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The Green Restart Whitepaper

Egypt's ambitious plans for sustainable energy, clean air and water

A green restart – fueling economic opportunity and climate action

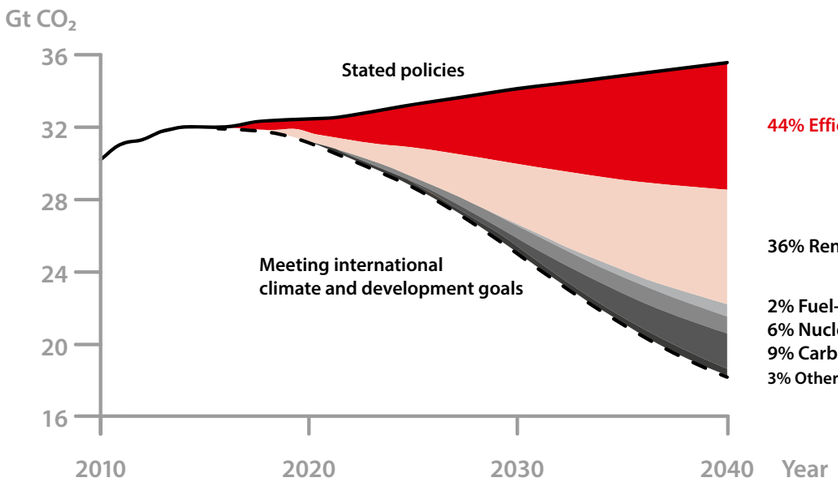
We have started to forge a road towards carbon neutrality. Now we need to speed up climate action while re-energizing the economy – by investing in a low-carbon world.

How to meet the goals of the Paris Agreement

By switching to more energy-efficient solutions, we reduce our overall need for energy – and reduce the need for extra capacity and investments in renewables. This is the most cost-effective and efficient path to long-term success.

The potential of energy efficiency is ready to be unleashed

The path to meeting international climate and development goals



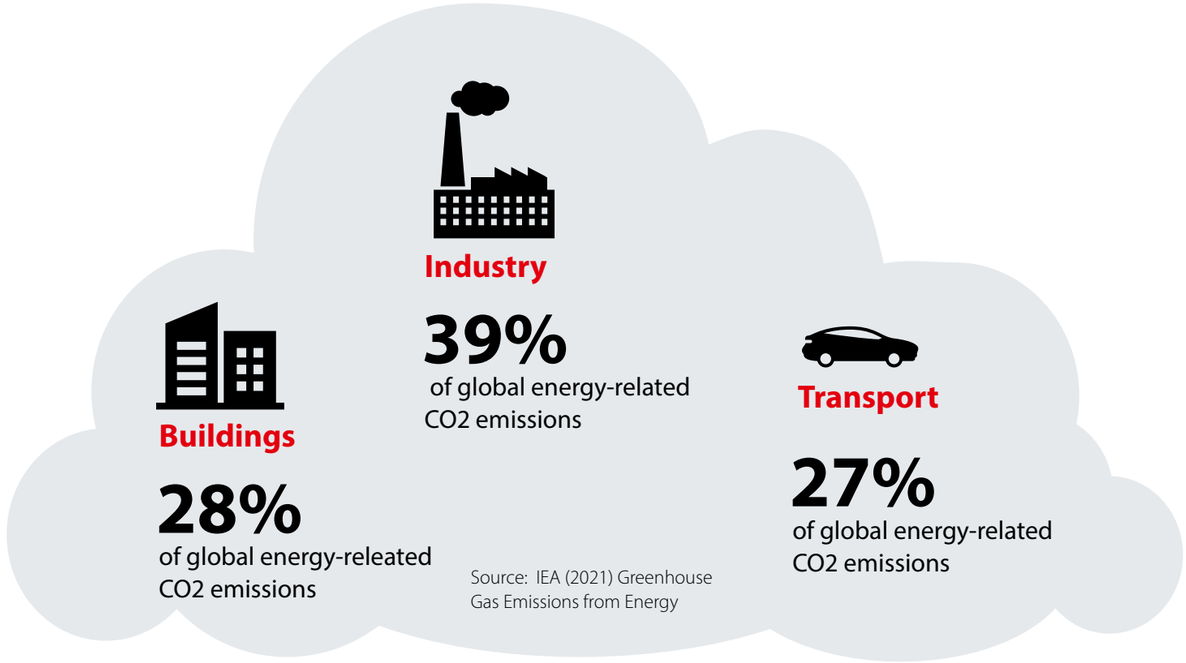
Source: IEA Energy Efficiency market report (2018)

44% Efficiency

36% Renewables

2% Fuel-switching
6% Nuclear
9% Carbon capture and storage
3% Other

The graph shows the six levers needed to move us from stated policies to a scenario where we can meet the requirements of the Paris Agreement in addition to other international energy-related development goals.



The benefits of going green

Buildings

30%

reduction in energy use through modern HVAC systems.

Source: Ecofys, Optimising the energy use of technical building systems, 2017

Job creation

9-30m

jobs would be created for every 915.000 € invested in energy-efficiency measures in the buildings sector.

Source: IEA, World Energy Outlook Special Report, 2020

Industry

8%

of global electricity demand could be saved by installing variable frequency drives on all electric motors.

Source: IEA, World Energy Outlook Special Report, 2020

Applying Egypt's ambitious plans for sustainable energy, clean air and water

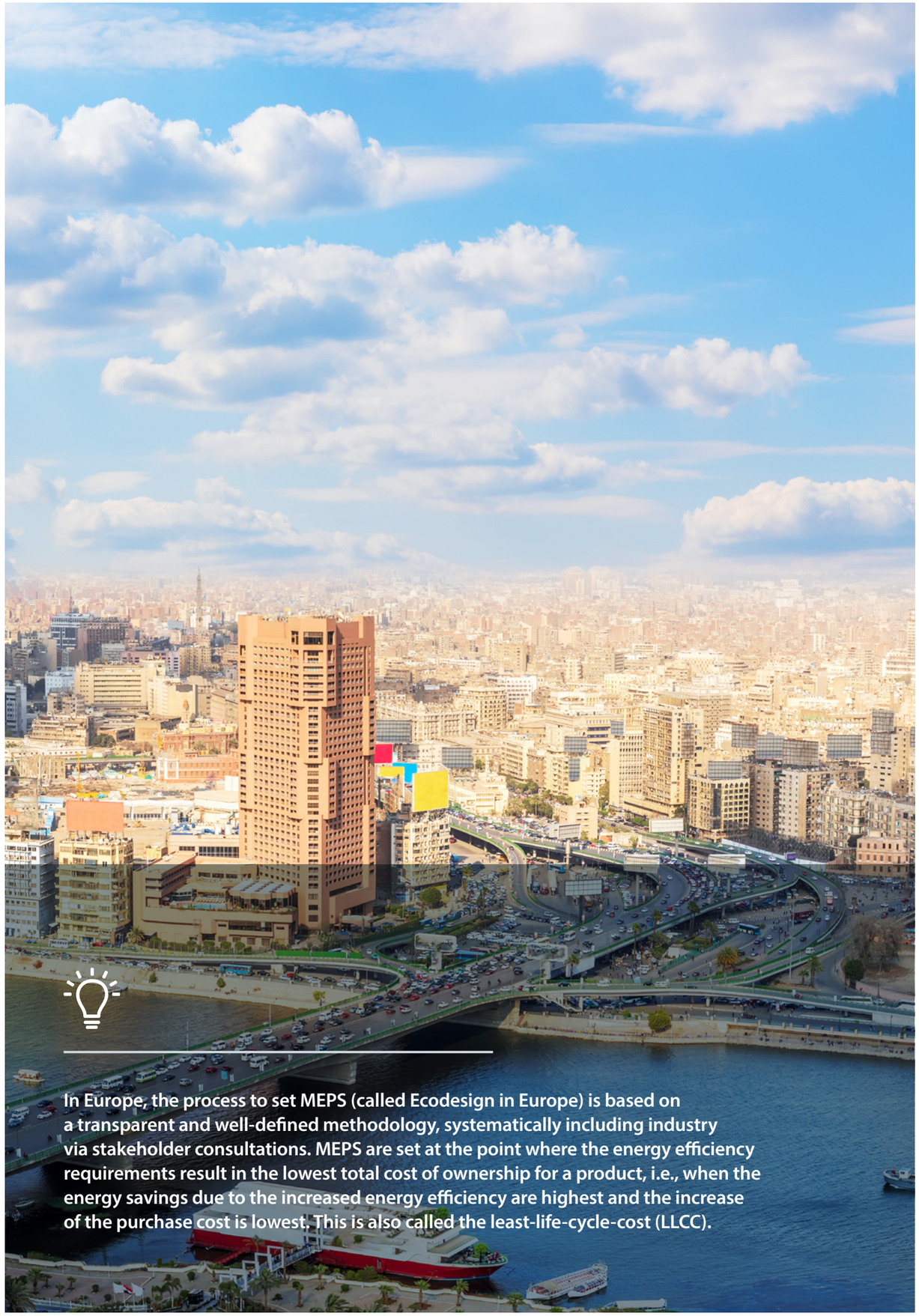
The latest findings of the IPCC report are crystal clear: the last decade has been hotter than any decade in the last 125,000 years. But it is not too late yet. If we take swift action to reduce emissions, we can reduce global warming and stabilize temperatures. UN Secretary General Antonio Guterres therefore calls the report a "code-red for humanity" and a "death knell for coal and fossil fuels before they destroy our planet."

Indeed, the highest share of greenhouse gas emissions is related to the consumption and production of energy. While we need to switch from fossil fuels to renewable energy, according to the IEA, energy efficiency can deliver more than 40% of the energy-related emissions needed to reach the Paris Agreement ambition. The good news is: Industry stands ready with energy-efficient technologies to enable and accelerate carbon neutrality. To have them rolled out massively, governments must act and prepare the ground, sending the right signals to markets and users.

With an economic growth rate that is among the highest in the region – forecasted to be at an average of 6.7% annual rate of growth – Egypt has already been actively preparing the ground to ensure healthy, comfortable and productive living and working conditions for its population. Ambitious goals on renewable energies, clean air and water, complemented by visionary projects such as the "new capital" are sending strong signals and put the country on the pathway towards a sustainable future. Systematically applying the energy-efficiency-first principle throughout the economy must be the foundation for this ambitious endeavor, with a specific focus on reducing energy demand in buildings and appliances by 20-80% and by 20% in the water sector.

Egypt's vision of a new capital city landscape bringing 19 smart, sustainable cities from concept and into reality by 2030 aims to bring down emissions from buildings by 33% and meet the 1.5 degree scenario through innovative solutions for smart, efficient buildings.

Source: League of Arab States, Financing Sustainable Development in Egypt, 2022



In Europe, the process to set MEPS (called Ecodesign in Europe) is based on a transparent and well-defined methodology, systematically including industry via stakeholder consultations. MEPS are set at the point where the energy efficiency requirements result in the lowest total cost of ownership for a product, i.e., when the energy savings due to the increased energy efficiency are highest and the increase of the purchase cost is lowest. This is also called the least-life-cycle-cost (LLCC).

Shifting minds towards energy efficiency

To make this happen on the ground, a mindset shift is crucial. The traditionally plentiful supply of natural resources in Egypt means that energy efficiency has not been prioritized for a long time, and, as a consequence, and, as a consequence, an energy-saving culture has not been established. Building on the experience from other regions in the world, there are five important avenues to trigger the much-needed shift:

1. **Products and their operation**
   Extend Minimum Energy Performance Standards (MEPS) and Energy Labelling requirements beyond off-the-shelf household appliances and ensure their consequent enforcement. Ensure energy-efficient operation by appropriate sizing and systematic service and maintenance

2. **Buildings**
   Strengthen building codes with a focus on energy performance.

3. **System**
   Implement energy-saving requirements or incentives by involving utilities, thus triggering the need for energy savings at user level.

4. **Sector Integration**
   Introduce comprehensive cooling plans, a district-based approach and the mandatory recovery of excess energy to reduce energy production.

5. **Digitalization**
   Introduce requirements for the systematic use of digitalized solutions to raise awareness and drive energy savings such as energy metering, building automation and control for commercial buildings, temperature sensors, etc.

To speed up the transition, industry should be systematically involved via stakeholder consultations or similar processes. Public-private collaboration can help find the most sustainable pathway to transform Egypt's cities into low-carbon-emission areas by 2030.

The Opportunity: A future-proof, comfortable, healthy and efficient Egypt

Egypt is one of the oldest civilizations in the world and brought us stupendous achievements and inventions across art and architecture, engineering and statecraft.

The country does not only have an impressive past, but also a vibrant future: With more than 100 million inhabitants, Egypt is the most populous country in the region, and the fourteenth most populous in the world. Already today, 43% of Egyptians live in urban areas – a share that is expected to increase to roughly 55% by 2050. In the same vein, population and the need for cooling is growing in remote areas – especially in the residential sector. On the other hand, so far only 6% of Egypt's total area is densely populated. The remainder is desert with only small or no settlements. This is where the "New Capital," an ambitious project with 19 new, smart, sustainable cities will be built.

To support the increase of both the population and the economy, creating a sustainable energy path is high on Egypt's agenda. Three areas in particular form the anchoring points of this sustainable transition, allowing for a future-proof, comfortable, healthy and efficient Egypt:

Increasing energy efficiency with smart and efficient technologies

Streamlining energy use with state-of-the art district-cooling networks

Tackling water scarcity with highly efficient desalination technology

The EU Energy-Efficiency Directive requires energy companies to save an annual percentage of their energy sales via energy-efficiency obligation schemes or alternative measures. The best-known instrument in this context are white certificates, which involves energy companies launching programs themselves geared towards energy-savings, for example energy-efficient renovation measures. Experience has shown that white certificates are highly attractive and can contribute strongly to energy-savings, provided the eligibility criteria are well defined.

The Challenge: The energy, the water and the health

Economic growth coupled with urbanization and a growing population inevitably leads to an increasing demand for energy and water. Indeed, the total final energy consumption in the country has been increasing steadily over the past decades, almost tripling between 1990 and 2018, with more than 80% being based on oil, natural gas and coal. In the same period, electricity consumption grew by a factor of five, with less than 10% being based on renewable energy.

Most of the electricity is being consumed by the residential sector, accounting for roughly 42% of the total consumption. According to Egypt's Ministry of Electricity and Energy, this is due to two factors: the expansion of residential housing and new communities to accommodate the growing population and the use of domestic appliances, not least for cooling during hot weather. These two trends are likely to continue and are crucial to ensure the health, well-being, and productivity of occupants.

However, the increasing need for energy combined with the country's reliance on fossil fuels contributes not only to greenhouse gas emissions but also to air pollution – an impediment to health, growth and development. The water scarcity problem, which has been exacerbated by climate change, adds to a potentially critical situation with increasing needs due to population growth, new cities and settlements, and requirements for industry and agriculture – the latter directly impacting the food supply chain. By 2025, water supply is estimated to drop below five hundred cubic meters per capita, an extremely low level that experts typically define as "absolute scarcity."
The highest share of water consumption use for agriculture also strongly affects the food supply chain.

The annual economic cost of air pollution on health in the Greater Cairo Area alone is about 1.4 percent of Egypt's gross domestic product.

Source: World Bank, Supporting Pollution Reduction Efforts to Protect the Health of Egyptians and Spur Economic Recovery, 2021

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Introducing **three solutions**

Increasing energy efficiency
with smart, efficient and
digitalized technologies

Streamlining energy use
with state-of-the art
districtcooling networks

Tackling water scarcity with
innovative and highly efficient
desalination technology

This is how we do it

Choosing best-in-class energy-efficiency products and basic optimization measures, including appropriate sizing, proper installation and system adjustments such as demand control, achieve final energy savings of well above 20% and a payback period of less than two years on average.

Source: Ecofys, Optimising the energy use of technical building systems, 2017

Increasing energy efficiency with efficient and digitalized technologies

Considering the strong increase in electricity consumption and the fact that more than 90% of the country's power generation is still based on natural gas and oil, Egypt has set an ambitious target: by 2030, the share of renewable energies in the power mix shall be increased to 42%. To achieve this goal in a cost-efficient way, serving both citizens and the economy, energy efficiency – in buildings in particular – are a crucial cornerstone.

Egypt's buildings sector accounts for nearly one-third of the final energy consumption (IEA, 2017). Efficient heating and cooling technologies can make a real difference in cutting energy use and emissions in this crucial sector, meaning that the energy will stretch further and will be used with more precision and flexibility. Making more efficient choices upfront when it comes to HVAC systems, correctly sizing the equipment and ensuring that capacity matches actual demand and will lead to trickle-down cost and energy efficiencies all the way through the system.

The basics

- Appropriate sizing of pumps for cooling applications
- Proper installation and insulation of pipework
- System adjustments such as temperature settings, air volumes, cooling supply

Choosing smart solutions

- Demand control and monitoring systems such as energy meters, variable speed control for pumps, chiller compressors and fans, sensors for air flow control, installation of modern thermostatic valves, etc.
- Building automation control systems in commercial buildings

Optimizing product efficiency

- The IEA predicts that cooling will become the strongest driver of growth in buildings' electricity demand, responsible for 40% of the total growth, and the second strongest driver of all electricity growth after industrial motors. This will lead to further increased peak demand, putting pressure on the grid. Space cooling can represent more than 70% of residential electrical demand in hot regions. Higher product efficiency, pushed by Minimum Efficiency Performance Standards, can reduce this impact significantly.

Streamlining energy use with urban planning and state-of-the art district-cooling networks

Streamlining energy use is a key pillar in decarbonizing urban areas. To do so, it is necessary to move from a linear approach to energy use, by which energy users act in silos, to a circular approach to energy use, by which a building is no longer considered an entity in itself but critical infrastructure and part of the overall energy system and district.

District energy networks are a very efficient pathway towards decarbonization.
They come in different sizes from micro-grids in a district or neighborhood to city-wide networks. It's in the context of district energy that sector integration becomes most visible and tangible, creating synergies between the production and supply of heating, cooling, hot water and electricity.

District-energy networks ensure the reduction of overall energy and electricity use, and, by extension, of CO_2 emissions as well as air pollution and water use. Especially for rapidly growing urban areas in hot-climate zones, such networks are ideal. They are also an important enabler for the integration of large amounts of fluctuating renewable energies into the grid, providing flexibility and reducing pressure during peaks, via thermal storage, cogeneration and heat pumps. This is very important for a country like Egypt, which wants to massively ramp up renewable electricity generation while the infrastructure still needs to be built up to accommodate for this expansion.

In case of already existing district energy networks, upgrading them by taking into account the concept of urban district energy planning, offers further opportunities to maximize the use of renewable energies, waste heat and not-in-kind technologies.

According to the UN Environment Program, district heating and cooling systems use up to 50% less primary energy for heating and cooling, making them a smart choice for climate-ambitious cities.

UNEP, District energy: a secret weapon for climate action and human health, 2019

Tackling the fast-growing demand for water with innovative and highly efficient desalination technology

Previously, to provide water to coastal areas in Egypt, water transmission lines transported water from the Nile to coastal cities. For example, Hurghada city used to receive water from the Nile via a 450 km transmission line with 11 water lifting stations.

Egypt has around 2900 km of coastline along the Mediterranean and Red Seas, with many cities and settlements along this line or nearby.

Today the cost of desalinated water is more competitive compared to the cost of transporting water from the Nile. With its seawater-desalination strategy, Egypt intends to address the increasingly urgent water scarcity problem in the country. According to the Ministry of Housing, Utilities and Urban Communities, the country is plans to have 45 new desalination plants by the year 2025.

Desalination is very energy and cost-intensive. Again, energy-efficiency and a circular use of energy show a more sustainable way forward.It is possible to reduce energy consumption, CO2 emissions and costs by using highly efficient components such as positive displacement pumps and by recovering excess hydraulic energy used to pressurize the seawater before driving it through the membranes.

Positive displacement-pumps save up to 20% energy during the desalination process, compared to centrifugal pumps, based on seawater reverse osmosis.

Source: Danfoss, Cost-effective water supplies with pd pumps, 2017

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Driving sustainable growth

The Danish Energy Agency supports partner countries to combine a sustainable energy future with economic growth. The Partnership programs are based on an inclusive, demand-driven and flexible cooperation model. In this model, peer-to-peer exchanges advance the understanding of policy options and strengthen planning, framework conditions, and regulation enforcement. The cooperation also aims at bringing together the private sector and stakeholders when relevant.

The proposed new Strategic Sector Cooperation (SSC) program with Egypt aims to facilitate government-to-government collaboration by making relevant Danish experience available in the Egyptian context. It is anticipated that the SSC program will focus on deployment and integration of renewable energy in the Egyptian energy system and long-term energy system planning along the lines of the current Integrated Sustainable Energy Strategy for 2035. The SSC-program is financed via the Danish Ministry of Foreign Affairs, as a three-year program running from 2019 to 2022.

This is where the transformation starts

Join the transformation and continue the conversation on danfoss.com

Checklist for action and how to get there

Egypt is at a crossroads: By shifting minds towards a more efficient and effective use of energy and resources, there is a major opportunity for a future-proof, comfortable and healthy Egypt offering a decent life for all citizens.

Setting minimum efficiency standards for products and appliances, developed in cooperation with government, industry and civil society.

Ensuring a **skilled workforce to appropriately size equipment** and provide systematic service and maintenance.

Requiring the use of **smart and digital technologies**, including temperature sensors, energy metering, electronic monitoring, building automation and controls, and others.

Involving utilities with dedicated energy-saving requirements or other incentives.

Introducing **comprehensive urban planning** with district cooling- networks and the mandatory recovery of excess energy to reduce energy use.

"It is definitely an exciting time for Egypt – new cities rising from the deserts, innovative urban development plans, cutting-edge technology and sustainable solutions that reduces the carbon footprint. The transformative journey they have undertaken is nothing short of inspiring!

We at Danfoss are honoured to be part of this and contribute to the country's rich history. Like Egypt's passion for building civilization, Danfoss also has flair to support governments across the globe to build cites of the future. Our comprehensive solutions will provide Egypt all the tools necessary to create a city that is energy efficient and a new Green Restart!"

Ziad Al Bawaliz
Regional President, TMA Region, Danfoss