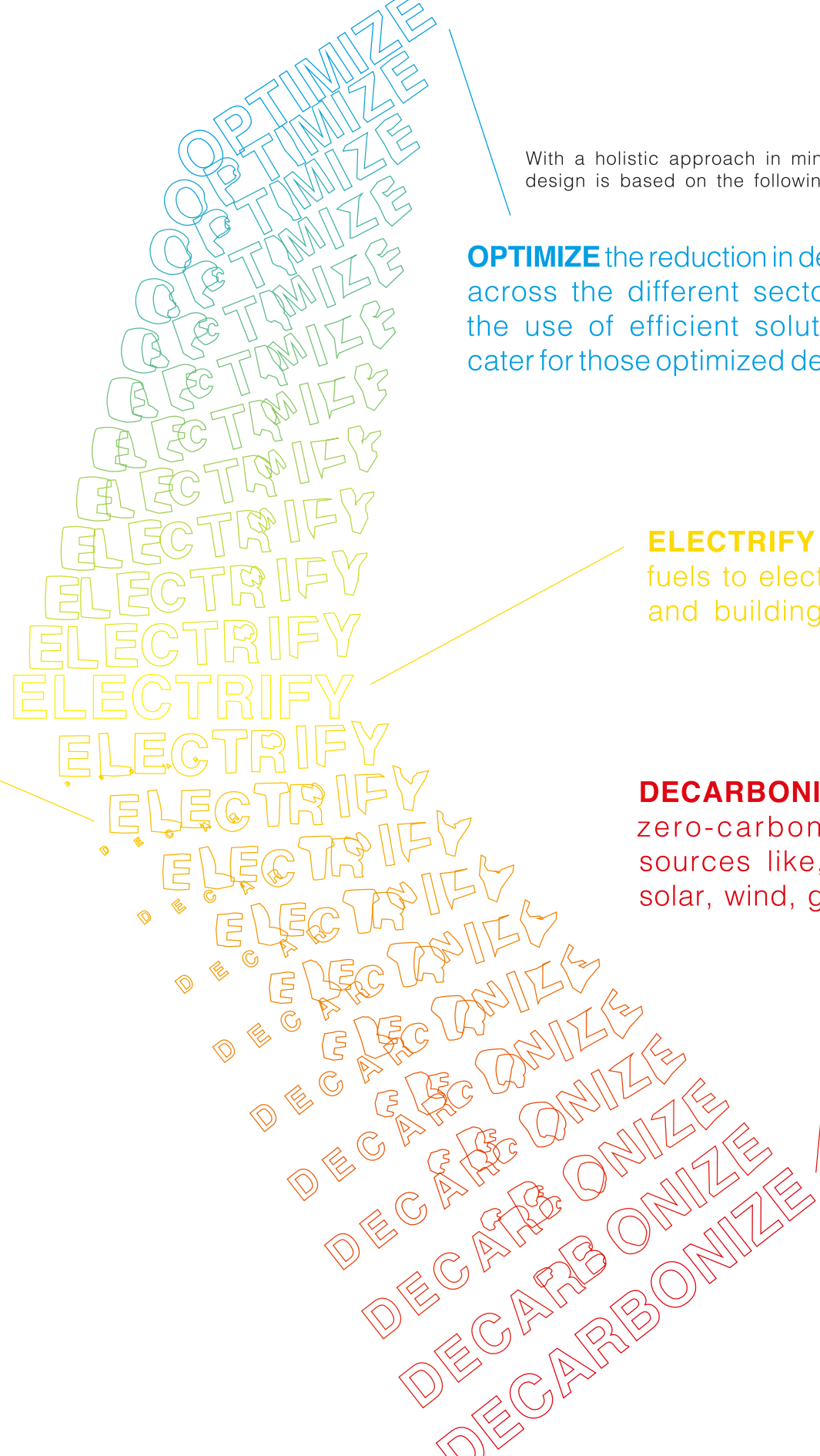
One of the greatest global environmental challenges is addressing climate-related risks. With cities and buildings accounting for a major portion of the worldwide energy use and CO₂ emissions, introducing efficiencies and designing sustainable cities will have the greatest impact and largest potential to curb resources depletion. Net Zero Carbon cities and Net Zero- or Positive- Energy cities will make a great impact in that realm.

“One of the greatest global environmental challenges is addressing climate-related risks. With cities and buildings accounting for a major portion of the worldwide energy use and CO₂ emissions, introducing efficiencies and designing sustainable cities will have the greatest impact and largest potential to curb resources depletion.”

Zero Carbon means that a project will achieve an annual carbon dioxide equivalent balance of zero such that the total carbon emitted is offset by carbon avoided (generated or offset).

Zero Energy means that a project will achieve an annual energy usage equivalent balance of zero such that the total energy used on an annual basis is offset by the amount of energy generated on site or nearby. Positive Energy status is achieved when the total created energy exceeds the total energy used on an annual basis.

Our design strategy for highly sustainable cities follows a rounded approach for the buildings and places to prioritize healthier environments and inhabitant well-being all while reducing operating costs by prioritizing sustainable practices. The emphasis is on a master plan that is innovative, intelligent, and all-encompassing while promoting energy efficiency and low carbon living.



With a holistic approach in mind, a low-carbon city design is based on the following guiding principles:

OPTIMIZE the reduction in demands across the different sectors and the use of efficient solutions to cater for those optimized demands.

ELECTRIFY the switch from fossil fuels to electricity for transportation and buildings.

DECARBONIZE transition to clean zero-carbon energy generation sources like, solar parks, rooftop solar, wind, geothermal energy, etc. ■



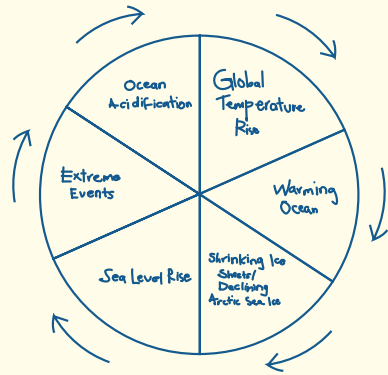
grfn provided sustainability and building performance enhancement services for multiple medium - and large - scale masterplans across the region.

Climate Change

Let us speak about Climate change and its impact on our generations.

By Ashraf Ali Khan

Climate change causes weather patterns to be less predictable affecting the liveability on the planet. From rising water levels to severe temperature conditions and precipitation uncertainties, the evidence for rapid climate change is compelling:



Greenhouse Gases

Throughout Earth's history, the climate has continually changed. When occurring naturally, this is a slow process that has taken place over hundreds and thousands of years. The human-influenced climate change that is happening now is occurring at a much faster rate. Adverse human activities, like fossil fuel burning, cause the emission of greenhouse gases (GHGs), which trap heat from the sun's rays inside the atmosphere causing Earth's average temperature to rise. This rise in the planet's temperature is called global warming. The warming of the planet impacts local and regional climates.

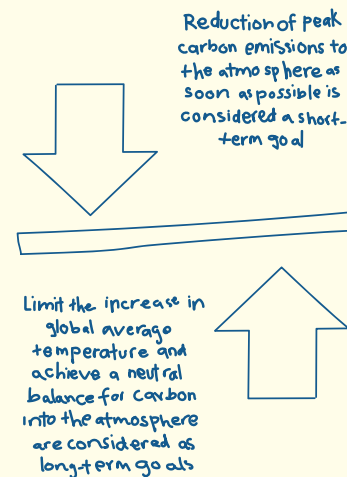
- Water Vapor
- Carbon dioxide (CO₂)
- Methane
- Nitrous oxide
- Chlorofluoro carbons (CFCs)

What is the Paris Agreement?

A historical agreement was signed by 196 parties in Paris in December 2015 at the United Nations Climate Change Conference (COP21) and became a legally binding international treaty on climate change in November 2016. The agreement is to limit temperature increase to 2°C (preferably 1.5°C) above pre-industrial levels. The Paris Agreement emphasizes the need to "pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risk and impacts of climate change".

The agreement requires social and economic transformation for implementation. It requires signatory countries to submit their plans for climate action by 2020; known as Nationally Determined Contributions or NDCs. The NDCs layout the actions that countries intend to take to reduce their GHGs emissions as well as actions they will take to build resilience to adapt to climate change.

The years since the Paris Agreement went into force, new markets and low-carbon solutions have emerged as more countries started setting their carbon neutrality targets. Low- and Zero- Carbon solutions are becoming more competitive and feasible. The United Nations Framework Convention on Climate Change (UNFCCC) predicts that "by 2030, zero-carbon solutions could be competitive in sectors representing over 70% of global emissions."



Carbon Budget

The neutral carbon balance refers to a balance of carbon emissions. It refers to a future, where the entries of carbon dioxide into the atmosphere, "sources", are compensated by removing carbon dioxide from the atmosphere at some other place, "sinks".

Achieving net-zero carbon emission is extremely important to meet our target of a maximum of 2°C (preferably 1.5°C) of global temperature increase, and to make sure that we don't overshoot our target.

There is more than one way to calculate our "Carbon Budget" defined as the allowable amount of additional carbon emissions to ensure temperature rise limits are met.

The Intergovernmental Panel on Climate Change (IPCC) report suggests that we have only a few years left at our current rate of emissions before we blow the 1.5°C carbon budget. Other studies suggest varying remaining carbon budgets. The idea of a "carbon budget" that ties an amount of future warming to a total amount of CO₂ emissions is based on a strong relationship between cumulative emissions and temperatures in climate models.

This relationship between cumulative emissions and warming is not perfect, as it will change based on what happens to non-CO₂ greenhouse gases, such as methane and nitrous oxide, as well as how quickly climate-cooling aerosols are reduced. It also does not perform quite as well when there are "net-negative" emissions – when more emissions are being removed from the atmosphere rather than being added.

Buildings and Climate Change

It is estimated that the built environment accounts for around 40% of all annual energy related GHG emissions. The industry is required to reduce these emissions by 50% by the year 2030 as part of the global decarbonization efforts to achieve the climate goals of the Paris Agreement.

When constructing a new building, designers should consider the building's carbon footprint and adopt routes to reduce it as well as making buildings resilient to climate change.

On decarbonization of buildings

- **Energy retrofits and energy-efficient designs** – perhaps the most straightforward of all, reducing the energy use associated with an operational building reduces the overall GHG emissions into the atmosphere.

- **Energy sources** – replacing all or part of the fossil fuels sources with carbon-free renewable energy, on site or off-site.

- **Circular principles** – Circular Economy principles play a great role in the reduction of carbon by promoting the reuse of existing buildings and structures. The more new-construction is avoided, the more carbon emissions are saved, whether by refurbishing the whole building and reusing a portion of it.

- **Whole life cycle** – Conducting whole life cycle carbon assessments of buildings is a more holistic approach to carbon management in the built environment as it also accounts for embodied carbon. Whole-life cycle assessments account for carbon associated with construction, refurbishment, and end of life in addition to operational use.

On resilient buildings

- **Resilient to heatwaves** – via considering passive design strategies of orientation, shading, optimized insulation, etc ..

- **Resilient to cold waves** – by improved building envelope designs, optimized orientation, and external paint colors

- **Resilient to drought** – through rain harvesting systems and water collection/storage

- **Resilient to flooding and sea level rise** – by constructing elevated structures

- **Resilient to strong winds** – by optimized building orientation, shape and form. As well as improved roof design ■



DE_{growth}

By Ayah Halawani

A case for degrowth

In a world where resources are being depleted at an alarming rate, and socio-economic concepts of restructuring continually fail to address issues of wealth parity, inequality and environmental degradation; implementation of radical transformative concepts that call for robust reform become imperative. Economic growth is driven by increased consumption, jeopardizing finite resources and the very same ecosystems in which they thrive, rendering efforts in sustainability and sufficiency as contradictory and futile. The outcome of an ever-growing economy is either catastrophic environmental degradation or an undesirable recession, to which degrowth offers the only viable exit.

Sustainable degrowth calls for the smooth reduction of production and consumption, paving the way for a more equitable society, sustainable ecosystems and the transition into a deep democracy and a participatory society.

Degrowth rejects GDP in its current definition as the true metric of economic and societal health, and recognises human and environmental welfare as equally - if not more - important measures for an equitable and sustainable reality, asserting that capitalism's pursuit of endless growth is neither feasible nor are its effects desirable. This stems from the premises that the abundant lifestyles of the affluent few have dire consequences on natural resources and the environment, and will only exponentially compound the problem if they were a goal to be pursued by everyone on earth. The natural response to this predicament would be to set limits on growth, to which current conventional promises of green growth offer only incremental and grossly insufficient solutions. These limits need not apply on "clean" industries and localized economies which are a desired outcome of the degrowth theory. A "selective degrowth" position differentiates between desirable and non-desirable economies, allowing ones that are in alignment with the objectives of the model to continue to grow.

Degrowth, as with growth, cannot sustainably be an end goal in itself, but is rather a transitional phase into a steady-state of economics in which consumption is environmentally and socially sustainable. The result of this is likely to be a lower GDP, but it is not the end goal, nor is it an indication of decline in other equally important dimensions of life such as well-being and happiness. Economic degrowth eliminates the need for competition as a means of survival and is in congruency with schemes that call for social welfare, such as reduced working hours, resulting in more fulfilled and better-quality lives.



A case against degrowth

The current state our political and socio-economic affairs are in dire need of reform and restructuring to achieve the levels of sustainability, equality and planetary harmony that will see us out of the climate crisis and the injustices caused by it. While degrowth offers a vision of environmental and social justice that is the aim of ecologists, culturalist, welfare socialists and scientists, it fails to account for the potential inequalities arising from mandating a policy of 'less means' on a growing population and the likelihood of its negative perception by the general public. It is questionable that setting "individual quotas of consumption" on the average citizen would be widely accepted, and whether it would serve the democratic cause. **The theory ultimately calls for "top-down" policy rather than bottom-up behaviour change schemes and grassroots movements raising questions of with who does the power of setting these policies rest, and whether or not we have the political infrastructure in place to guarantee non-authoritarian states are not an outcome of such a robust strategy.**

Additionally, pleading for 'across the board' degrowth will undoubtedly affect hard-gained progress in the fields of renewable energy, clean production and green technolog, casting an uncertainty on the environmental outcomes of the strategy. If said economies are to be excluded from the degrowth agenda by adopting a "selective degrowth" approach, then the question becomes how is this different to currently adopted strategies of green growth, which are widely accepted and with proven efficacy in democratic settings, eliminating the additional struggle and time-consuming efforts needed to achieve political support and public acceptance of new policies. A sounder approach would be to aim for eliminating inequalities, addressing the climate emergency and adopting welfare policies all the while aiming for growth in environmentally-sound economies and reduction in resource-inefficient industries, regardless of the effects on GDP – 'a-growth'. Adopting resilient strategies that address issues at hand rather than 'out with the old and in with the new' models offer more viable, realistic and time-efficient means to address the compounding and time-sensitive crises at hand. The Degrowth model is a utopian approach to real problems. ■





project HIGHLIGHT

Energy Advancement



SAUDI ARABIA Energy Audit & Tender Support Services

Technical Consultancy Services - conducting walkthrough audits in facilities, reviewing bids and issuing clarification requests, finalizing scores based on a preapproved scoring matrix, M&V plan review, reviewing detailed facility audits, and selecting practical measures.

KUWAIT

District Cooling Guidelines & Feasibility

Kuwait currently has a few small and private district cooling systems in place or under construction. GRFN were hired to provide the governmental entity of Kuwait Public Housing Authority with a comprehensive financial, legal, and technical study that enables the adoption of District Cooling in Kuwait. The Public Housing Authority is the planner and developer of the main cities in Kuwait. GRFN conducted a holistic study to aid the adoption of district cooling schemes across all new cities via assessing the feasibility of adoption on a large-scale basis.



DUBAI

Energy Audit and M&V

Energy auditing and M&V consultancy for Etihad ESCO's multiple retrofit projects.



Measurement for Dubai DSM Strategy

Consultancy to improve the measurement & evaluation of the Dubai Demand Side Management Strategy energy and water savings reporting mechanisms.



Dubai Cooling Market Study

Robust assessments of the size of the cooling market in Dubai, the extent of penetration by district cooling and other cooling methods, the actual efficiency of district cooling and the efficiencies of other cooling systems.



Dubai Building Energy & Water Rating System

Benchmarking and statistical analysis for the development of an energy and water building rating scheme for the emirate of Dubai.



ABU DHABI

Pilot Energy Retrofit Project

Consultancy for Energy Retrofit Management (ESCO selection, supervision, M&V) for 8 pilot buildings and selection of 150 further buildings eligible for energy retrofit.



★ AEE Middle East Energy Retrofit Project of the Year 2020

★ CIBSE BPA Retrofit Project of the Year 2021

ADDCCD - Energy Audit Services

Energy audit services for a few buildings by the Department of Community Development in Abu Dhabi.



DoH - Energy Audit Services

Energy audit services for a few buildings by the Department of Health in Abu Dhabi including the SEHA Headquarters.



ADEK - Energy Audit Services

Energy audit services for 12 schools by ADEK Abu Dhabi.



Back to Basics- On Sustainability



"The Choice is Yours"
as published by the MEP Middle East Magazine
June 2021
By **Omnia Halawani**

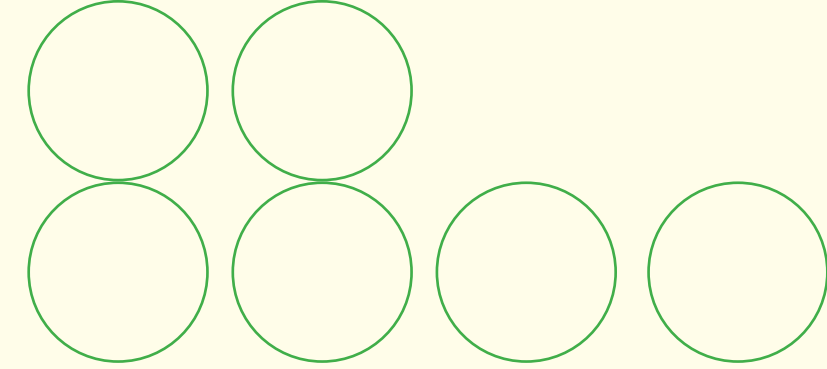
It is no secret that the building and construction sector accounts for the largest share of energy-related carbon dioxide (CO₂) emissions at nearly 40%, globally.

EDITOR'S NOTE:

In the UAE, CO₂ emissions attributed to construction are speculated to be much higher due to the large demand for air-conditioning, with buildings accounting for up to 70% of the electricity consumption.

Population growth, rising prosperity, expanding access to key resources, the roll out of the COVID-19 vaccines, and the need for continuous power supply for mission-critical facilities such as hospitals, IT data centres, industrial and infrastructural units, and backup electricity setups, have increased the Middle East's energy demand, which is set to grow further by 3.35% per annum for the next 15 years.

At such a crucial juncture of the planet's life, integrative design studies and building performance simulation studies are stealing the spotlight as one of the main solutions to tackle climate change – especially with countries such as the UAE and Saudi Arabia leading the diversification dialogue and setting an example for sustainability standards.



ON SUSTAINABILITY

THEY ASKED:

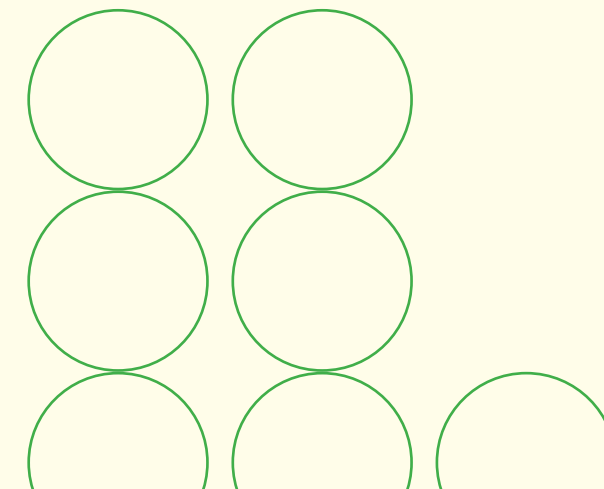
Could you illustrate why integrative design studies and building performance simulation studies are crucial to the success of complex construction projects? How important is this to go beyond compliance-verification methods to improve energy efficiency and the project lifespan?

WE SAID:

The compliance-verification method is a corner that we often find ourselves in. While we are seeing a lot of advancement in client requirements for sustainability, those requirements rarely go beyond the traditional check box methods were the "sustainability consultant" aims to tick as many boxes as possible to achieve credits without really exploring the sustainable options deeply or without following a truly integrated design approach. We have, at numerous times, when acting as commissioning agents, reviewed energy models that are far from the actual design. They are altered to serve a specific energy use reduction but fail to inform/influence the actual design to follow suit. The resultant is a sustainable design-rated building with actual in-situ performance far from the predicted values.

Sustainability compliance is not the only compliance-verification corner, other projects are even more traditional, looking only to satisfy minimum guidelines issued by local governments. Sustainability and energy efficiency are still optional or non-existent in most of the tenders.

A shift in perspective is essential for a better performing built environment. A shift in **(1) requirements and (2) how sustainability is actually pursued by the consultants in the industry. ■**



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START IT RIGHT
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START IT RIGHT



START IT RIGHT

Minimize risks by focusing on the early stages.



Green Evolution



ME Consultant
June 2016
By Omnia Halawani

*Parts of the Q&A were published

What's your take on sustainability in Middle Eastern cities? How far have we progressed on this front?

It is a wide misconception that this part of the world has never been sustainable. Old architectural approaches in the UAE incorporated a lot of passive sustainability measures like shading, wind towers, and low window-to-wall ratios.

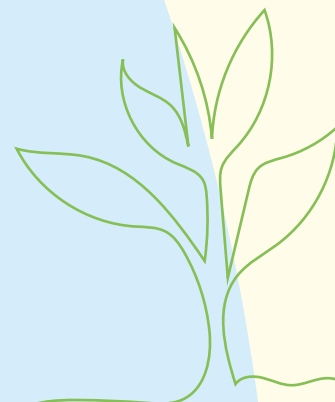
We also have some notable architects that pioneered sustainability on a worldwide scale. Hassan Fathy, the Egyptian Architect who was recognized by the Aga Khan Award for Architecture Chairman's Award in 1980, saw the value of sustainable construction long before it became a craze in the west. Climatic conditions and public health considerations shaped many of his architectural decisions. Windcatchers, courtyards, and dense brick walls were some of the strategies incorporated in his architecture. The UNESCO described his famous New Gurna Village with the following:

The main characteristics of New Gurna Village consist of its reinterpretation of a traditional urban and architectural setting, its appropriate use of local materials and techniques, as well as its extraordinary sensitivity to climatic problems. It demonstrated, within the era of "modern movement" that sustainability and social cohesion could also be met with vernacular architectures, local materials and techniques.

The UNESCO goes on to describe the project as "an outstanding example of sustainable human settlement and appropriate use of technology in architecture and planning."

When the exponential growth occurred in the GCC, this is when sustainability took a back seat to construction speed. It has now regained its position as one of the pillars for sustainable economies thanks to the wise and determined leadership.

"When the exponential growth occurred in the GCC, this is when sustainability took a back seat to construction speed."



While cities like Dubai fiercely encourage sustainable practices, they still rank 33rd and 34th on the global index according to the Sustainable Cities Index 2015. Why do you think this is and what can we learn from cities like Frankfurt, London and Copenhagen (in terms of best practices in construction, energy usage etc.) that rank in the top five on this list?

It is a well-established fact that successful and rapidly developing countries face serious environmental challenges due to the fast growth paces in population and in energy and water demands. The exponential growth in the UAE, and other Middle Eastern cities, has led to an increase of the countries' energy usage and the energy use per capita. It's worthwhile to note that every room in the UAE is air conditioned and to have an apple-to-an-apple comparison, the weather and climate should be taken into account when developing rankings such as the Sustainable Cities Index. In cold climates, inefficiency in buildings, like inefficient appliances and lighting, will benefit the heating system since these inefficient equipment generate more heat. But in a city like Dubai inefficient lighting and plug loads would add to the cooling load and drive the consumption of the air conditioning equipment even higher.

That said, legislations that are currently in place and constantly being introduced by the municipalities and standardization authorities will help in closing the gap between the UAE cities and the other cities considered more sustainable at the moment.

Dubai already has a vision of having 75 percent of its energy as renewable by 2050.

"It's worthwhile to note that every room in the UAE is air conditioned and to have an apple-to-an-apple comparison, the weather and climate should be taken into account when developing rankings such as the Sustainable Cities Index."

How can Middle Eastern cities achieve their economic and growth targets while being sustainable at the same time?

Economic and growth targets do not contradict sustainability. Green economies exist and are far from being a new concept. More than 190 nations, including the UAE, agreed in Rio+20 Summit in 2012 that Green Economy is one of the vital tools to achieve sustainable development and to eradicate poverty.

In 2012, HH Sheikh Mohammed bin Rashid Al Maktoum announced the launch of a long term national initiative to build green economy in the UAE under the slogan: "A green economy for sustainable development". The initiatives that were started under this strategy come under the following various sectors: oil and gas, water and electricity, industry, construction, transport and logistics, waste management, land use and agriculture, financial services, and tourism and hospitality. Some of those initiatives include renewable energy projects, efficiency standards and green building codes, public transportation, waste-to-energy projects, organic farming, ESCOs, and green hotels. It is anticipated that more national and local policies will be enforced in a coordinated manner to facilitate this green agenda.

The biggest assumption is that sustainable practices are often expensive especially when you're trying to implement it during the construction process. What are your thoughts on this and how can the industry work around this issue?

It is true. It is definitely more expensive to implement sustainable practices if it commences at construction stage. It is also difficult to do so if you have a team member (architect or MEP designer) who is not "green-conscious". This is why we always stress the importance of adopting an integrated design process, which brings together all stakeholders on the table from the beginning. Also, to construct a sustainable building, one has to start with reducing the building's energy-consuming loads, then use efficient equipment to cater for this reduced load, and finally add renewables. All of those three steps are obviously optional. But it doesn't make sense, and is also more expensive, to jump to level 3 without securing the first two steps first.

Dubai is home to some of the tallest towers in the world, how can a city like this ever justify itself as a sustainable city?

Tall buildings normally house more efficient cooling systems that are better maintained. Also, high-density areas justify the use of district cooling which is one of the pillars in the Demand Side Management program in Dubai, which was designed to deliver Dubai's energy efficiency.

There have been some studies suggesting that high-density or vertical cities, will have a lower environmental impacts as they occupy less footprints reducing commute and other adverse effects on the environment. Other studies contradict this by stating that the majority of the environmental impact actually comes from the land, water, power and emissions associated with the creation and transportation of things that we consume. A study in New York City showed that shorter buildings consume less energy on average than taller buildings. The Energy Use Intensity increases steadily from buildings that are 1-9 floors high to buildings that are 30 floors high; after which a plateau is reached.

Considering the hot climate here, there is obviously a great deal spent on cooling. How can you achieve carbon neutrality in this climate?

A few years ago, we have conducted a study for the Dubai RSB, through a consortium, to quantify how much cooling in Dubai really consumes. The result was that, then, 67% of the emirate's power is used by cooling systems at peak. This emphasizes the importance of exerting efforts to making this sector more efficient. The cooling systems in the majority of buildings here are oversized; here is an easy and straightforward area for optimization. The selection of more efficient cooling systems also plays a vital role. In the study we have found that 50% of the cooling systems in the city are Split Units and Ducted Split/package units.

are better-off designing buildings with proper orientation (East-West), low U Values, low Window-to-Wall ratios, external and internal shading, and improved façade. **All of this will effectively contribute to the reduction of cooling load requirements and hence, the sizing and consumption of the inevitable artificial cooling systems."**

How do you think architects can incorporate natural cooling practices in building designs so that they save on artificial cooling?

In this part of the world it is impossible to depend on natural cooling solely. A lot of locally based clients have faced issues with this when consultants, normally Western, design buildings based on such features. Every region has its own characteristics and we cannot blindly apply strategies that work for the cooler climates. The investment put into such features does not warrant the minimal use in this part of the world. It is more practical to adapt to the climate of the region. Architects are better-off designing buildings with proper orientation (East-West), low U Values, low Window-to-Wall ratios, external and internal shading, and improved façade. All of this will effectively contribute to the reduction of cooling load requirements and hence, the sizing and consumption of the inevitable artificial cooling systems.

Masdar City is supposed to play an integral role in transforming Abu Dhabi. What progress has been made with this project and in your opinion, is it going to put the emirate on the global map in terms of its sustainability?

Masdar has been instrumental in driving sustainability in the emirate of Abu Dhabi and also in many other cities around the world through renewable energy projects and research.

Creating a sustainable city from scratch is probably easier than working with existing infrastructure. What are the challenges that are involved with making existing Middle Eastern cities more sustainable?

It is definitely more expensive to reinvent a city as a sustainable one. Retrofitting existing buildings still faces a lot of hurdles when it comes to financing and client buy-in. There is also the infrastructure like aging energy delivery systems. Cities will need smarter and more resilient infrastructure for communities to thrive into the next century.

What can we expect from sustainable cities going forward and how far are we realistically from achieving these goals?

I believe that the governmental- and federal- led initiatives are taking us in the right direction. The vision that HH Sheikh Khalifa bin Zayed Al Nahyan set by "Vision UAE2021" and the initiative of HH Sheikh Mohamed bin Rashid Al Maktoum "A green Economy for Sustainable Development" both put sustainability at the forefront. Also, the historic agreement that was reached in COP21 between 195 nations means that actions and investments towards a low carbon and sustainable future that is also resilient will be unleashed on a worldwide scale. ■

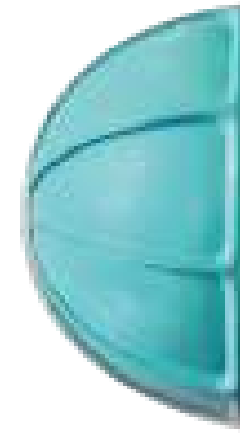


project HIGHLIGHT

Warehouses Complex

Location: Dubai
Value: USD29M
Plot Area: 70,000 sq.m
Services: MEPF Design + Supervision

The warehouses complex located in Jebel Ali Industrial Area is composed of 39 buildings housing 52 warehouses and cold stores, administrative buildings, and utility buildings on a plot area of 70,000 sqm. grfn's scope involved full MEP design for infrastructure and buildings in addition to construction supervision. ■



Location: Dubai
Value: USD110M
Built-up Area: 120,000 sq.m
Services: MEPF Design + Supervision

This upscale mixed-use development is located in a prime location on Al Wasl street in Dubai in Al Safa district. Al Safa balances the bustling side of Dubai with a quieter and more family-friendly side making it a perfect district to combine residential, retail, commercial, educational, and sports facilities.

Al Ferdous is a complex of four B+G+1 mixed-use buildings. All four buildings feature retail and F&B spaces on the ground floor. Three buildings house residential blocks on the first floor and the fourth is an offices-building.

[grfn](#) provided MEPF design and construction supervision. ■

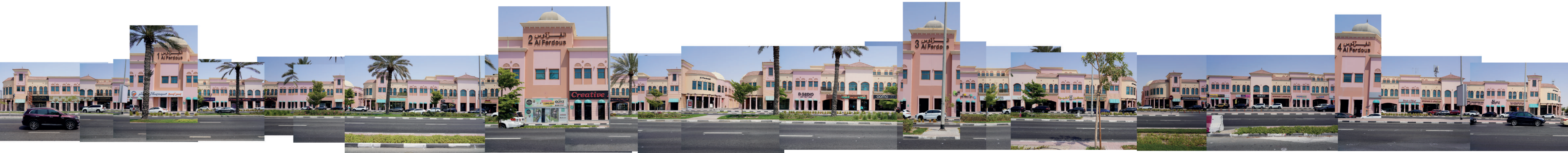


project **HIGHLIGHT**



Al Ferdous 1,2,3,4





Integrated Engineering



“Strategic Thinkers”
as published by the MEP Middle East Magazine
May 2021
By Omnia Halawani

Editor's note:
Prevention is better than cure – the age-old adage counsels, but unfortunately, there are still stakeholders within the MEP industry that seem to overlook the “prevention” because it could burden their individual role on the project or due to the fact that they aren’t held accountable for the “cure” when it’s needed.

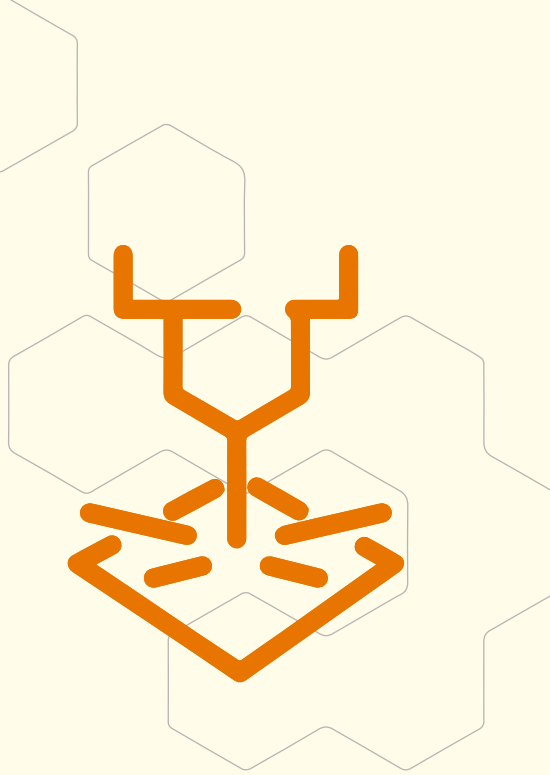
Rather than addressing challenges at the pre-concept and MEP planning and design stages, it has almost become the norm for the industry to opt for “value engineering” at the late stages, despite the additional cost and time it requires – not to mention the energy consumption and other efficiencies on the project that could have otherwise been reduced.

“Such a path, that does not invite stakeholders to coordinate from the onset, affects planning processes and fail to account for needs and valuable expertise.”

They asked:
What according to you is biggest challenge that needs to be addressed at the pre-concept and MEP planning and design stages, and has the time come to add “Integrated Planning” as an essential digitised tool?

How crucial is it to plan eight or ten steps ahead, as one would in a game of chess, rather than be focused only on present milestones and deliverables?

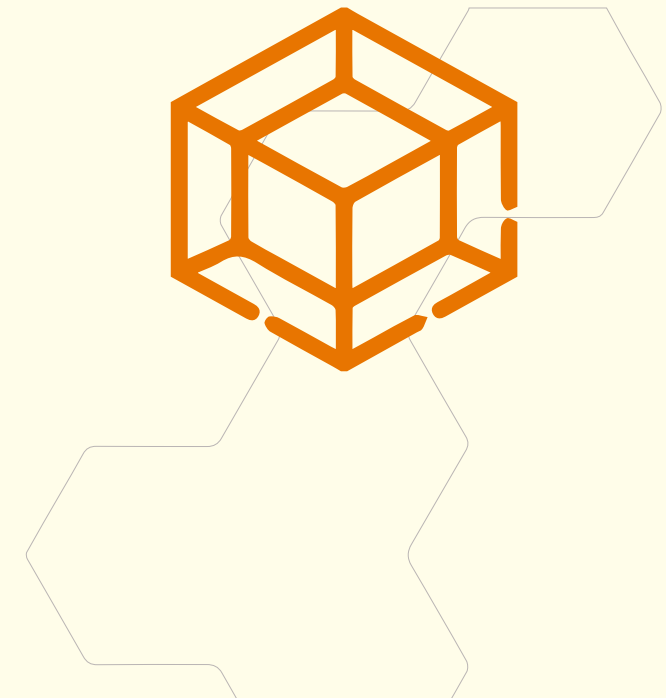
We said:
The drawbacks of conventional design strategies mainly reflect on increased project timelines and costs. If developers are to adopt a mindset that addresses this, the market will progress at a much faster pace. Developers remain to be the main driver of how the design and build team will operate and coordinate. Unfortunately, the way many tenders and projects progress fall back onto the conventional methods that naturally involve a series of handovers: from owner to architects, then to MEP designers, to contractors to occupants. Such a path, that does not invite stakeholders to coordinate from the onset, affects planning processes and fail to account for needs and valuable expertise. In many cases, design issues are only discovered late in the process when changes become more expensive.



They asked:
Are technologies such as AutoCAD, Navisworks, BIM, and Revit becoming merely methods of acceleration or are they being used to their optimum potential? Is technology advancing at a pace beyond human skills sets and capabilities?

We said:
BIM has proven to be an essential and influential advancement to the industry. While it is not deployed everywhere, it is for sure being increasingly adopted on major projects. The challenge with BIM and advancing technologies varies widely. Engineers who adopt BIM as a daily engineering tool (as it should be) would not face issues with the widespread use of the technology. That would be a struggle to others who treat it as an add on. Gaps when integrating Revit with other engineering software (ex: energy simulation) still do exist. Sometimes it is easier to build a model from scratch on the simulation software than to fix endless invisible issues with the BIM model that would affect the integrity of the energy model.

One of the main uncaptured potentials of BIM is its adoption beyond its 3D capabilities and its use for clash avoidance. As the use of BIM advances beyond 3D, the gap and struggle with the technology increases. We continue to advocate the use of the technology to its optimum potential.



“Engineers who adopt BIM as a daily engineering tool (as it should be) would not face issues with the widespread use of the technology.”

They asked:
“The human nature is to resist change” – what solution would you offer to address this concern within an industry that is attempting to adopt better practices and embrace newer technologies?

We said:
I think that we are seeing better integration between many universities and the industry. More and more graduates are readily equipped with Revit skills and the knowledge of using multiple energy simulation programs for example. And I do believe that this is an essential building block to address this concern.

As for the rest of the industry, I always believe change is inevitable. It is either you remain comfortable with the traditional ways and alongside this be forced to limit your options in a diminishing market, albeit slowly; or adopt change and advancement of the betterment of all ends. To excel one should be constantly afraid of falling behind. ■



District Cooling is **NOT** Always the Answer

By *Omnia Halawani*

District Cooling (DC) has huge potential to reduce high electricity demand from air conditioning especially at times of peak load. With cooling (and heating) accounting for more than half of cities' consumption of energy and cities representing more than 70% of the global energy demand, cities hold a great opportunity to positively affect the transition to sustainable energy.

But is District Cooling always feasible? Definitely not.

To conduct a District Cooling feasibility study, we mainly depend on the masterplan that indicate the potential developments by building types and zones. With this breakdown, masterplans determine the maximum developable square footage for each site along with the mix of uses: commercial offices, hotels, retail, residential, and community facilities. We would then apply cooling load density factors, equivalent full load hours, market penetration factors, and load diversities.

The most prominent indicators of DC feasibility are the cooling requirements, development density, and load diversity.

It is common to find district cooling providers and property developers overestimating cooling requirements. This is due to the providers relying on the load estimates provided by the real estate developers, and the developers relying on designers who place unnecessary cascading safety factors that result in exponentially overestimated loads. In instances, developers may also be over optimistic about their projects. The result is inefficiently oversized plants and unnecessary inflated capacity costs. The inefficiency of this scheme is attributed to design overestimation. Development densities would largely affect the chilled water distribution system costs. Cooling distribution networks entail high capital and installation costs. The greater the distance between buildings, the longer the

pipes run and the higher the costs while charges remain fixed. Compact land use means buildings are closer together which means less pipe is needed to connect them, decreasing costs and losses. There are instances where DC providers do not pay sufficient attention to the cooling density of the development. There are some examples where district cooling was built for low-density developments, like villas complexes, where it is inherently more expensive than conventional cooling alternatives. A pipe run feeding villas is more expensive than a pipe run with the same cooling capacity feeding a building with multiple dwellings.

In Europe, the term pipeline density or linear cool density is a common benchmark for evaluating the feasibility of district cooling projects. Linear cool density is a measure used in district cooling to distinguish the annual demand expected per meter of network installed. The linear cool density is reduced if the network is in an area with low cool density, such as the outskirts of a city. A reduced linear cool density means a higher-level cost of the network. The benchmark value depends on local conditions.

Finally, high customer diversity deems district energy systems more attractive. For example, office buildings have high cooling demand mainly in the weekdays daytime while residential buildings usually have intensive cooling demand at night and weekends. Thus, the cooling need of residential buildings can be considered complementary to that of office buildings. In mixed-use areas, there are many types of energy consumers (commercial, residential, public buildings) that are usually located in close proximity. They create smoother and less-profiled energy demand. The commercial or mixed-use type provide the highest EFLH (Equivalent Full Load Hours – a crucial measure to develop business models for DC systems) possible due to the variety of load profile. This will provide higher Internal Rate of Return (IRR) and less payback periods. The adoption and encouragement of mixed-use zoning is one of the most important tools that local governments can use to reduce emissions. The significant benefits that mixed-use zoning has on the economics of district energy should make this planning tool even more of a priority to local authorities. ■

“The adoption and encouragement of mixed-use zoning is one of the most important tools that local governments can use to reduce emissions.”

District Energy systems come with multiple benefits: Efficiency in rationalizing electricity consumption, conserving natural resources, and reducing operating and maintenance costs for very large real estate developments. But while District Cooling as a technology brings along a myriad of social, economic, environmental, and benefits, implementing **an inherently unfeasible DC system will result in:**

- 1. High distribution network costs deeming the system not attractive for service providers or investors with eventual relaying of costs to end users at inflated rates resulting in unsatisfied customers.**
- 2. Low utilization of plant capacities.**
- 3. Tariff fees that are higher than conventional cooling systems resulting in customers disconnecting from the district system or unsatisfied customers if enforcement is applied.**



grfn can assist you with conducting feasibility studies to determine whether your development is eligible for a district energy system or not. We have conducted feasibility studies on cities, districts, and developments scales as well as for the oil and gas sector.

“When the compressors are serving critical loads like data centers reliability becomes of prime concern and standby systems are sought.”

Do you see a ramp-up in demand for compressors once the blueprint of the EXPO 2020 was announced and as we get closer to the other coincidental mega-event, the 2022 FIFA World Cup?

Every building in the GCC requires compressors mainly in its air conditioning machines ranging from small (less than a ton compressor) to mammoth (1,250 ton compressors).

The compressor market goes hand in hand with the construction industry. A great deal of compressors market is also in the existing building stocks where old compressors require change at their end-of-life cycle. Additionally, the current existing building efficiency is being looked at in the UAE and GCC. In Dubai, through its DIES* 2030 plan, it has been announced that 30,000 buildings will be retrofitted. Most of the compressors in those buildings will be replaced with new compressors which will also boost the compressors market.

How critical are compressors from reliability, energy efficiency and safety perspectives?

In cooling systems compressors account for 70% to 90% of yearly energy consumption. The lower figure is for water cooled chilled water systems where pumps and cooling towers power consumption constitutes a considerable amount of energy consumption.

In the UAE it is estimated that 50 to 70% of yearly building energy consumption is used by air conditioning systems so energy efficiency of compressors is very important for the country's vision in reducing the energy consumption. When the compressors are serving critical loads like data centers reliability becomes of prime concern and standby systems are sought.

From a safety perspective, refrigerant standards, namely ASHRAE 15 and 34, should be adhered to in design and operation to ensure safety is maintained.

What are the drivers of growth for the compressors industry?

On one end, there is the demand of the construction industry for new and existing buildings. On the other end, legislation for equipment efficiency and refrigerant environmental friendliness drive the improvement in the compressors industry.

Are there any new technologies in the compressors market?

Magnetic refrigeration technology is seeing a lot of development in the fridge markets. The experts claim that the technology can cover up to 80% of the vapor compressor market today.

As for the vapor compression, compressors using natural refrigerants are being adopted today like CO₂, however HFCs* compressors are still the dominant.

Magnetic bearing compressors are also gaining popularity due to their higher efficiency and no use of oil. They are still, however, not widespread due to their higher cost.

What are the types of refrigerants used in compressors? Are there any changes made to the compressors based on the type of refrigerant to be used?

Currently CFCs* are obsolete. HCFCs* are being phased out under the Montreal protocol and HFCs are dominant. HFOs* are surfacing and the first chiller using HFO was installed in London in 2012. Also, more natural refrigerants like CO₂ and water ammonia are gaining momentum. Every refrigerant has different pressure and enthalpy characteristic curves and thus compressor designs are based on the refrigerant intended to be used in them. When refrigerants share characteristics, compressor designs need not change. For instance, R438A has been designed to replace R22 without the need of compressor adjustments since both refrigerants share similar pressure and enthalpy characteristics.

What are the challenges facing the compressors industry under the current market circumstances?

As with any other industry, recession is the main challenge facing the compressors industry. Another challenge is the environmental requirements and regulations that are requiring more environmentally friendly and more efficient refrigerants.

What effects do legislations and regulatory guidelines on refrigerants have on the compressor design and R&D?

Legislation and pressure from the international environment agencies to come up with refrigerants that are “safe”, non-flammable and with no ODP* or GWP* is the drive behind the entire R&D in the refrigerants industry. ■

*Dubai Integrated Energy Strategy
*HFC - HydroFluoroCarbon
*CFC - ChloroFluoroCarbon
*HCFC - HydroChloroFluoroCarbon
*HFO - HydroFluoroOlefin
*ODP - Ozone Depletion Potential
*GWP - Global Warming Potential

The Pumping Heart



*“The Pumping Heart”
as published by the Climate Control Middle East Magazine
May 2015
By Hassan Younes*

Rajiv Pillai interviewed Hassan Younes and other industry professionals on the subject of compressors. Here is what we said:

Environmental Consciousness among MEP Consultants



As published by *Climate Control Middle East* September 2016
By **Hassan Younes**

The leadership in the GCC region has been introducing a raft of measures to encourage better building performance. Initiatives, such as Green Building regulations, building-retrofit programmes, net zero energy buildings, smart cities and IoT, point to the right direction in terms of intent. Equally, measures, such as robustly embracing 3D printing and ICF, indicate a paradigm shift in how the leaders envision buildings to be constructed.

Broadly, we are witness to market transformation and disruptive approaches, which have the potential to cut project timelines, and improve energy efficiency, indoor environment, reliability, resource conservation, etc. But largely speaking, are consultants, sub-consultants, architects, contractors and sub-contractors prepared to align themselves with these changes? How much will this mindset affect the push towards sustainable development and socio-economic development? How much is the impact of developers and building owners on consultants and contractors? How big is their influence in undermining quality?

In view of the above, what are the remedial steps that need to be taken for an uncompromising approach to delivering quality in building design and construction, so that the region emerges as having structures that embody sustainability and robustly support socio-economic development?

“Soft Landings is a cradle-to-operation project process which enables designers and constructors to focus more on operational performance outcomes.”

Here is what we had to say:

Q - Has there been a palpable change in mindset and approach in the MEP consultancy community in the wake of vision statements issued by different GCC governments? Or, is it still the same?

The MEP consultancy community is not all of the same mindset. However some consultancies have started the internal change to meet the new governmental requirements.

Q - Generally speaking, do consultants care about the projects they have designed after the buildings are up and running? Is there a need for a government-mandated mechanism to ensure consultants learn from projects with a view to improving their performance in future projects?

Unfortunately, few to none visit the buildings after they are up and running. The soft landings framework has been suggested in the UK to counter the inefficiencies in construction.

Soft Landings is a cradle-to-operation project process which enables designers and constructors to focus more on operational performance outcomes. The approach helps project teams to deliver buildings that achieve their energy and environmental performance ambitions, while also focusing more on meeting the needs of occupants. Soft Landings requires clients and their design teams to make more use of performance feedback, from pre and post-occupancy building evaluations, to better inform client requirements and design briefs. The consultant would stay on board for one or two years after the building gets occupied to make sure all systems are working as designed. This will definitely increase the consultancy cost on the owner but with all the problems buildings are facing nowadays it seems like a necessary measure.

Q - How responsive are consultants to such trends as BMS, Blot, nZEB, smart cities, retrofitting, etc.?

In today's market most of the consultants claim to know it all. That's why owners need to have informed teams to select the appropriate consultant for the appropriate job. Taking for example BMS, we rarely find fully functional BMS on site. Who is to blame? Well this might be worth a separate article.

Q - What is the level of commitment towards, and concern for, the environment?

For most of the cases it is business as usual mindset. Consultants are running businesses and their main target it to satisfy the owner's requirements while spending the least amount of time. Environmental consciousness is uncommon among many consultants; but not all.

Q - Are consultants rushing through projects and often bypassing due diligence measures?

That is true, and it has many reasons. First reason is unrealistic timelines by the owner. The second reason is uninformed consultants who would copy paste from other projects without looking into the specific need of the project at hand. We do a lot of design reviews and the number of mistakes we find is alarming.

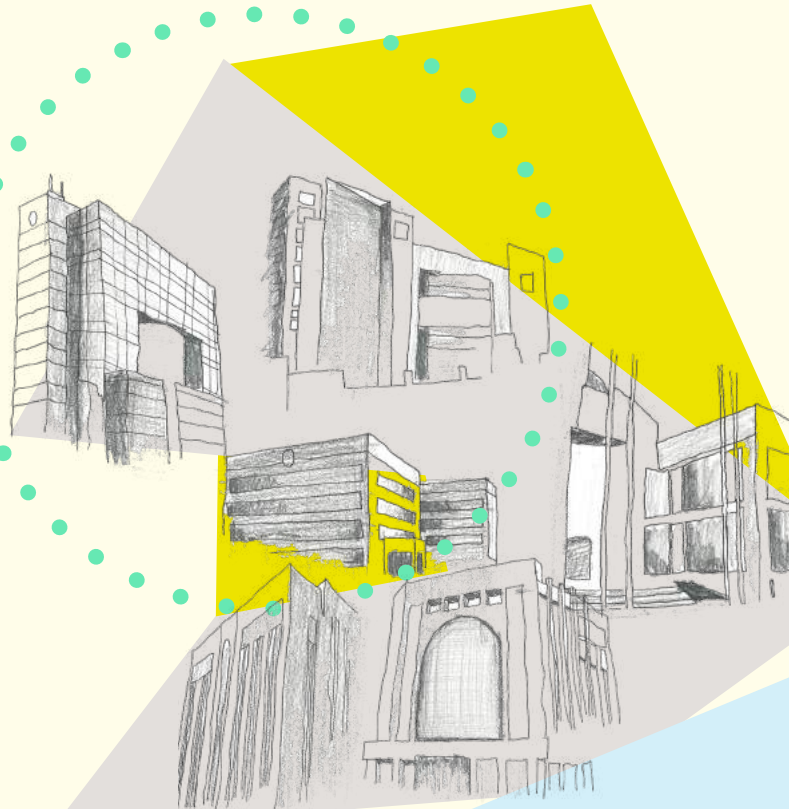
Q - Is there still a strong copy-paste culture, which is detrimental to energy efficiency and IEQ goals?

Every project has its requirements, and the concept should be tailored to fit the project. Get the concept right and your goals are 80% achieved.

Q - If copying and pasting is an international phenomenon, what can the MEP consultancy community in the region do in terms of leadership, and in terms of offering a paradigm shift for the better?

Copying and pasting is obviously not delivering the goals of projects. It is up to the clients and building owners not to accept such designs and to expose those consultants. ■

Large Energy Efficiency Projects



DoE in ABU DHABI

Consultancy for Energy Retrofit Management (ESCO selection, supervision, M&V) for 7 pilot buildings and selection of 150 further buildings eligible for energy retrofit.

of buildings **7**
Type: **commercial**

-  AEE Middle East Energy Retrofit Project of the Year 2020
-  CIBSE BPA Retrofit Project of the Year 2021

EMAAR

Energy benchmarking for all of Emaar properties and setting a plan for energy management. Done twice in 2016 and 2019.

of buildings **58**
Types : **Retail, residential, commercial, hotels, malls**



ALDAR PROPERTIES

Consultancy for Energy Retrofit Management for 90+ assets owned and managed by Aldar Properties in Abu Dhabi. Scope spans selection of ESCO all the way through implementation supervision, commissioning management, and M&V.

of buildings **200+**
Types: **residential, commercial, schools, hotels, malls**

TECOM

Consultancy for Energy Retrofit Management for 9 large communities managed by TECOM in Dubai; ~160 buildings. Scope spans selection of ESCO all the way through implementation supervision, commissioning management, and M&V.

of buildings **160+**
Types: **41 boutique offices, 9 warehouses, 5 souks and various other types**

M&V for ETIHAD ESCO

Sole M&V Consultant for Etihad ESCO's multiple retrofit projects including Dubai airport and DEWA plant.

of buildings **50+**
Types: **Airport, Powerplants**





NAKHEEL

Consultancy for Energy Retrofit Management for 9 malls and 1 hotel. Scope spans audit, selection of ESCO, implementation supervision, and commissioning management.

of buildings **9 malls + 1 hotel**

Types: Malls, Hotel

Consultancy for Energy Conservation Study across multiple Nakheel communities. Spanning between Level 3 audits for 30 buildings (each type) and Level 1 for all other buildings.

of buildings **298**

Types: Malls, Residential

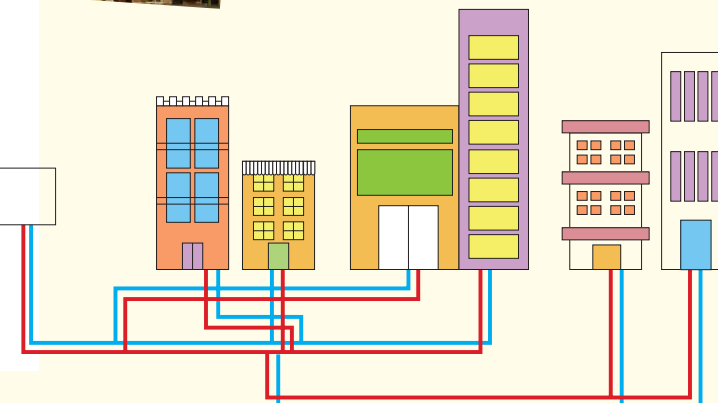


EMICOOL

Consultancy for Energy Retrofit Management for 4 district cooling plants owned by Emicool in Dubai. Scope spans audit, selection of ESCO, implementation supervision, commissioning management, and M&V.

of plants **4**

Type: District Cooling



GEMS EDUCATION

Development of a holistic energy conservation, renewable, IEQ, and smart buildings plan for the educational giant. Scope covers selection of ESCO/contractor, supervision, and M&V.

of schools **46**
Types: Educational

MERAAS

Consultancy for Energy Retrofit Management for 59 buildings in Discovery Gardens in Dubai. Scope spans audit, selection of contractor, implementation supervision, commissioning management, and M&V.

of buildings **59**

Types: Residential

GITEX 2019 - Energy Sustainability Champion Award



project **HIGHLIGHT**

Educational Intervention

GEMS Education is a home-grown UAE company, with an unparalleled track record of providing quality education across multiple curricula to meet the needs of local populations.

Today, GEMS Education operates more than 250 schools in 13 countries, with a global network made up of some 174,000 students from more than 175 countries. They are the oldest, most well-regarded choice for quality private education in the Middle East and North Africa region. They are also the largest employer of UK- and India-trained teachers outside their home countries.

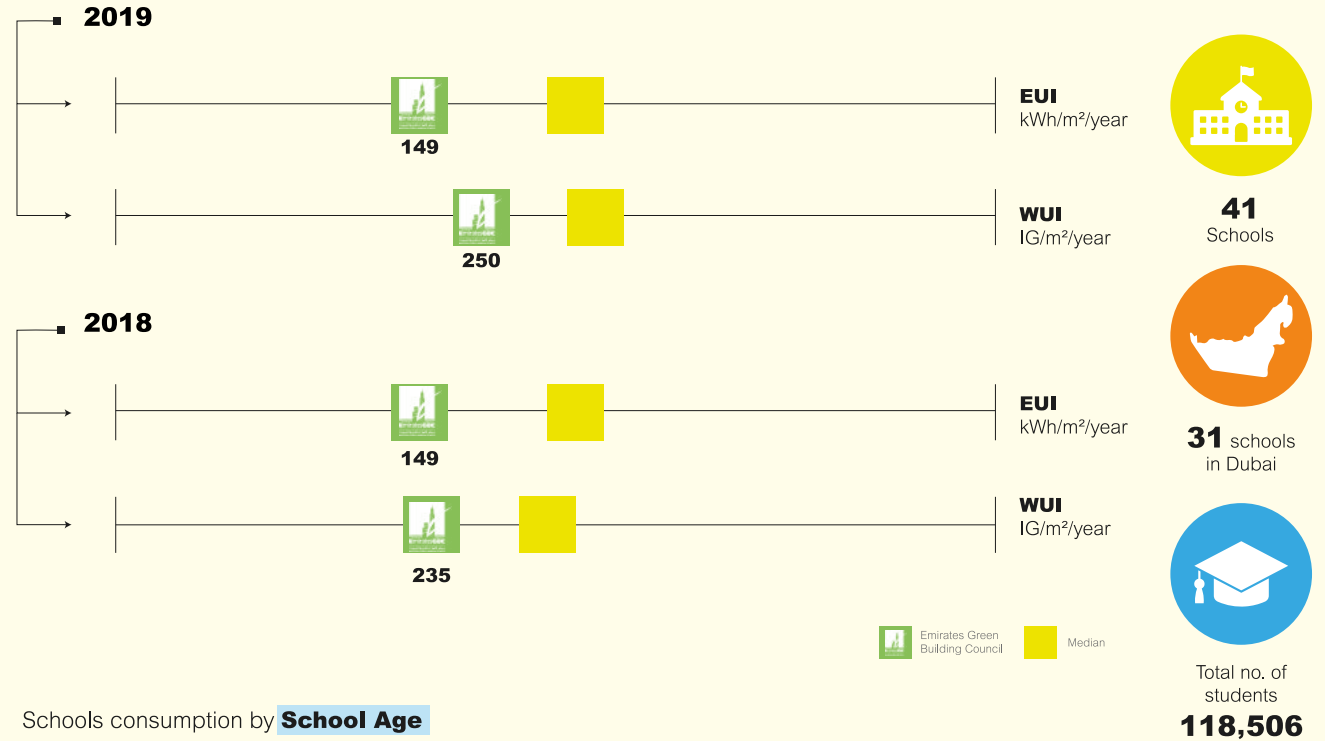
Focusing on the UAE, GEMS Education is operating 46 schools in six different emirates; Abu Dhabi, Dubai, Sharjah, Al Ain, Fujairah and Ras Al Khaimah with around ~120,000 students and ~15,500 employees which makes it the leading provider of private education in the UAE.

In line with UAE's vision 2021, precisely the sustainable environment and infrastructure initiative, where the UAE Government wants to ensure sustainable development while preserving the environment, and to achieve a perfect balance between economic and social development, and being one of the leaders in its discipline, GEMS created their own environmental policy which aims to create an institutional culture which works to continually improve environmental impacts and to deliver environmental enhancements wherever possible.

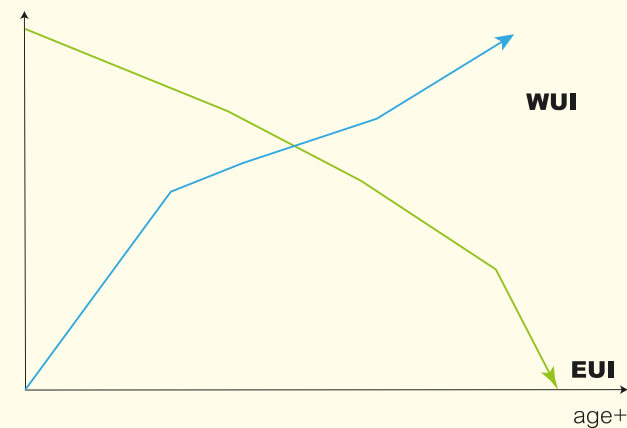
Being such an aspiring organization towards sustainability, we developed "GEMS Energy Plan" which aims to reduce the energy expenditure of GEMS Education through an innovative plan with Zero CapEx by GEMS based on an established business model that is supported and regulated by the government and in which grfn acts as the experienced and trusted client representative for maximum benefit, optimized performance, and guaranteed savings. ■

“an innovative plan with Zero CapEx by GEMS based on an established business model that is supported and regulated by the government and in which grfn acts as the experienced and trusted client representative for maximum benefit, optimized performance, and guaranteed savings.”

FINDINGS & RESULTS

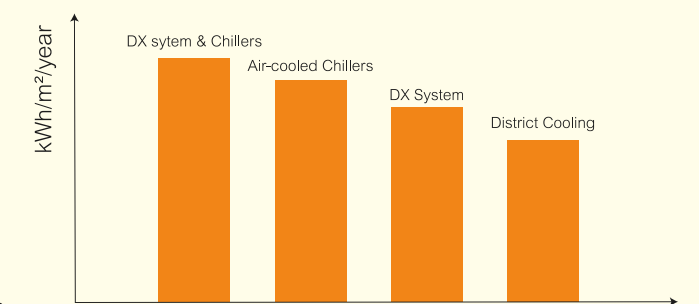


Schools consumption by **School Age**



WUI: Water Use Intensity
EUI: Energy Use Intensity

Schools consumption by **Ac Systems**



WHAT ARE THE COMMON PITFALLS?

With due diligence tasks, we ensure that you get a full well-rounded and in depth understanding of the asset. Some of the common metrics deficiencies we analyze involve:

1

Plant efficiencies – with large ranges across the region (0.8 kW/ton to 1.2 kW/ton), the most prevalent issue when trying to determine plant efficiencies is either the lack of instruments, uncalibrated and faulty instruments, and the lack of historical data and trends.

2

Underutilized capacities – oversized plants at the time of construction.

3

Low Delta T Syndrome causing lost potential plant capacity.

4

Plant operations – many plants still rely on manual and semi-auto operations with significant human intervention. The control sequences, in some cases, are also found to be out-dated or not even commissioned.

5

Plant maintenance – the maintenance in plants vary largely between extreme poor conditions, with near zero compliance to standards and best practice, to well maintained plants with prolonged expected life.

Do your Due Diligence

By Omnia Halawani

As with any professional transaction, District Cooling and chiller plants acquisitions involve detailed legal, financial, and technical due diligence exercises. An acquisition transaction is critical and, thus, due diligence tasks should be taken in sufficient detail to alleviate risks by fully understanding the assets and its features and shortcomings.

Technical due diligence services involve reviewing the condition of the current assets, highlighting concerns, appraising operation and maintenance procedures, and assessing the operational parameters like efficiencies, delta T, and peak loads. Potential upgrades that would bring benefit into the asset's value and operations should also be highlighted. The overall objective is to obtain all relevant and up-to-date information of the target asset and to understand any significant shortcomings which are, otherwise, not apparent. The scope includes assessment of the equipment and plant condition to address the performance at asset and system level, highlighting of all strengths and weaknesses, evaluation of the plant design and operation based on the Client's standards and requirements, and identification of any replacements or expansion costs alongside a comparison to the present standards and regulations to form unbiased recommendations on the plant condition, and identification of all major risks involved.



grfn provided technical due diligence services for over 400,000TR of District Cooling and Chiller plants across the region.



WHO

BENEFITS?

+ The **buyer** gets peace of mind that they have all the information needed to make the right deal. They will be able to analyze the transaction completely and will be able to understand the advantages and disadvantages of acquiring the asset and be able to accurately forecast expenditures and asset life.

+ The **seller** gets a deeper dive into the integrity of their asset and can help them remedy deficiencies prior to the transaction.

By conducting detailed site audits, analysis of available current and historical data, assessment of design conditions, and appraisals of the plant operations, a due diligence exercise will provide buyers and sellers with clarity on the actual asset condition and measures to improve the plant's state and value.

project HIGHLIGHT



20 Plants
90,000 TR

Technical and ESG Due Diligence for 20 District Cooling & Chiller Plants

Due diligence services for 20 District Cooling and Chillers Plants. The plants are a mix of operational and under-construction plants, including both Water-cooled and Air-cooled plants. The total installed capacity of the Water-Cooled plants adds up to over 80,000 TR and that of the Air-Cooled plants adds up to over 10,000 TR.

5 Plants
110,000 TR

Technical and ESG Due Diligence for 5 District Cooling Plant in Dubai

Due diligence services for 5 District Cooling with an overall capacity of around 110,000 TR. The plants are Water-cooled operational with ages varying from 5 to over 20 years old.

10 Plants
125,000 TR

Technical and ESG Due Diligence for 10 District Cooling Plants across the UAE, Egypt, Oman and Bahrain

Due diligence services for 10 District Cooling Plants. The plants are a mix of new and near-end-of-life plants including both Water-cooled and Air-cooled plants. The total installed capacity of the plants is around 125,000 TR.

1 Plants
50,000 TR

Dubai Festival City DCP

A technical assessment of the District Cooling Plant of capacity 50,000TR serving the mixed used development in Dubai Festival City, that includes multiple residential, commercial and hospitality buildings. The study was directed to evaluate the current condition of the plant and recommend necessary improvements for optimization. ■

Retrofitting DCPs

By *Omnia Halawani*

Water-cooled centralized chiller plants and district cooling plants offer the potential of improved energy use associated with chilled water production or air conditioning. But does the general performance of district cooling plants measure up?

Through multiple technical assessments, surveys and due diligence activities conducted, we have witnessed regional plants in MENA ranging in efficiency from 0.75 kW/tons to 1.2 kW/tons. According to ASHRAE, an excellent coefficient of performance in chiller plants has a value of over 5.0 or plant efficiency of under 0.7 kW/ton.

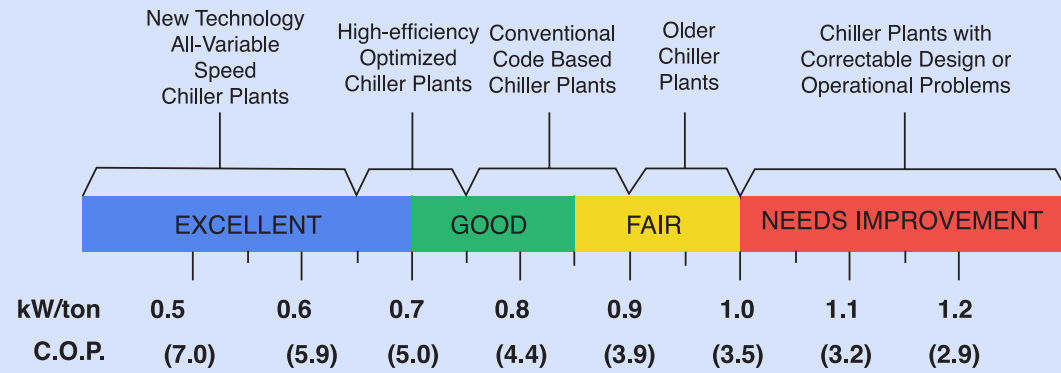
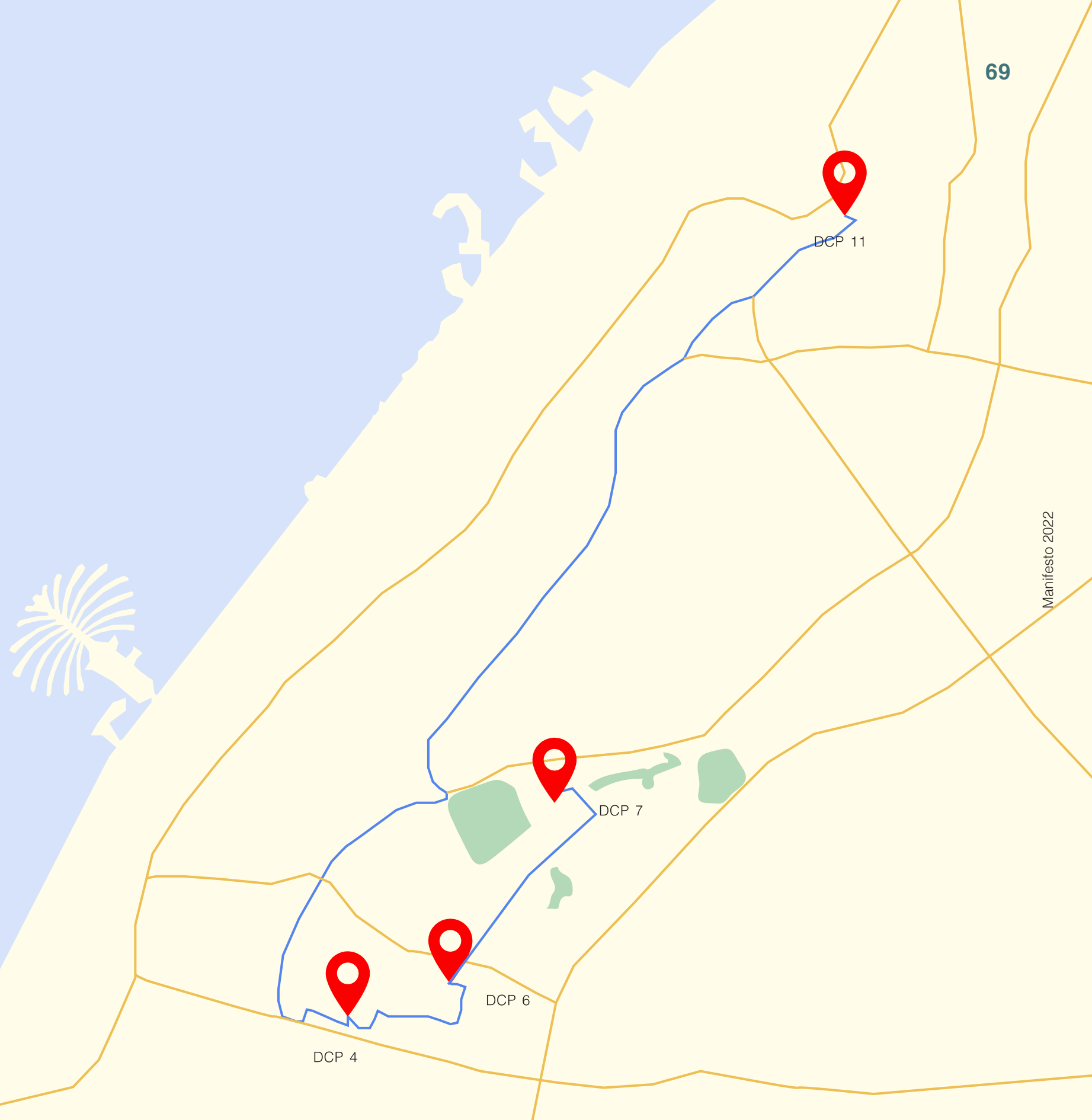


Figure 1 ASHRAE COP Classification

The potential associated with energy retrofits of the ill-performing plants is one to be harnessed. Addressing the optimization of district cooling plants through structured engineering approaches and detailed energy audits to allow the plant to respond to and modulate in accordance with demand, offers significant savings as well as operational improvements.

Through our involvement in multiple District Cooling Plants retrofits, we follow a systematic approach to retrofits that offer the service providers benefits on the energy expenditure with healthy financial returns and long-term value. In addition, the retrofits also improve the overall plants functionality by fixing or adding upgraded control and supervisory systems, prolonging equipment life, improving Operation & Maintenance protocols, and digitization of assets and solutions. ■

grfn global has supported energy retrofits in multiple District Cooling Plants in Dubai as the client representative and consultant.





Mechanical
Electrical &
Plumbing

Status Quo for the Retrofit Market

MEP Middle East
October 2018
By Omnia Halawani

“The energy auditor needs to be capable of demonstrating the financial benefits of retrofits to the building’s owner for the project to be successful and for the model to be sustainable in the long run.”

Despite the Dubai government’s efforts to drive the retrofit of existing buildings by 2030, there is still a sense of resistance from clients to adopt retrofit projects. Omnia Halawani feels that if a project does not make financial sense, it will not be sustainable. She does admit that the government’s backing of retrofits is a great and a crucial step that gave retrofitting a needed push. However, she says: “The energy auditor needs to be capable of demonstrating the financial benefits of retrofits to the building’s owner for the project to be successful and for the model to be sustainable in the long run. This is where experience matters. Poorly done energy audits, over-promised savings, and poor delivery of retrofits are driving promising clients away from retrofits.”

Halawani believes that the UAE has companies and resources with technical capabilities to carry out successful retrofits. She says: “There are several stocks of buildings that are eligible for energy savings. The market can be estimated at around \$1.6bn.” However, MEP contractors tend to refrain from taking part in retrofit projects as they view “the project value to be much less than new construction projects and they do not want to get into the hassle of financing”.

Everything has to make sense financially. Some developers are reluctant to invest in energy efficiency projects in the fear of missing out on other more straightforward growth opportunities. However, Halawani says that investment cycles and payback periods for such retrofit projects are extremely short, with operational measures offering immediate payback and savings figures of 10-15%.

“...investment cycles and payback periods for such retrofit projects are extremely short, with operational measures offering immediate payback and savings figures of 10-15%.”

Technical Aspects

Moving on to the technical aspects of retrofitting, particularly when refurbishing a live environment, Halawani says that one of the main concerns in any retrofit project is the level of disturbance to occupants be it residents, employees, or customers. She asks: “How can you replace the chillers without affecting the thermal comfort? How can lights be retrofitted with minimal inconvenience? How can one upgrade a Building Management System without having a major effect on systems’ operations?” There ought to be collaborative efforts with the building’s facility management and the building owner/operator. She says: “Retrofits can happen during nights or weekends, or they can be phased. Also, a temporary system may be erected to enable dismantling the old and assembling the new system.”

When it comes to the extent to which a building should be retrofitted, Halawani lists down ASHRAE’s three levels of energy audits.

A Level 1 audit or a walkthrough audit can provide valuable insights into the plausibility of achieving savings. She says: “We normally advise our clients to go with a Level 1 audit if they have a large portfolio of buildings and there is a need to benchmark them to prioritise the buildings for more in-depth audits and retrofits.” But a Level 1 audit is ideally complimented by a Level 2 or 3 audit for an in-depth study.



“Traditional measures work and are, in many times, the way to go. But we were involved in a few projects in which our innovative solutions won us the project as they provided our clients with measures that were easier to implement, were less costly, took less time to install, and provided optimum operations.”

Audits of Level 2 and 3 are needed when the building is to undergo a retrofit, especially a capital intensive one. When CAPEX is involved, it is vital to get an accurate estimation of the savings to assess the feasibility of the retrofit. A Level 1 audit does not result in a savings estimate that can provide the required level of assurance. A Level 2 audit requires conducting in-situ measurements of parameters deemed influential in the determination of the savings.

Level 3 involves more measurements as well as energy modelling or simulation. By building a calibrated energy model of the building, one can test the proposed energy conservation measures and accurately predict the savings.

Innovations and Projects

grfn looks for innovative measures to provide its clients with better outcomes and improved payback periods. Halawani adds: “Traditional measures work and are, in many times, the way to go. But we were involved in a few projects in which our innovative solutions won us the project as they provided our clients with measures that were easier to implement, were less costly, took less time to install, and provided optimum operations. “We have also promoted the use of Building Information Modelling, central control and monitoring, and occupant user interfaces to aid the better implementation, monitoring, and results of retrofit projects.”

The firm is currently involved in several retrofit projects across the GCC with multiple governmental entities, such as Abu Dhabi’s Department of Energy (DoE), where the firm is involved in the first governmental Energy Performance project in Abu Dhabi. The project targets to retrofit eight DoE-owned buildings in Abu Dhabi and Al Ain and targets 30% reduction in energy through innovative energy management solutions. The project is in line with the strategic objectives of the DoE and supports the Abu Dhabi 2030 Vision. grfn is the energy efficiency consultant on the project overseeing the selection of the bids, implementation of the retrofits, and the yearly measurement and verification over the performance period.



In Dubai, the firm was involved in the monitoring and enhancement of the Dubai Demand Side Management (DSM) Strategy, which is one of the three pillars of The Dubai Integrated Energy Strategy (DIES 2030). DIES 2030 was developed by the Dubai Supreme Council of Energy (DSCE) to support the vision of the Emirate to “become a role model to the world in energy security and efficiency” and stems from the nationwide vision for the UAE “to be among the best countries in the world by 2021”.

The DSM Strategy 2030 targets a 30% reduction in electricity and water by 2030 which corresponds to 19TWh reduction in electricity and 46 BIG (Billion Imperial Gallons) in water reductions. It aims to achieve that through the eight core programmes, one of which is “buildings retrofits”. She says: “One of the objectives of the project we’re involved in is to update of the savings estimations methodology and results. It is such a stimulating task which involves quite a lot of data collection, energy simulation, and complex analyses.”

Besides this, Saudi has also initiated its energy efficiency program. The Saudi Public Investment Fund (PIF) has set up a super ESCO, NESCO (The National Energy Services Company). A royal decree mandates all governmental entities to contract NESCO exclusively for retrofitting of all buildings in Saudi. She concludes: “We are providing consultancy services to NESCO in these exciting projects.” ■

“One of the objectives of the project we’re involved in is to update of the savings estimations methodology and results. It is such a stimulating task which involves quite a lot of data collection, energy simulation, and complex analyses.”



project HIGHLIGHT 

Highlight the Effort

By Omar Darwish

In a bid to improve the performance of their buildings and in alignment with the national UAE targets for sustainable development, DAFZA (Dubai Airport Free Zone Area) adopted a number of energy conservation measures and renewable energy installations across the buildings under their jurisdiction. The DAFZA headquarters, specifically, was treated as a role model to the other DAFZA buildings having received the LEED EBOM Platinum rating in 2016 with a score of 86 – the highest recorded in the UAE in 2016. This was achieved through a set of advanced energy and water saving measures applied as well as in-house expertise in energy management and conservation. The measures included demand flow control for central chilled water system, demand-based ventilation strategy where variable drives and CO₂ sensors are installed to operate the FAHUs as per the occupancy rate and CO₂ levels, a full lighting retrofit introducing efficient LED lighting and automatic controls, increased reliance on treated sewage effluent water for irrigation and cooling towers, and reduced water flows. This is all complemented by an advanced and fully integrated Building Management System enabling full control over all energy-consuming systems. An in-house team of experts deploys awareness programs and initiatives for users' engagement. A few buildings across DAFZA are also equipped with dashboards to display the achievement of targets and to offer tips and patterns to influence tenants' behavior. DAFZA continues to exert efforts to reduce energy consumption year on year. Over a six-year period until 2018, their achieved target for reduction was around 30%.

“This is all complemented by an advanced and fully integrated Building Management System enabling full control over all energy-consuming systems.”

In addition to energy conservation measures at the HQ, DAFZA installed multiple highly efficient roof top solar photovoltaic panels on the buildings across DAFZA. The total installed capacity is over 2,500 kW (as of March 2020). DAFZA's long term plan is to have all eligible rooftops and parking shades equipped with solar PVs. Starting in 2017 with a PV production capacity of only 65 kWp, this was ramped up to around 5,200 kWp capacity in 2020. Despite being mid-rise buildings with limited available roof area compared to the buildings' gross floor areas, the PV system offsets a range of 5% up to 25% energy use of the whole building. DAFZA diverted over 1,000 metric tons of Carbon Dioxide Equivalent during a period of one year with a total PV production of around 1,450 MWh.

In early 2015, DAFZA was one of the first semi-government organizations to comply with a scheme by the Dubai Supreme Council of Energy where they mandated walkthrough energy audits for Dubai government buildings above 1000m². These audits, back then, showed that DAFZA buildings were found to be efficient due to the retrofits voluntarily undertaken prior to the mandate.

grfn assisted DAFZA in measuring and highlighting their efforts in energy efficiency and renewables adoption and have also collaborated with the authority to benchmark their buildings against a planned buildings energy and water rating system in Dubai. ■



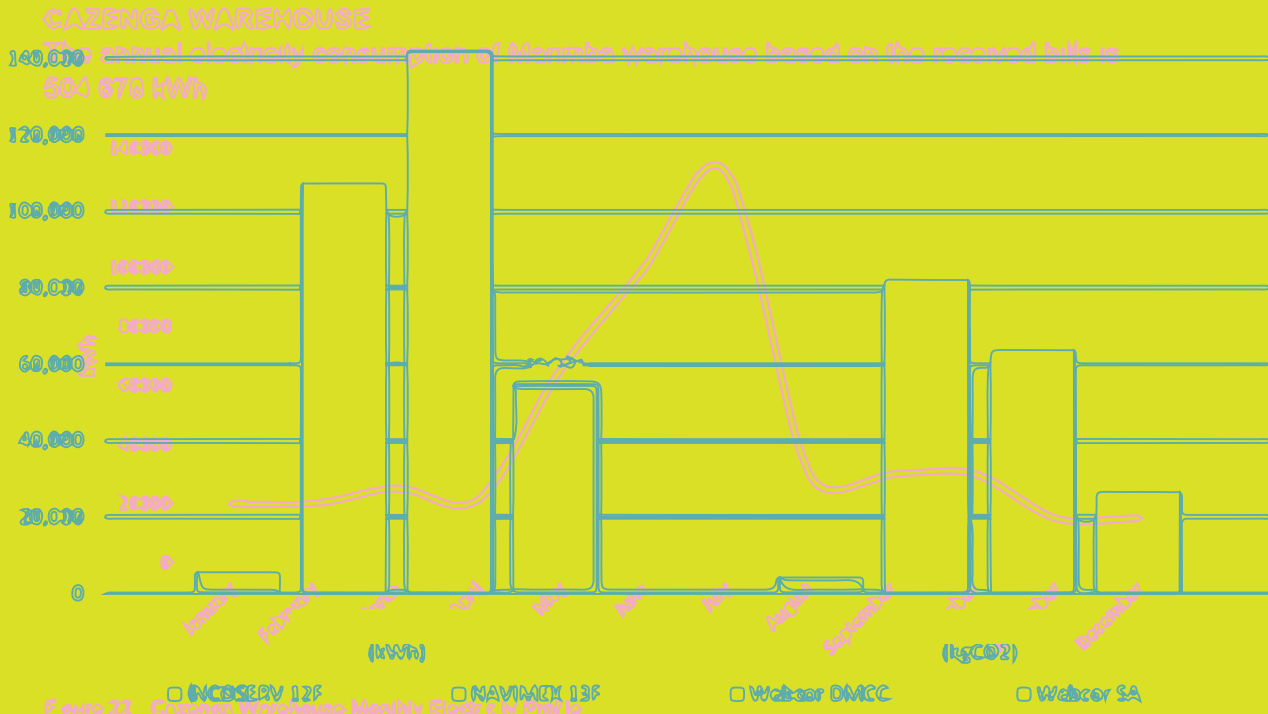


Figure 22 - Offices Annual Energy Consumption and Carbon Footprint

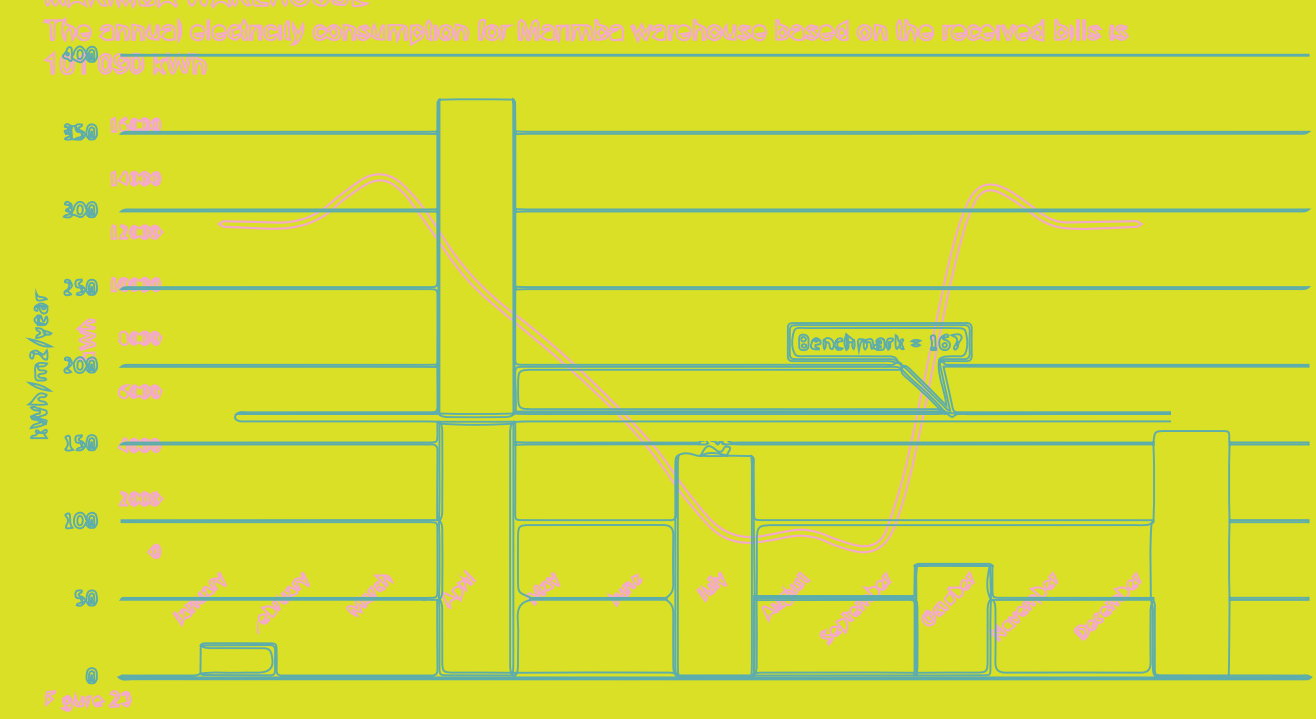


Figure 23 - Offices EU

What is your impact?

By Omar Darwish

“By measuring the performance of equipment, it helps to understand the buildings’ usage trends, which in turn allows them to identify key parameters that contribute to poor performance of the building.”

project HIGHLIGHT

Global climate change and carbon emissions have been receiving more attention lately especially after many countries directed their attention towards a sustainable future. As one of the means to negate the impact of climate change, companies and organizations have started tracking their “Carbon Footprint” and adopting measures for reduction of operational energy use. Webcor Group has approached grfn to study their various facilities and identify a strategy to improve their global ecological footprint as a part of their Corporate Social Responsibility commitment. Webcor is a leading player in the agricultural commodities market and the FMCGs (Fast-Moving Consumer Goods) market. They have over 15 facilities around the globe; in Switzerland, Lebanon, and Angola, including; offices, factories and warehouses, and supermarkets and over 3,200 dedicated employees. The project consists of three stages; assessment stage, activation stage, and implementation stage. The assessment stage includes a preliminary energy analysis and benchmarking. The activation stage includes performing energy audits for the identified facilities and proposing solutions and recommendations to reduce the energy consumption for the group and thus reducing their carbon emissions. Finally, the implementation stage which includes implementing the proposed EEMs (Energy Efficiency Measures) during the activation stage through ESCOs.

The engagement commenced with a Preliminary Energy Assessment and an energy benchmarking study to track energy performance and identify the potential for changes in performance over time. This phase helps owners, building managers, or regulators to understand their facilities’ energy use trends which in turn allows them to identify key parameters that contribute to poor performance of the building. Energy and carbon footprint baselines were developed for the group benchmarking the facilities among themselves as well as comparing them to similar buildings. We prioritized facilities based on likelihood for retrofit success and the level of potential for energy and emissions reduction.

This developed carbon footprint baseline will enable Webcor Group to take further steps to adapt to a changing climate and to build a more resilient business model. ■

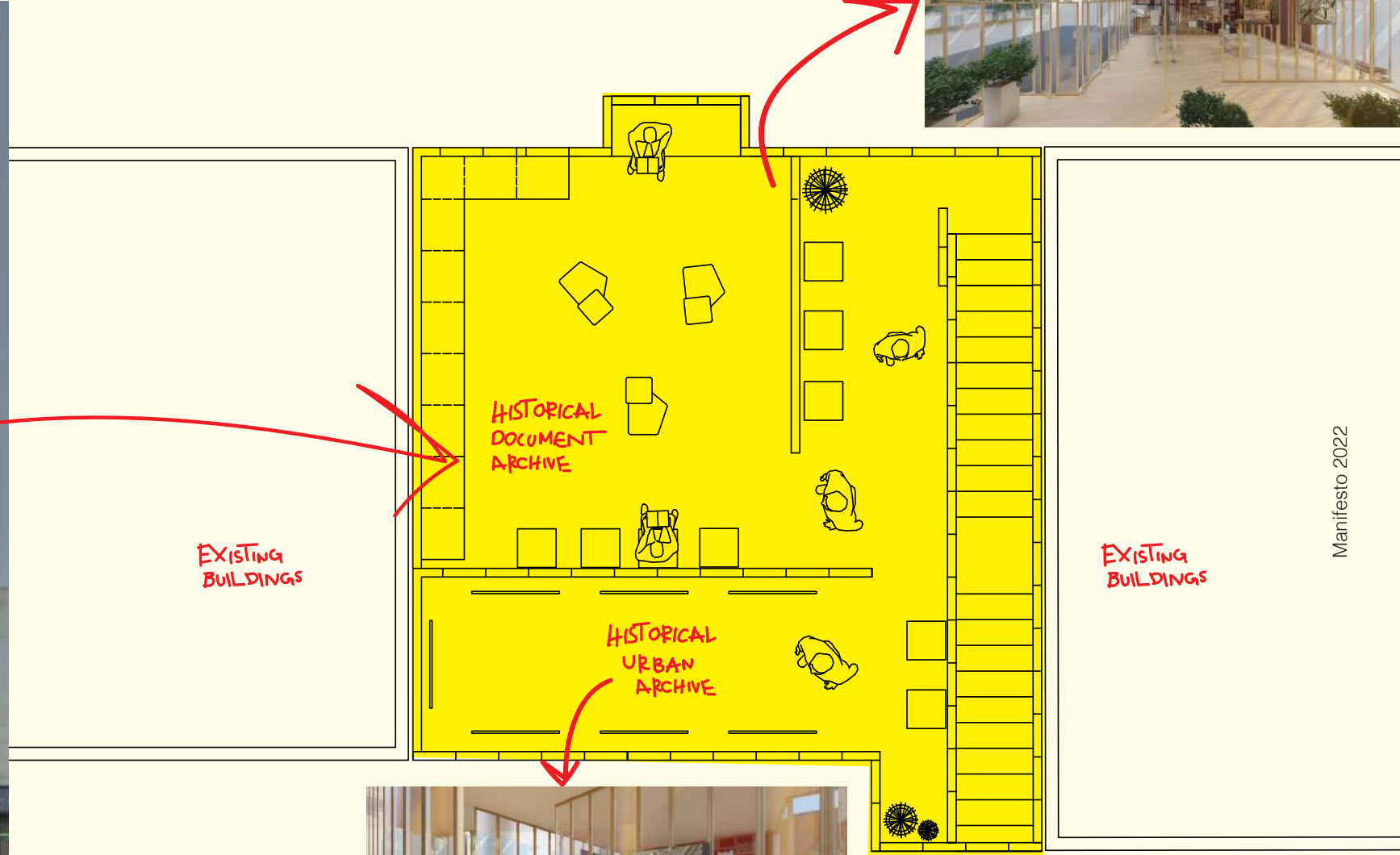
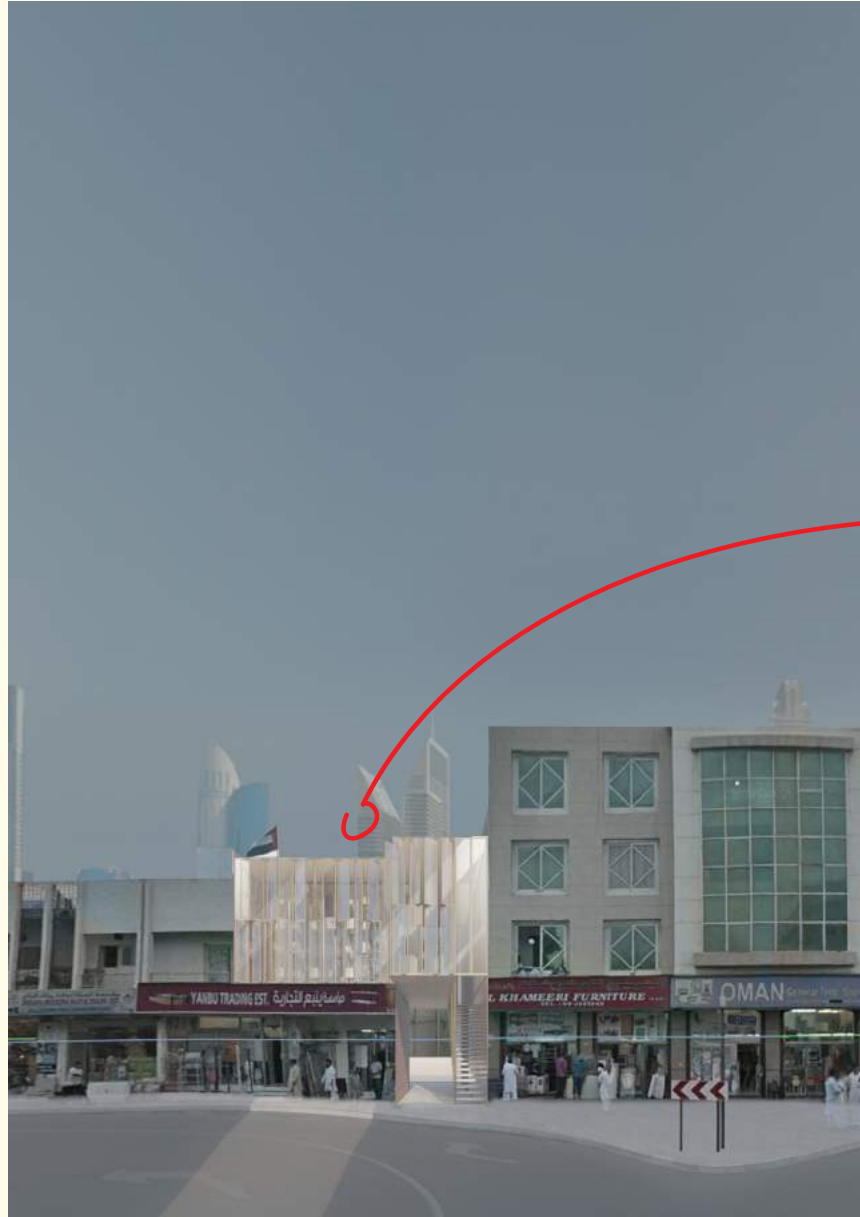
City Interventions

within the city

By Amar Gamal & Ahmed El Haj

Situational Archive:

A visual archive is conceptualized for a neighborhood that was soon-to-be-demolished. The buildings survived the demolition plans after the 2008 crisis slowed the development projects in the area. The archive is a unit that can be inserted within the urban environment to capture its essence, both conceptually with its reflective facade, and functionally through the active participation of its community members to document its history and intricacies. The archive holds a gallery and a document archive space that preserves - at the least - it's memory.



Manifesto 2022

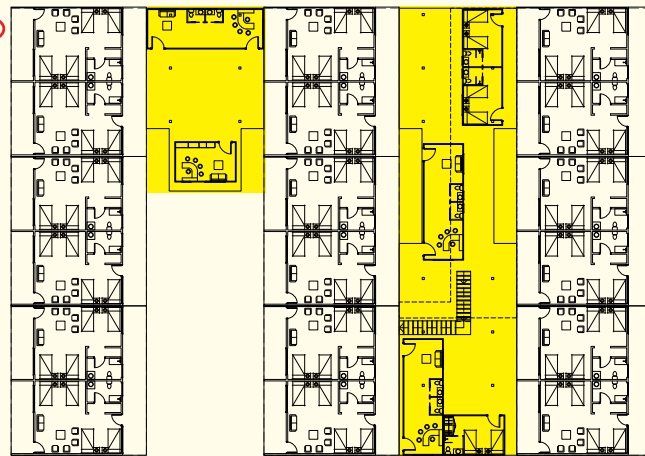
Low cost housing intervention:

We explored the addition of a mixture of private living spaces and public communal spaces to social housing communities, as a means to relieve overcrowding and encourage social interaction. The shared spaces include libraries, vertical farms, and flexible workshop spaces that foster collaboration.

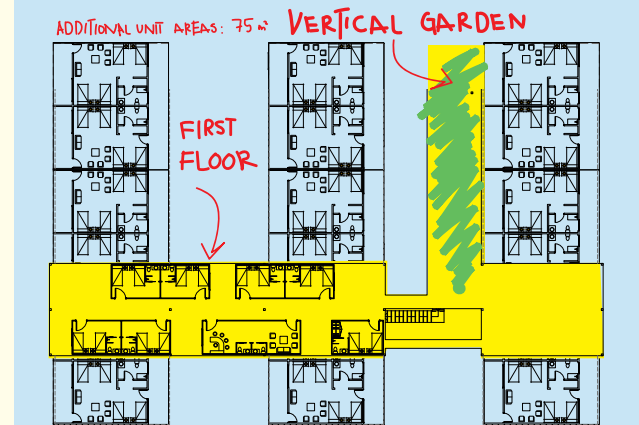
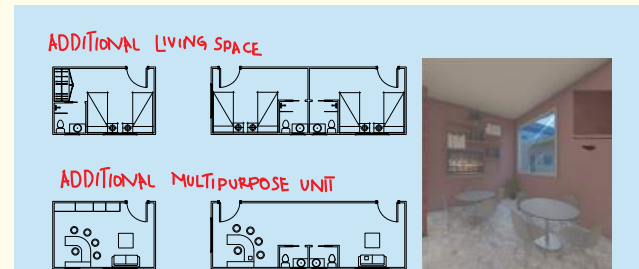
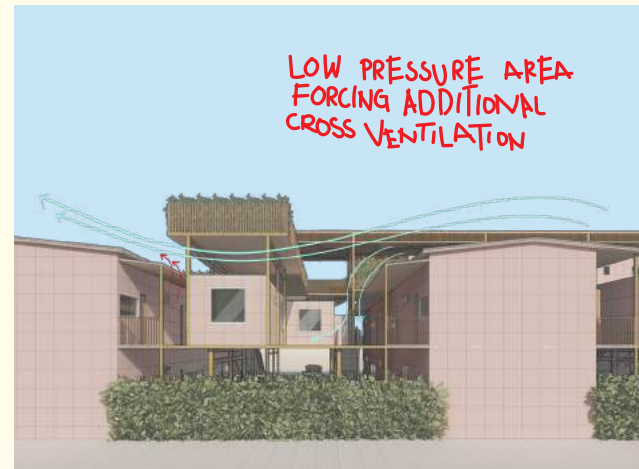
The structure is parasitical and attaches to existing structures as an interventional solution, and the modularity of the construction allows for repetition, expansion and flexible use. ■



GROUND FLOOR



ADDITIONAL AREA: 400 m²
EXISTING FLOOR PLAN: 820 m²

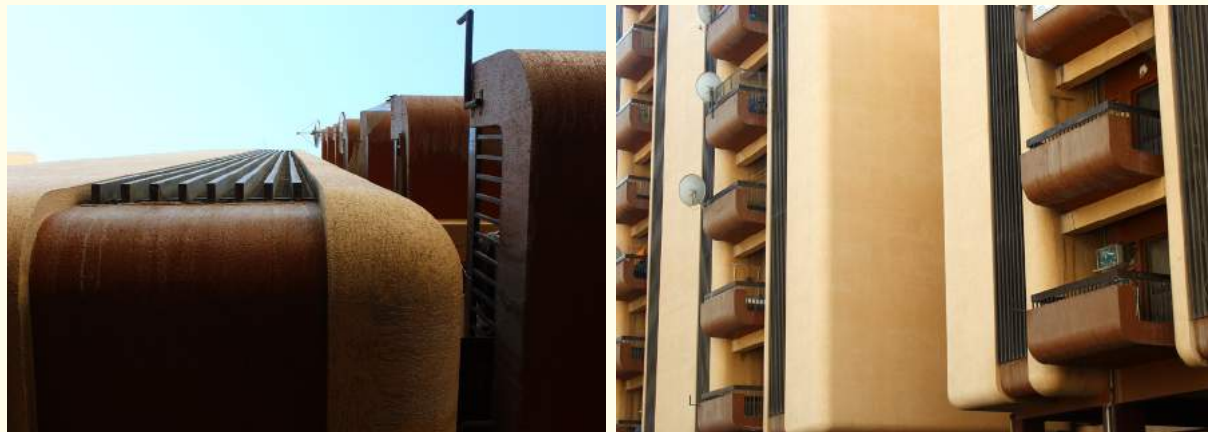


Modern Architectural Heritage

Photographs by Aman Darwish

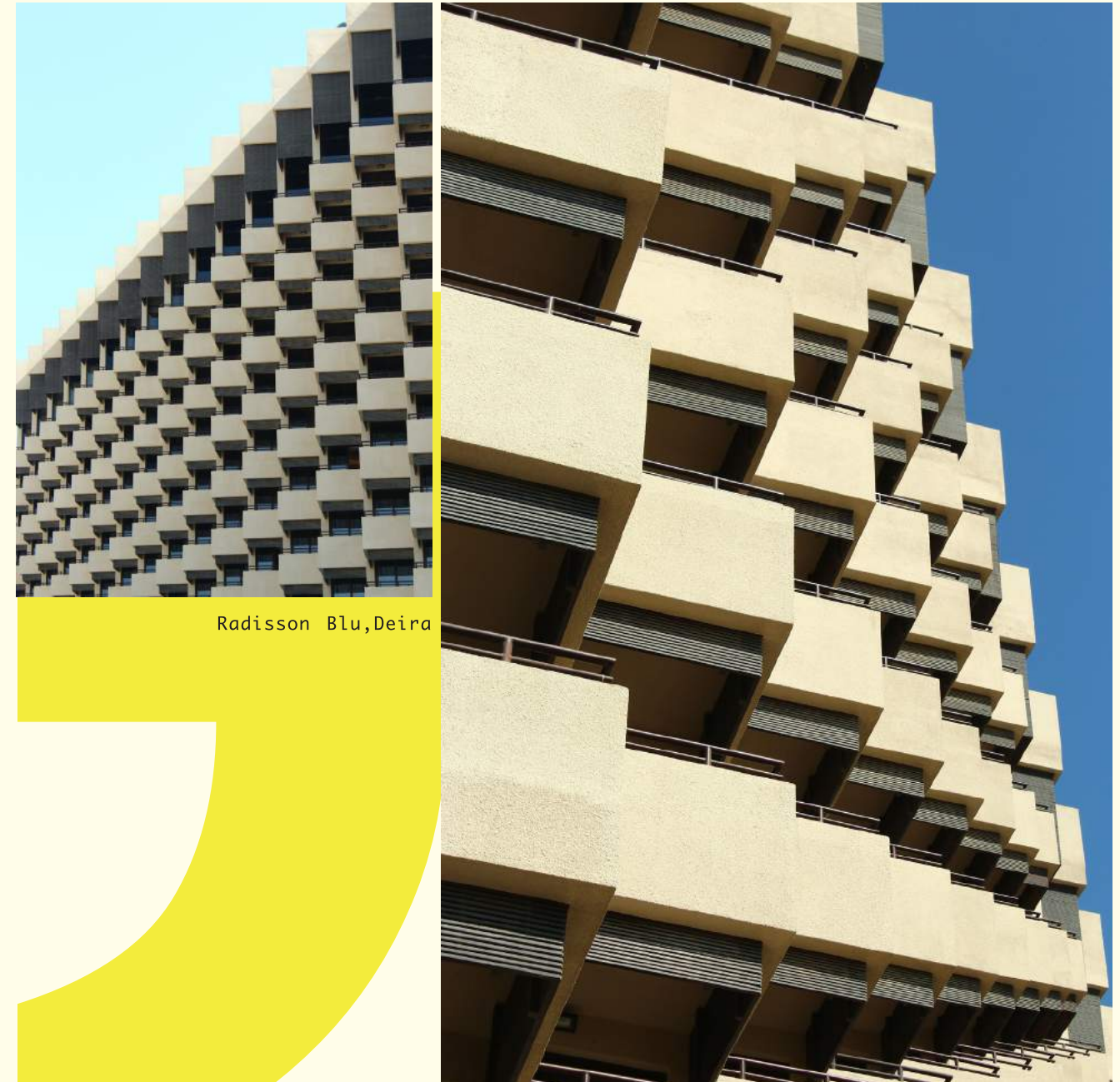
Heritage:
 /'herɪtɪdʒ/
 Features belonging to the culture of a particular society, such as traditions, languages, or buildings, that were created in the past and still have historical importance."

The Cambridge Dictionary



Unnamed, Deira

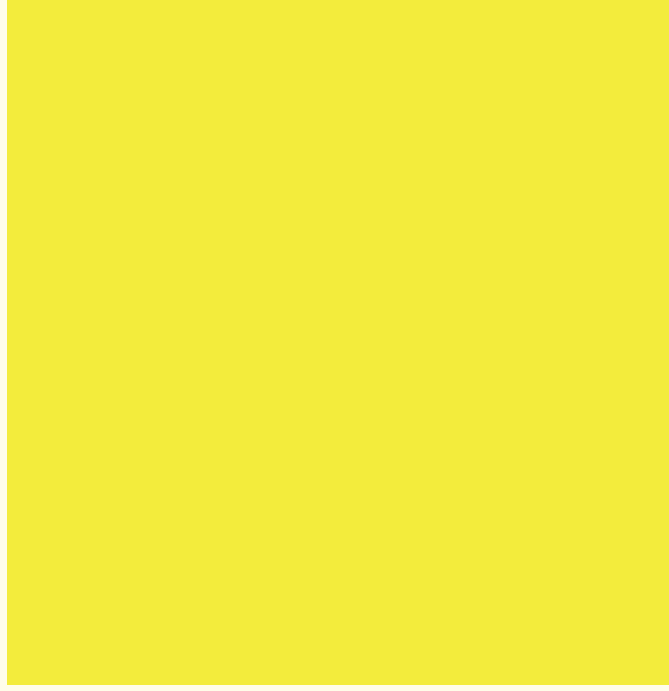
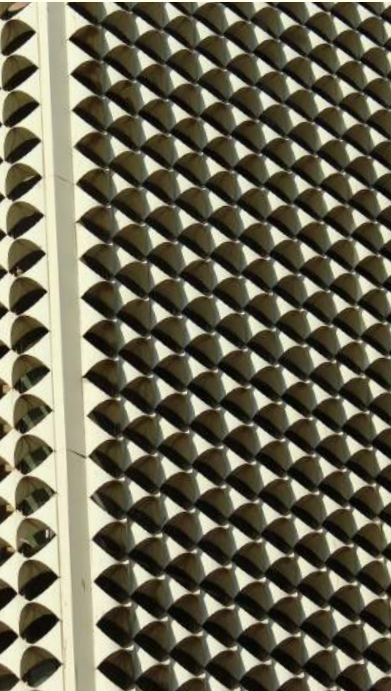
"... all must be adapted to the genius of the place, and beauties not forced into it, but resulting from it."
 Alexander Pope on Genius Loci



Radisson Blu, Deira

Medwinn Medical Center Tower, Deira

Deira Tower, Baniyas Square



Manifesto 2022



“the notion of cultural heritage embraces any and every aspect of life that individuals, in their variously scaled social groups, consider explicitly or implicitly to be a part of their self-definition.”
Susan Pearce



Link to Webinar:
Preservation of Modern Architecture by Ayah Halawani for EmiratesGBC, January 2021



A Building Owner's Cheat Sheet for Energy Retrofits!

By Ayesha Nabeela

“The advisor is also an unbiased professional safeguarding the rights of all stakeholders involved with the ultimate goal of achieving a successful project.”



Consult an Energy Advisor

Energy Retrofit Projects that have an experienced advisor on board have shown a higher success rate than the ones that do not. The role of an energy advisor is to be the Owner's guide from start of a project to its completion. The advisor is also an unbiased professional safeguarding the rights of all stakeholders involved with the ultimate goal of achieving a successful project. The advisor will:

- a. Assess the facilities' backgrounds, audit the installed systems and their modes of operation, scrutinize occupancy trends, study occupants' complaints, and establish the baseline and scope for the retrofits. The above form a solid part of the bids to be issued to the market; ensuring a common ground on which the bidders will present their proposals resulting in successful tendering processes.
- b. Provide insights and tips to the Owner on potential bidders drawing from past experiences and established prequalification matrices. After bids are received, the consultant conducts techno-commercial analyses of the bids, reviews the suggested Energy and Water Conservation Measures for technical soundness and commercial feasibility, and assists the Owner with selecting the most suited bid for their facility.
- c. Ensure quality and adherence to best industry practice, manage timelines, and push to maximize savings.



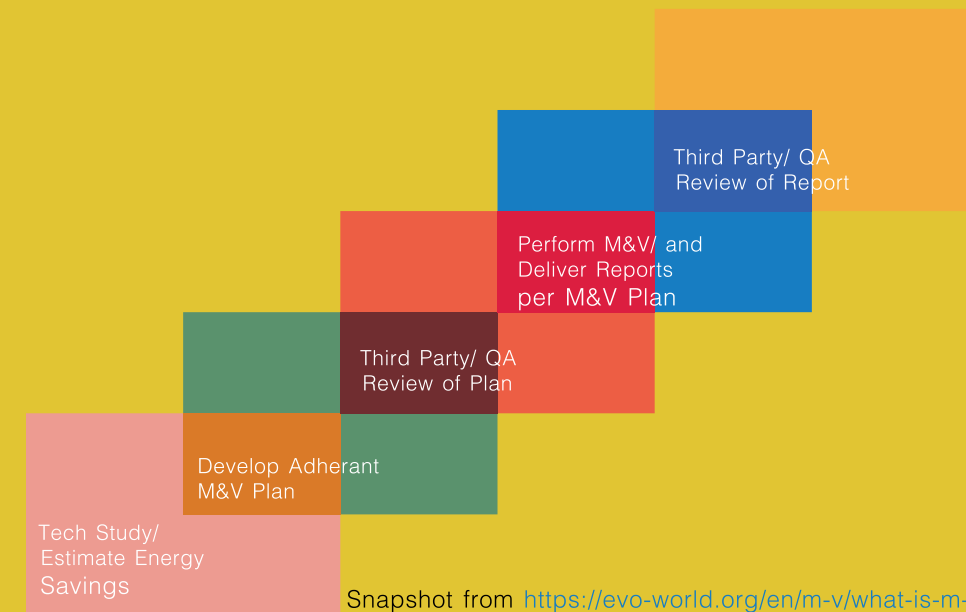
Hire a 3rd party Measurement & Verification (M&V) Reviewer at early stages

Hiring an M&V Reviewer at the early stages of an energy retrofit project will ensure that the contractual M&V plan is verified, corrected and validated by an expert team, is being continually followed and that the M&V data quality is maintained.

The post implementation stage (M&V period), marking the beginning of the energy performance period, is a source of many disputes in retrofit projects. The complexity associated with adjustments and savings reporting requires that a certified and experienced professional is on board to vet and verify the reported savings and to ensure that both entities; the owner and the contractor, are adhering to transparency and accuracy.

We recommend reading the explanation on M&V and the approach on www.evo-world.org. They state that “M&V is not just a collection of tasks conducted to help a project meet IPMVP* requirements. Properly integrated, each M&V task serves to enhance and improve facility operation and maintenance of savings. As shown in the figure below, M&V activities overlap with other project efforts. Identifying these project synergies and establishing roles and responsibilities of involved parties during project planning will support a coordinated team effort. This can leverage complementary scopes and control M&V-related costs”.

*IPMVP: International Performance Measurement & Verification Protocol

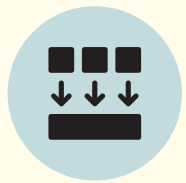




Provide sufficient time and budget for the Detailed Buildings Assessments

With time and budget restrictions on the pre-contract buildings assessments, it has been common to retreat to assessments of partial or representative facilities. It is vital to acknowledge the uniqueness of each building with varying occupancy trends, types of uses, operational hours, systems, maintenance regimes, age of assets, etc.

Mandating the condition assessments for all facilities is important for the success of a retrofit and for establishing sound baselines and savings calculations. Such assessments can be done pre- or post-tender, depending on the project's timeline, budget, and client preference.



Start with Preliminary Energy Assessments (PEA)

A PEA precedes a building energy audit. In a PEA, the historical utility use/cost is analyzed and normalized to the facility's area to arrive at the Energy utilization Index (EUI) expressed in kWh/m²/yr. The EUI is then used to benchmark your facilities against external peers/ similar buildings to determine the potential for energy savings and improved building performance. During a PEA, the analyst can also prioritize your own facilities in terms of eligibility for retrofits prioritizing buildings with the highest potential for savings or the highest need for a retrofit (ex: end of life equipment). The resultant of a PEA is nominating buildings for further engineering studies and analyses. For large portfolio of buildings, a consultant may advise grouping facilities into packages based on similarity, need, proximity, or other factors.

Lessons Learnt



Poor due diligence, flawed financial models, technical mistakes, unvetted proposed measures, and lack of experience will lead to unsuccessful retrofits. Here is a collection of our lessons learnt:

ECMs Selection should consider the equipment condition, savings impact, longevity, and for the ECM to be of a proven technology.

Existing Equipment Conditions those are frequently not investigated properly during the audits stage leading to issues during the implementation stage for non-suitability of the ECMs proposed or other complications. A common example is non-compatibility of valves or motors with proposed Variable Frequency Drives. Another example is proposing ECMS that would compromise equipment warranties like wet-walls absorption systems or vortex condenser systems on new chillers.

Lack of Coordination between the stakeholders (ESCO, building owner, facility manager, sub-contractors, consultant) are the cause of nuisances, delays, and eventually disputes. All parties play a role to ensure effective coordination. All site activities should be coordinated between all parties for effective implementation of ECMs on site.

Planning When working with a large number of buildings, the different buildings teams are normally at different stages or pace to comment or give feedback leading to delays/ incomplete information received by ESCOs. This results in delays and non-optimum implementation plan.

Maintenance Procedure they play an important role in the cost of implementation (ex: malfunctioning isolation points, freezing water pipes, etc.). Maintenance issues should be investigated and adopted into the project plan.

Noncompliance to international standards For example, baseline calculation methods and adjustments that do not align with IPMVP will affect the accuracy of calculated savings and verified results.

Attributing Savings to where they don't Belong like accounting for savings from cloud-based monitoring systems or smart monitoring systems. These systems are installed to provide a visual and remote access to the system and theoretically cannot generate savings of their own. The savings would/ should already be accounted for in the system being monitored. ■



Digital Twins

By Ayah Halawni

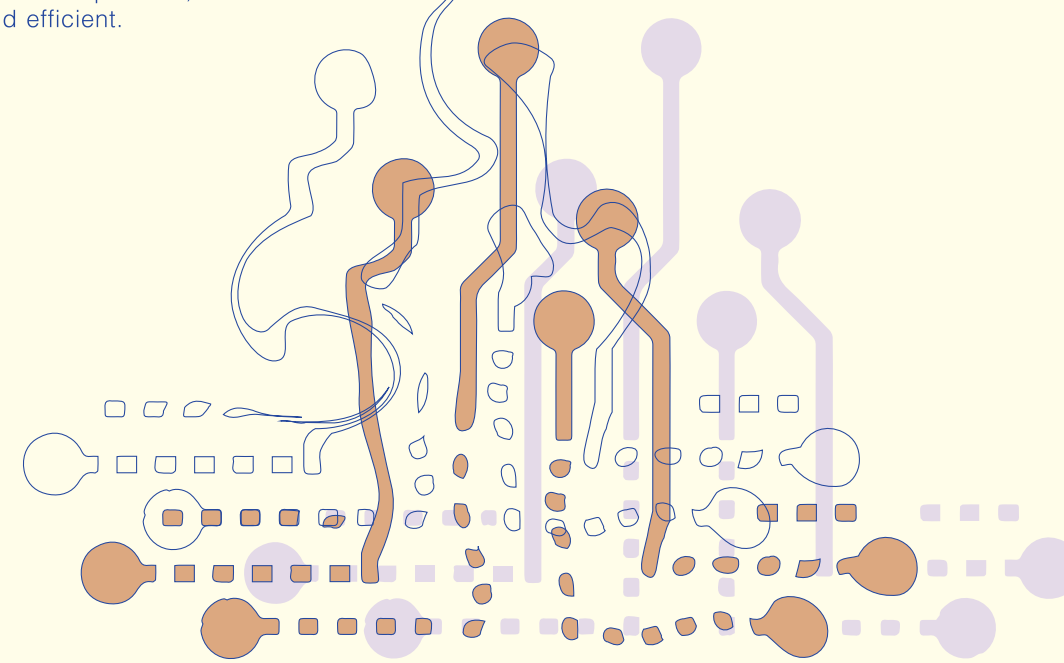
As the world heads towards a new age of artificial intelligence, a future in which challenges to inclusivity in policy-making becomes conceivable. While efforts to develop the democratic process in areas of socio-economic spheres strive to be on par with the rapid digitization and subsequent automation of governance, the construction and planning industry still has a lot of work to do. Urban planning continues to be, at large, a unilateral process informed by static data entombed in pdfs. The emergence of City Digital Twins could offer a unique opportunity for better-informed decision making and more representative urban planning and civil architecture development processes, and in turn facilitate the creation of more resilient and sustainable cities. Digital Twins are smart virtual models of cities that are fed real-time data on city-wide activities such as traffic, pollution levels, air quality, population and demographics, facilitated by the Internet of Things (IoT). This article will explore the incorporation of 'people's voices' as a parameter within the City Digital Twin model, as an adaptation strategy to address the widening gap between city planners as they adopt automation, and the city inhabitants. The article will present different methodologies and interfaces in which this can be adopted to aid in the creation of more resilient and sustainable cities.

“Digital Twins are smart virtual models of cities that are fed real-time data on city-wide activities such as traffic, pollution levels, air quality, population and demographics, facilitated by the Internet of Things (IoT)”

Architectural design and urban planning inherently attempt to place the human being at the center of the design process, and inclusivity and diversity continue to be a shared goal as institutions and governments increasingly favor co-creation to address issues of the climate emergency. But as our cities and governments actively pursue automation, issues of data ownership, representation and bottlenecks of political bureaucracy begin to surface. It is therefore essential that the methodologies in which voices of stakeholders, and specifically those of citizens, are captured during the decision-making stages evolve in a manner that is on par with data collection from other variables, to ensure congruency of inputs and facilitate the democratic process. With the growing adoption of digital twins by governments, and the deployment of real-time sensors and data collectors across our cities, a need to create a seamless integration of stakeholder input within the automated process emerges.

A study conducted last year critiques the urban design process of the Barcelona Superblock Urban Intervention Project(1), and outlines how the project was jeopardized due to lack of representation and citizen involvement. Despite its practical and environmental merits and the apparent enthusiasm around the project locally and within the media sphere, a low voting turnout and political opposition resulted in the project arriving to a halt. The authors argue that merits of a transformational adaptation strategy are not sufficient if not backed by a diverse representation during the implementation process, which needs to be both transparent and efficient.

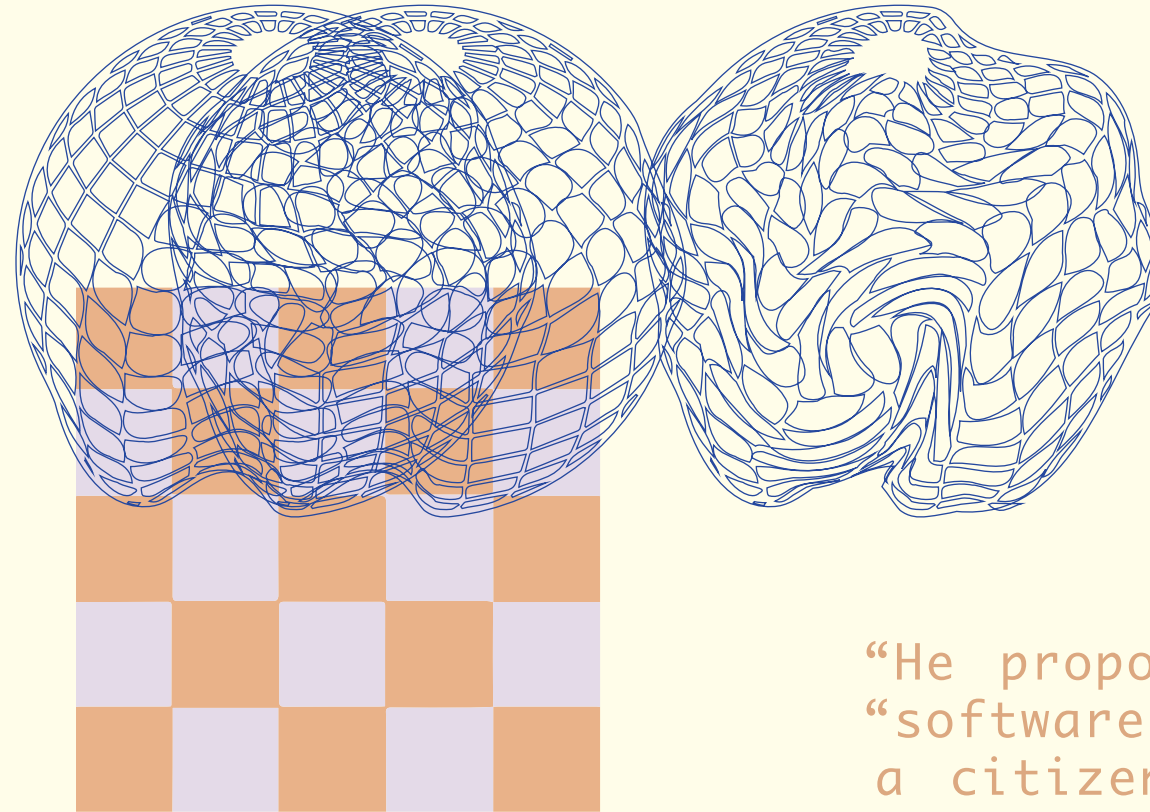
“The experiment was driven by the demand for a human-centered approach to planning, that considers the varied social and environmental needs of citizens, and gives back sovereignty of data and access to information to the citizens.”



“The issues that arise from this interface are the same issues that we face with current political voting systems, namely low turnout and lack of enthusiasm on the subject matter.”

Another experimental project⁽²⁾ conducted in Herrenberg, Germany, picked up on the need for more participatory processes within the urban planning arena, as we transition from digitization to automation. The experiment was driven by the demand for a human-centered approach to planning, that considers the varied social and environmental needs of citizens, and gives back sovereignty of data and access to information to the citizens. The 3D city model provided by local authorities was transformed into a Digital Twin through the deployment of sensors across the town, and was integrated with VR technology which is designed for collaborative working, allowing users distant collaboration during analysis and visualization of empirical and real-time data. The experiment was set up so there was a main 'operation', and supplementary nodes distributed across various locations and events in town, all linked virtually, enabling collaboration.

The experience was found to be overall very positive by the participants, except in areas of interface complexities. 97% of the participants thought that the approach could have a positive effect on public participatory processes. The approach is a step forward towards facilitating city-wide scenario planning and co-creation processes between government representatives, experts and the general public. Its limitations, however, lie in the locality of the setup. Although collaborators are able to “connect” from different nodes, these nodes are placed at specific locations to which participants need to have access to. The issues that arise from this interface are the same issues that we face with current political voting systems, namely low turnout and lack of enthusiasm on the subject matter. This ultimately results in a non-representative outcome, jeopardizing the acceptability by the public as with the Barcelona Superblock Urban Intervention case study.



If decisions of the future are going to be based on insights from artificial intelligence, then a possible solution to enable congruency of data inputs is to automate that of the stakeholders' views. Cesar Hidalgo imagines a way in which this could happen in his Ted Talk titled 'A bold idea to replace politicians'. He proposes the introduction of a “software agent”, which is essentially a citizen's “twin”, as a solution to political bureaucracy and as a replacement to the concept of representatives in the democratic process. The agent, backed by algorithms that infer an individual's preferences and voting tendencies, would be able to, in theory, take an infinite number of decisions on an individual's behalf. From the data that appears on our social media feeds, to preferred lists of music and movies on our devices. This concept, in many ways, governs our digital lives today. Integrated within city digital twin systems, the novel idea could offer a conceptual solution to participation and engagement in critical environmental and socio-economic issues, and could forge an equitable and vocal route for the non-politically bound and the marginalized. For this solution to be viable, however, it would need to create a space for stakeholder communication and education, which is critical to the success of the co-creation process. And while it guarantees autonomy, the solution gives rise to issues of personal privacy and data ownership, as is the case with many of artificial intelligence applications today.

Whether manual, digital or automated, and irrespective of the interface, urban planning processes are in need of more participatory processes that empower citizens. Advocating for the congruency of stakeholder input with other data within twin city systems presents a resilient strategy that allows for voices to be heard. It proposes a shift in paradigm from the rigid architecture and planning processes in place today and promises to alleviate the polarity that exists between urban planners and city inhabitants, realizing the full potential of automated infrastructure. ■

“He proposes the introduction of a “software agent”, which is essentially a citizen's “twin”, as a solution to political bureaucracy and as a replacement to the concept of representatives in the democratic process.”

¹⁾The study was conducted by Christos Zografos, Kai A. Klause, James Connolly and Isabelle Anguelovski and is titled 'The everyday politics of urban transformational adaptation: Struggles for authority and the Barcelona superblock project'.

²⁾The experimental project was conducted by Fabian Dembski, Uwe Wossner, Mike Letzgus and Michael Ruddat and is titled 'Urban Digital Twins for Smart Cities and Citizens: The Case Study of Herrenberg, Germany'.



Natural Materials for Social Welfare - *The Case of El Minya*

By Ayah Halawani

Photographs by Khaled Desouki/AFP/Getty Images

The building and construction industry in Egypt is responsible for 39% of all carbon emissions, with 11% of all emissions being directly related to building materials, construction processes and operation throughout the lifecycle of buildings. This places immense pressure on the building and construction industries to be able to reach decarbonization goals of 2050. While Egypt's contribution to carbon emissions is at 0.68% as of 2019, its upward economic growth trend and increased GDP year-on-year only means that the emissions are set to increase, unless a decoupling between GDP and CO2 emissions is achieved. This would entail an aggressive green policy and wide-spread implementation of green solutions across sectors.

The selection of suitable sustainable materials could offer up to 30% reduction in CO2 emissions throughout the building's lifecycle. This article sheds light on the appropriateness of using locally available raw materials for contemporary construction within the governorate of Minya – (or El Minya), Egypt, in comparison with red fired bricks, which is one of the most widely used construction material across Egypt, along with reinforced concrete, as a means to reduce the environmental impact of buildings in the governorate. Minya governorate is located in Upper Egypt on the left bank of the Nile, 225 km south of Cairo. Minya is among the ten poorest governorates in Egypt. With poverty rates estimated at 54%, and with the shortage in energy resources across Egypt and the approximate 30% hike in red brick prices over the past three it is imperative that low-cost and sustainable construction materials and methodologies be adopted for future development.

“The use of natural materials as a replacement to brick would be economically viable, but the resistance predominantly comes from lack of social acceptance, as well as the lack of skill and publicized and regulated techniques for alternative construction methods.”



When assessing the sustainability of a material within context; environmental, economical and social aspects must be considered. It is common that environmental aspects are given precedent over the socio-economical ones, making real-life implementation of sustainable ways unfeasible to implement. This is evident when comparing sustainability criteria priorities between developed and developing countries where socio-economic factors play the biggest role in defining and employing sustainable materials. For example, international rating systems such as LEED and BREAM, present limited value when assessing socio-economic-related aspects of a building in general and of material selection specifically, despite being two of the most widely adopted tools, even in the global south. Socio-economic aspects consider cost of production and delivery, job creation for locals, decentralization of production, social acceptance, and easy-to-transfer technologies.

The adoption of natural sustainable materials for construction may be able to partially address the compounding socio-economic housing issues, utilizing the abundance of natural building material resources and the breadth of knowledge inherited from the nearly five-thousand-year wealth of historic and traditional natural building technique references. With limestone, clay and straw widely available in its vicinity, there is a real need for revival of vernacular building methodologies in Minya powered with advanced construction technology and awareness on the versatility, aesthetic qualities and functional superiority of natural materials.



Traditional fired brick in Egypt is predominantly made of readily available desert clay, after the government banned the use of Nile clay in the production of bricks due to its scarcity after the construction of the High Dam. While the composition of brick in Egypt is predominantly a mixture of desert clay, sand and water, the real threat comes from firing and increased Embodied Energy (EE) and Embodied Carbon (EC) values. These are estimated at 2.4 MJ/kg and 0.94 kgCO₂/kg respectively based on production processes in Egypt. While conventional materials are typically favored for their performance and cost, in the case of Egypt this theory does not hold as the quality of brick is poor due to lack of governance and third-party verification, and its cost is comparatively higher than, for example, CSEB. The fired brick industry in Egypt is also reported to have unsafe working conditions and employs underpaid workers. The use of natural materials as a replacement to brick would be economically viable, but the resistance predominantly comes from lack of social acceptance, as well as the lack of skill and publicized and regulated techniques for alternative construction methods.

“Socio-economic aspects consider cost of production and delivery, job creation for locals, decentralization of production, social acceptance, and easy to transfer technologies.”



Earth and Straw as building materials are readily and abundantly available, with a wide variety of historic, vernacular and modern references. Earth-built structures offer excellent indoor thermal and general user comfort. Straw, typically discarded as an agricultural waste, is a bio-based material that sequesters carbon. A lesser-known fact is that the majority of non-ceremonial ancient Egyptian architecture was built using mud bricks, with a combination of wood, reeds and mats. One great example of this is the Ramesseum Vaulted Storage Magazines. Additionally, vernacular architecture in the rural areas around the Nile valley on the other hand mainly consisted of one or two-storey buildings made of clay. Modern and contemporary exploration of Earth as a building material in Egypt is, however, sparse, experimental and with little documentation. Soil compositions are also highly variable, making adopting tried-and-tested international techniques challenging. Although earth construction in Minya would be economically viable offering an opportunity for job creation, market demand and social acceptance remain low, and a lack of specialized skills and regulation make it difficult to implement.

Having said that, at the turn of the last century renowned architect Hassan Fathy explored the revival of traditional and historical vernacular and architectural techniques in modern light. The architecture strategy of Hassan Fathy was highly based on the use of natural materials, especially mud bricks, to construct modern dwellings and spaces with high thermal comfort. He utilized geometric radial arches and vaults to deflect sunrays, and devised a double thickness mudbrick mechanism that act as a thermal storage system, keeping the spaces cool during

the day and warm at night. Great examples of his work are the villages of New Baris and New Gournah.

Lime is also available in abundance in Minya, with one of the largest limestone formations just on its outskirts, producing a premium quality product. Limestone allows for the production of a favorably larger brick than the fired brick; 27x15x13cm rather than 20x10x5cm, making the construction process more efficient. Lime is one of the most versatile products with many diverse uses across industries. In Egypt it is typically utilized for roadbeds, products such as fertilizer, paint and binders, seawater demineralization, as well as in agriculture as aglime. Its incorporation as a primary building material, however, faces similar challenges to earth and straw construction, namely social perception and acceptance is low with lack of awareness of its potential uses. Lime may also change in the architectural identity of a place if adopted on a wider scale. Work environments in lime quarries of Minya are also notoriously dangerous, imposing taxing conditions and low pay.

Minya was a significant Pharaonic city, and is home to ancient Egyptian pyramids and tomb structures built primarily utilizing limestone and sandstone. Another interesting lime construction example is Zawiyet El Mayyeteen or City of the dead, which is one of the largest burial sites in the world. The compound utilizes limestone bricks with clay render. With the nature of the project being a burial site, aspects of thermal and general human comfort may not be of applicable nor of concern, but the structural integrity and performance offer an opportunity for exploration.

Egypt is rich in natural material resources, making the

“ Although **earth construction in Minya would be economically viable offering an opportunity for job creation, market demand and social acceptance remain low, and a lack of specialized skills and regulation** make it difficult to implement.”

Incorporation of natural materials in the construction industry is a viable exploration as a means to reduce the nation's carbon footprint and efficiently manage its energy resources especially while it faces housing issues and energy shortages. Earth, lime and straw are all available locally, and are excellent sustainable materials with low EE and EC values that could replace traditional building materials, even if partially. Social acceptance and skilled knowledge, however, remain the true barrier to the scaled reintroduction of natural materials within the construction industry in Egypt. ■



Function. Function.

By Omnia Halawani

A well-designed space should embed the wellbeing of occupants as a core target. After all, the function of spaces and buildings is to serve those occupants and their needs. The extents by which designs provide comfortable environments for building users are affected by a myriad of factors. When those factors are not addressed holistically, this can lead to poor building performance ranging from discomfort to harm and ill health.

Some considerations that well-designed and functional spaces should address are thermal comfort, visual comfort, access to daylight and views, indoor air quality, acoustic performance, and health and well-being. Collectively, those factors are better known as Indoor Environmental Quality conditions.

MEP (mechanical, electrical, plumbing) systems largely impact the quality of the indoor environment by influencing thermal comfort like temperature and humidity levels, odor, air quality (stuffiness), lighting levels adequacy, glare control, and controllability of systems.

Apart from MEP-related issues, functional aspects of spaces like circulation, access, sufficient space per user, and furnishing materials selections are also important elements of a well-designed and functional space. ■

An established system that can act as a guide for designer is the **WELL Building Standard** which identifies as a "performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and wellbeing, through air, water, nourishment, light, fitness, comfort, and mind."

Another known system is **Fitwel** which is a "commercial building rating system that provides guidelines on how to design and operate healthier buildings."

Both standards focus on implementing strategies for improving the health of the occupants.

grfn global has consulted on multiple projects to improve the indoor environmental quality in spaces like MBR's Solar Innovation Centre, Honeywell's Dubai offices, Masdar offices, and ENEC offices.



Plug the Skills Gap



"Man the Oars"
as published by the MEP Middle East Magazine
July 2021
By Omnia Halawani

The MEP industry in the Middle East is "akin to a frail ship on the reef of time", experts within the industry have stated in a chorus of warnings. They have indicated that the ship could soon run aground if the technology to run the ship, the processes to keep it afloat, and the people with the expertise to steer it clear of dangerous waters aren't prioritised at the earliest.

they asked:

What are the skills gap (if any) that the industry needs to address? What is the impact the industry will face if these skills gaps are not addressed? What are some solutions/ suggestions to address these skills gaps?

we said:

We see a gap in skills between those taught at universities and those required on the job. Universities, at large, prepare engineers with basics to enter the field. Only a few equip them with all rounded trainings, skills, and knowledge. Examples include the use of BIM, energy simulation software, project management software, measurement tools and instruments, etc

On the other hand, engineers in this region get to work some of the largest and most complex projects with the tightest timelines. The speed by which engineers can gain experience and skills in this market is excellent. But without proper training, processes, and guiding standards, this speed and complexity may lead to mistakes, reworks, and increased projects budgets.

In a field as demanding as the construction field, we have found out that our employees find it difficult to focus on personal and professional development amidst the day-to-day operational and projects scope of their work. Therefore, we have booked their calendars for mandatory group internal trainings complimentary to other external technical trainings and their monthly targets for personal development over platforms that we provide to them. ■

INNOVATION

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Tapping into advancements, technology, and future trends.



Net Zero School

By Hassan Younes

Location: Dubai, UAE
Latitude: 25.2° North
Longitude: 55.3° East

BUILDING FORM
Total Floor Area: 26,800 m²
Floors: G+3+R
Window to Wall Ratio: 30%



Solar Photovoltaic Panels:
 - 4,000 m² including exterior overhangs/shades, play fields
 Inclination 22.7° from horizontal
 Monocrystalline module efficiency of 20%
 Electrical conversion efficiency 85%

Lighting: Highly efficient lighting, Lighting Power Density – 3 W/m²

Plug Loads:
 5 star ESMA or Energy Star rated appliances

Dedicated Outdoor Air System
 Double Wheel heat recovery
 Primary wheel – 80% sensible, 75% latent;
 Secondary wheel – 80% sensible, 0% latent

Cooling System
 EC Motor FCU
 Cooling setpoint – 24°C

Water Booster Pumps
 VFD Equipped - IE4/IE5 motor

Induced draft cooling tower with variable speed fans

Water Cooled Magnetic Bearing Chillers COP 6.3 @ AHRI

Two Variable Chilled Water Pumps - reduced Chilled Water loop flow and pumping power due to reduced cooling loads - IE4/IE5 motors

ENVELOPE PROPERTIES:

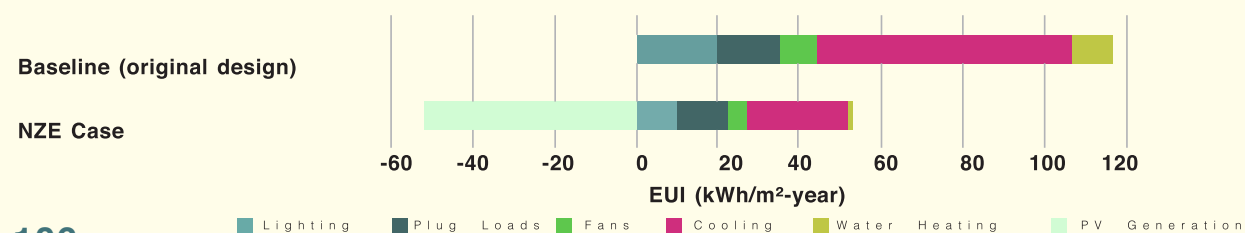
Element	U-Value (W/m ² -K)	SHGC
Exterior Wall	0.41	N/A
Roof	0.23	N/A
Window	1.78	0.34
Exterior Shading, Projection factor		0.75

INFILTRATION

- Tight construction (5m³/hr/m² at 50 Pa) to reduce infiltration
 - School classrooms are pressurized with the introduction of outside air to further reduce infiltration

Baseline vs NZA Case

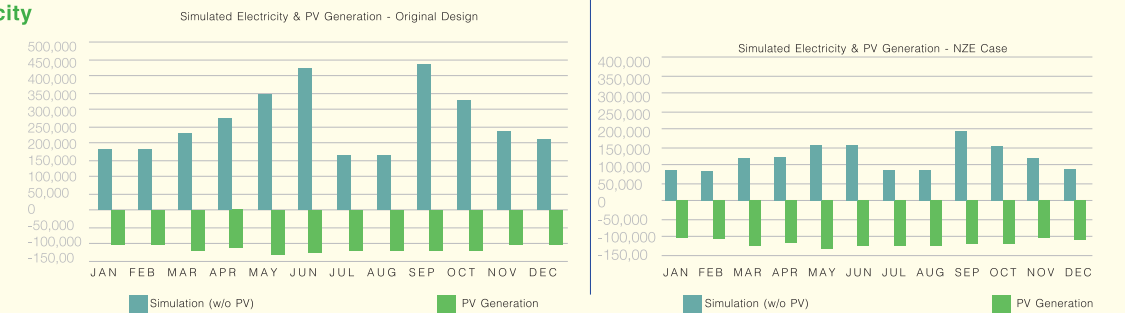
Energy Utilization Indices (EUIs) Comparison by End-Use Breakdown



NZE ANALYSIS

Criteria	Baseline	NZE
Simulate (Usage without PV (kWh/m ² /yr)	118	54
Net Usage with PV	66	2.7

Simulated Electricity & PV Generation



Unmanned District Cooling Plants

By Omnia Halawani

The widely improved technological advancement in artificial intelligence, data acquisition and monitoring, and advanced controllers deem the realization of Unmanned Machinery Spaces (UMS) a possibility. In here, we explore how to automatically operate and monitor multiple district cooling plants from a central station with minimal human interference.

Many automated plants still rely on human interferences for their operation. These plants are assisted by manpower to perform necessary assessments, checks, operation, and safety. By adopting full automation techniques with all necessary safety interlocks, a fully automated unmanned space can be achieved.

So, what are the basics needed as a steppingstone to make a plant “remote-ready”?

On the Design and Installation Front...

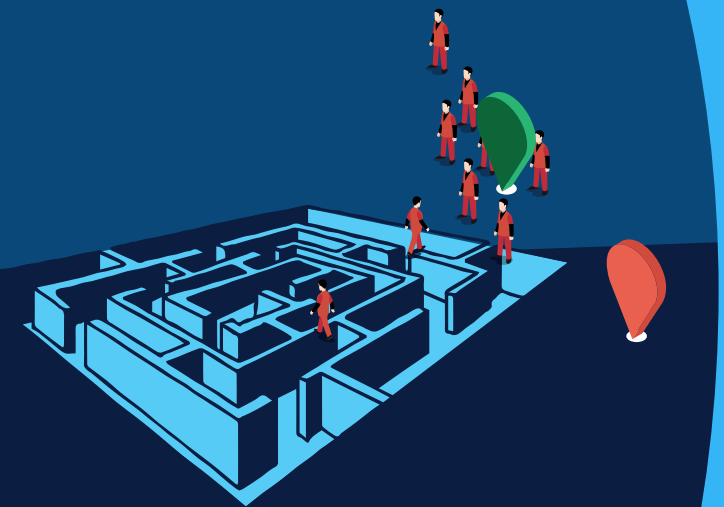
A plant should house a comprehensive network of accurate sensors, actuators, and transmitters to enable the intended control logic. The first step is to draft a solid control philosophy, identify the measurements required, and design the network of sensors and associated transmitters as well as valves actuators accordingly.

The machinery and equipment, on the other hand, should seamlessly integrate with the control and monitoring system at the plant.

An advanced and suitable Control and Monitoring Systems (CMS) is the most critical element completing the installation requirements for a full and successful integration of plant equipment, sensors, actuators, and machinery. The CMS should be completely functional and integrated to a distantly located command center.

The central command center should be capable of acquiring data from the different plants/premises connected to it, while displaying all the instantaneous operating parameters, faults, alarms, etc. in a clear way to the operators. There are several integrations means between plants and a CCC. Fiber Optic networks and GSM are quite wide-spread. The selection criteria should take into consideration area/distances, construction constraints, availability, reliability, speed, and maintenance needs.

“An advanced and suitable Control and Monitoring System (CMS) is the most critical element completing the installation requirements for a full and successful integration of plant equipment, sensors, actuators, and machinery.”



On an Operational Front...

The plant should be set up with adequate, reliable, and safe auto control sequences. Strict and robust safety strategies should be imbedded accommodating different levels of alarms criticality and facilitating timely intervention by remote well-trained professional operators for critical issues.

To enable a truly unmanned space, the systems in the plants should produce meaningful, informative, and periodical automatic reports and trends that provide clear visibility on the plant’s performance, analyses, and predictions.

Unmanned Machinery Spaces can benefit from reduced human intervention in operation, remote control and monitoring from a central station, reduction in operational cost, and improved overall plant management and efficiency. ■

Smart is Efficient

By Omnia Halawani

Buildings are for people. Optimizing occupancy services should be the ultimate goal. In 2020, the human factor has become more important than ever and the focus on indoor air quality has seen a hike. We have also observed an increased attention to running costs and optimizing them, energy costs included. Another upside to 2020 is the exponentially increased reliance on Information and Communication Technology (ICT). While we were forced to engage in digital collaboration, building owners and operators delved into optimizing the auto controls in their buildings, at the least, to achieving totally unmanned spaces.

The potential of capitalizing on these shifts in mindsets brings us to highlighting how “smart” can help achieve an energy efficient, occupant friendly, and environmentally conscious buildings.

We like to define smart buildings as well-managed, integrated physical and digital infrastructures that provide optimal occupancy services and comfort. They are reliable, energy efficient, robust, cost effective, sustainable, and adaptable.

◆ **RELIABLE**
reduced equipment failures via predictive and preventive measure

◆ **ENERGY EFFICIENT**
operated in an optimum manner to reduce energy cost and usage

◆ **ROBUST**
less reliance on and the ability to overcome human error and natural disasters

◆ **SUSTAINABLE**
use active and designed-in techniques to achieve improved indoor environmental quality and lowered impact

◆ **COST EFFECTIVE**
reduced operational costs by improved analytics and predictive models

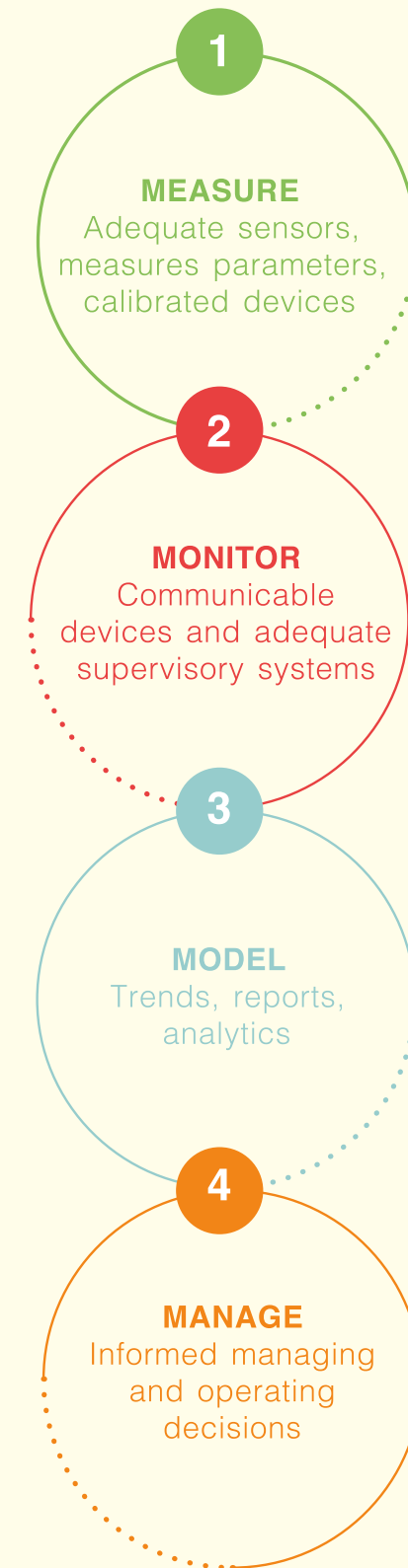
◆ **ADAPTABLE**
have the ability to interact with occupants for optimal occupancy services

“The potential of capitalizing on these shifts in mindsets brings us to highlighting how “smart” can help achieve an energy efficient, occupant friendly, and environmentally conscious buildings.”

Smart buildings interact with the people, systems and external elements around them. They learn from past experiences and real-time inputs. They adapt to the needs of the people and the businesses within them by increasing comfort, efficiency, resiliency and safety. And today there is a new need: to protect people from future pandemics; we do not want to repeat COVID-19 over again.

To achieve a smart building, one needs to deal with the collection, integration, and analysis of a vast amount of data. With the increased adoption of ICT technologies, more and more data are being generated within buildings. Data that is heterogeneous, asynchronous, and of different formats. Building Management Systems need to be designed and specified to process this large amount of data in their real time and historical variances. The main goal is to extract meaningful trends and information to make data-driven decisions.

The process from data collection to building management is very much explained with the following cycle:



“Building Management Systems need to be designed and specified to process this large amount of data in their real time and historical variances. The main goal is to extract meaningful trends and information to make data-driven decisions. ”

A smart building does not only aid the connectivity and adaptability of the building, but it is also a tool that participates in the improvement of the full life cycle of a building. During commissioning, a smart building is a connected tool for tuning performance. During operations, it facilitates predictive actions rather than reactive responses. It also results in a more energy efficient building via holistic management of energy using equipment, intelligent operation and predictive maintenance, and lower energy costs. Furthermore, the real info and data can support validation of analytical models and performance simulations for Research and Development. ■

List of Projects

▲ ▲ ARCHITECTURE & INTERIOR DESIGN

Masterplans & Buildings

RACHID KARAMI INTERNATIONAL FAIR TSEZ ▲

ZABEEL COMMERCIAL DEVELOPMENT ▲

RODA HOTEL EXTENSION DEVELOPMENT ▲

CEREMONY- KAIRA LOORO ▲ ▲

Commercial, F&B and Retail

STANDALONE BUILDING FOR HADOOA RESTAURANT & CAFÉ AT IBN BATUTA MALL ▲ ▲ ▲

HADOOA RESTAURANT & CAFÉ AT SHEIKH ZAYED ROAD ▲

ALPYS AL SAFA 1 ▲ ▲

EXHIBITION STAND FOR AL KAMDA FALCON ▲

Residential

ROYAL HOUSE IN LONDON ▲ ▲

ROYAL WINTER HOUSE RENOVATION ▲ ▲ ▲

ABU DHABI VILLA-1 ▲

▲ ENGINEERING

Buildings

USD110M AL FERDOUS COMPLEX- AL WASL STREET, DUBAI ▲ MEP design & supervision

BURJ KHALIFA FLOOR 150+ ▲ MEP systems redesign & retrofit

USD96M 5*STAR HOTEL TOWER, B+G+4P+32 IN SOBHA HARTLAND ▲ MEP design

USD54M SAABRIN- RESIDENTIAL BUILDING ON MINA ROAD ▲ MEP design & supervision

USD29M WAREHOUSES COMPLEX IN JEBEL ALI INDUSTRIAL ▲ MEP design & supervision

USD18M INDUSTRIAL COMPLEX ▲ MEP design

NAD AL SHEBA MALL ▲ design review

DEIRA MALL ▲ design review

AL KHAIL AVENUE ▲ design review

MINISTRY OF INDUSTRY AND ENERGY NEW HQ BUILDING ▲ VAC design

CREEK TOWER ▲ VAC systems redesign

RESIDENTIAL DEVELOPMENT ON PLOT C-008-009, TECOM ▲ design review

RESIDENTIAL TOWER IN BUSINESS BAY ▲ design review

HILTON CORNICHE ABU DHABI (NOW RADISSON SAS) ▲ facility condition assessment

AL MAMZAR HOTEL ▲ VAC design review

Villas

600+ VILLAS AT MUDON ARABELLA- HVAC systems upgrade ▲ design review & supervision

POLO VILLA RESIDENCES ▲ MEP design & supervision

BUGATTI VILLAS ▲ MEP design

ROYAL SEASIDE VILLA ▲ MEP design

PEARL JUMEIRAH VILLA ▲ MEP design

SHARJAH VILLA-1 ▲ MEP design

DUBAI HILLS VILLA ▲ MEP design

District Cooling

300,000TR DISTRICT COOLING IN KUWAIT ▲ ▲ Feasibility, advisory and design

NET ZERO CARBON CITY CONCEPT IN RIYADH ▲ ▲ ▲ Sustainability and district cooling design

AL RAHA BEACH -250 ETS ▲ Design & supervision

DCP UPGRADE AT JUMEIRAH ISLANDS ▲ Design

DISTRICT COOLING SYSTEM FOR OMAN LNG FIEL ▲ Feasibility and advisory

CITY WALK MALL, DUBAI ▲ Technical audit & optimization

CAIRO FESTIVAL CITY ▲ ▲ Technical audit & optimization

TABREED BAHRAIN SEAWATER PLANT ▲ Technical audit & optimization

20 DISTRICT COOLING & CHILLER PLANTS IN DUBAI - 80,000TR ▲ Technical due diligence

5 DISTRICT COOLING PLANTS IN DUBAI - 115,000TR ▲ Technical due diligence

DUBAI FESTIVAL CITY ▲ Technical due diligence

DUBAI FESTIVAL CITY ▲ Low delta T consultancy

FAIRMONT THE PALM ▲ Low delta T consultancy

DAMAC BY PARAMOUNT ▲ Low delta T consultancy

INDEX TOWER ▲ Low delta T consultancy

12 EXECUTIVE TOWERS IN BUSINESS BAY ▲ Low delta T consultancy

GREEN COMMUNITY 1&2 ▲ Low delta T consultancy

AMITY SCHOOL AT JUMEIRAH ISLANDS, DUBAI ▲ DC connection

AD MARINA MALL ▲ DC connection

▲ ENERGY EFFICIENCY

Commercial, F&B and Retail

ADVECT OFFICES



DUBAI MALL AQUARIUM

▲ MEP system upgrade

DUBAI MALL F&B

▲ Exhaust system retrofit

DUBAI MALL WATERFALL FOUNTAIN

▲ MEP system upgrade

EMIRATES NUCLEAR ENERGY CORPORATION OFFICES-

▲ VAC optimization/ rectification

MASDAR CITY OFFICES

▲ VAC optimization/ rectification

EXPO 2020 SITE OFFICE

▲ MEP and VAC design

COURT OF HH CROWN PRINCE OF ABU DHABI

▲ VAC optimization/ rectification

RITZ CARLTON MOORISH

▲ MEP design

RITZ CARLTON FARMHOUSE RESTAURANT

▲ MEP design

RITZ CARLTON KAHEELA RESTAURANT

▲ MEP design

YIN YANG SPA CENTER, AL SAFA 1, DUBAI

▲ MEP design

BARRACUDA SEAFOOD RESTAURANT

▲ MEP design

VALENTINO STORE AT THE DUBAI MALL

▲ MEP design

Other

GAS O&M CONSULTANCY AT NAKHEEL COMMUNITIES



GOLDEN MILE 1 & 2 SHARED BILLS ALLOCATION



New Construction

LAHORE TIMES SQUARE, PAKISTAN

▲ ▲ ▲ Design energy efficiency and modeling

40+ NEW SCHOOLS PROTOTYPE DESIGNS, KSA

▲ ▲ Design energy efficiency and modeling

GEMS NATIONAL SCHOOLS FOR BOYS, UAE

▲ Energy modeling

GEMS NATIONAL SCHOOLS FOR GIRLS, UAE

▲ Energy modeling

Advisory Services

VARIABLE DISTRICT COOLING PLANT MODEL

▲ ▲

CONVENTIONAL COOLING STUDY

▲ ▲

BENCHMARKING FOR A BUILDING ENERGY AND WATER RATING SCHEME FOR DUBAI I DUBAI RSB

▲ ▲

DUBAI DEMAND SIDE MANAGEMENT STRATEGY I TAQATI

▲ ▲ Technical consultancy and modeling

DUBAI COOLING MARKET STUDY I DUBAI RSB

▲ ▲ ▲

CLEVELAND CLINIC ABU DHABI

▲ ▲

Energy Retrofit Management

EIGHT DOE BUILDINGS IN ABU DHABI & AL AIN

▲ Tendering, Supervision, Commissioning Management, M&V

92 ASSETS BY ALDAR PROPERTIES (200+ BUILDINGS)

▲ Tendering, Supervision, Commissioning Management, M&V

9 BUSINESS PARKS BY TECOM (160+ BUILDINGS)

▲ Tendering, Supervision, Commissioning Management, M&V

NAKHEEL MALL & HOTELS (9 Malls + 1 Hotel)

▲ Energy Audits, Tendering, Supervision, Commissioning Management

ABU DHABI DOE'S 150 GOVERNMENTAL BUILDINGS

▲ Energy Audits

MERAAS- DISCOVERY GARDENS (59 BUILDINGS)

▲ Energy Audit, Engineering, Tendering, Supervision, Commissioning Management, M&V

DUTCO GROUP (5 BUILDINGS)

▲ Energy Audits, Tendering

GII LABOR CAMPS (3 BUILDINGS)

▲ Energy Audits, Tendering

THE INDEX TOWER

▲ ▲ Energy Retrofit Management, Low Delta T Mitigation

EMICOOL DISTRICT COOLING PLANTS 6, 7 & 11

▲ Energy Audit, Tendering, Supervision, Commissioning Management, M&V

Energy Retrofits Related Services

ENERGY RETROFIT DISPUTE

▲ Technical expert for litigation

GEMS ENERGY RETROFIT PLAN

▲ ▲

NESCO , TARSHID

▲ audits and bids assessments

EMAAR PROPERTIES

▲ Energy benchmarking

PARK PLACE

▲ M&V

ETIHAD ESCO PROJECTS

▲ M&V

Energy Audits

NAKHEEL ENERGY CONSERVATION STUDIES (298 BUILDINGS)

▲ ASHRAE Level III and I

ETIHAD ESCO- ENERGY AUDIT SERVICES

▲ ASHRAE Level I

DUBAI MARINA MALL

▲ ASHRAE Level III

FAIRMONT THE PALM

▲ ASHRAE Level III

SEDRAH TOWER

▲ ASHRAE Level III

RAHA BUILDING

▲ ASHRAE Level I

ZEE TOWER

▲ ASHRAE Level III

GEMS NMS SCHOOL

▲ ASHRAE Level I

AL SAHEL HQ

▲ ASHRAE Level I

HAMZA TOWER

▲ ASHRAE Level III

INDIGO TOWER

▲ ASHRAE Level III

PHOENIX TOWER

▲ ASHRAE Level III

IMPERIAL RESIDENCE

▲ ASHRAE Level III

Capacity Building

ENERGY RETROFIT TRAINING FOR ABU DHABI GOVERNMENTAL DEPARTMENTS



ISO50001 TRAINING FOR ABU DHABI GOVERNMENTAL DEPARTMENTS



ENERGY EFFICIENCY TRAINING FOR AL SAHEL CONTRACTING



▲ SUSTAINABILITY

Masterplans

LAHORE TIMES SQUARE

▲ ▲ ▲ Sustainability, design energy efficiency and modeling

AL KHOBAR WATERFRONT

▲ ▲ Sustainability & LEED campus

NET ZERO CARBON CITY CONCEPT IN RIYADH

▲ ▲ ▲ Sustainability and district cooling design

Rating Systems

ADHA NEAR ZERO SUSTAINABLE VILLAS

▲ ▲ ▲ Estidama 4 Pearls

GREEN COAST HQ

▲ ▲ LEED NC Gold

DUBAI ECONOMIC DEPARTMENT IN DEIRA, DUBAI

▲ ▲ LEED EBOM Gap Analysis

GEMS AL REEM PRIMARY SCHOOL

▲ ▲ Estidama 2 Pearls

GEMS AL REEM SECONDARY SCHOOL

▲ ▲ Estidama 2 Pearls

COURT OF HH CROWN PRINCE OF ABU DHABI

▲ LEED EBOM support

Independent Commissioning Agency/ Management

EXPO 2020 UAE PAVILLION

▲ ▲ LEED & Sa'fat ICA

GEMS AL REEM PRIMARY SCHOOL

▲ ▲ Estidama ICA

GEMS AL REEM SECONDARY SCHOOL

▲ ▲ Estidama ICA

Indoor Environmental Quality

THE ROYAL DANISH CONSULTANT IN DUBAI

▲ ▲ IEQ Consultancy

HUMIDITY AND MOLD MITIGATION IN A FIVE STAR RESORT IN DUBAI

▲ ▲ IAQ Consultancy

HUMIDITY AND MOLD MITIGATION IN HIGH RISE TOWERS IN AJMAN

▲ ▲ IAQ Consultancy

HONEYWELL OFFICES

▲ ▲ IAQ Consultancy

Corporate & Other Services

AL SAHEL CONTRACTING SUSTAINABILITY

▲ Corporate sustainability policy

PROJECT SOLIS/ DUTCO- ROOFTOP SOLAR

▲ ▲ Renewables design and supervision

WEBCOR GROUP

▲ ▲ Group sustainability and energy benchmarking

DAFZ ENERGY AWARDS

▲ ▲ Renewables and energy use assessment

