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Artificial Intelligence: Transforming the Future of Energy and Sustainability

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Artificial Intelligence

Transforming the future of energy and sustainability

In April this year, McKinsey estimated that Artificial Intelligence (AI) technologies and techniques have the potential to create somewhere between \$3.5 and \$5.8 trillion in value annually across 19 different industries. As the technology becomes more sophisticated and the understanding of its potential applications improves, AI will continue to fundamentally alter the way many of these 19 industries look and operate. AI's presence is already being felt as it unlocks new value, new investment, improved efficiency and better data analysis across every major industry.

While most businesses across the world are primarily looking at AI for its ability to generate new revenue and cut operational costs, its potential to boost sustainability is perhaps most exciting to organisations looking for ways to solve the most pressing environmental challenges. In reality, the ecological and economic benefits of AI go hand in hand, as the reduction of waste and creation of better, more efficient ways of doing things continues to save us time, money and minimises the impact on the planet's overall health. Current predictions from PwC suggest that by the end of the next decade, AI could unlock a \$5.2 trillion contribution to the global economy but also a 4% reduction of greenhouse gases (GHG).

As AI gathers in momentum and sophistication, the future will see a marrying of human and artificial intelligence – an outcome that seems necessary to overcome the pressing problems of climate change and other ecological disasters that are unfolding on an unprecedented scale.

Transforming the Future of Water

How can AI help revitalise the process of conserving, producing and delivering our world's most precious resource in a manner that provides water security for all, but without draining our very finite reserves? How is AI cleantech changing the way we view and utilise water across the world today, and how will it affect our future consumption habits?



AI in Water

The three biggest impacts of AI are:

1

BUILDING BETTER
WATER INFRASTRUCTURE

2

TACKLING WATER WASTAGE
AT THE SOURCE

3

ENABLING SMART
FARMING



BUILDING BETTER WATER INFRASTRUCTURE

AI can enable the creation of more efficient ‘digital water’ systems

It's not just water that flows through our pipes and taps every day – invaluable data is steadily flowing alongside it. Many of the inefficiencies of current-generation water utility systems are now steadily being addressed through the use of AI-based analytical systems empowered by Internet of Things (IoT) sensors and smart meters, a combination powerful enough to continuously track, predict and respond to water demand levels in the most effective and sustainable manner possible.

Increasingly referred to as ‘smart water management’ or just ‘digital water’, such systems place AI at the heart of a new way of managing water. The system's raw processing power effectively analyses everything that's happening across the system, while its machine learning elements allow it to

continually improve its understanding of how best to respond. With AI in the picture, governments and utility providers can build and deliver water infrastructure that is overseen by an all-seeing management solution that never tires and can constantly adapt its approach to any given situation or contingency.

\$30 million

The value of a recent contract to supply and install 120,000 smart meters in Saudi Arabia

For example, August 2019 saw Giza Systems announce that it has been awarded a \$30 million contract to supply and install 120,000 smart water meters in the Northern and West Northern Regions of Saudi Arabia. Once implemented it will effectively reduce operational costs and water wastage

while boosting the accuracy of water usage data, providing a solid infrastructural base for further AI-based innovations. Another demonstrative project would be Dubai Electricity & Water Authority's (Dewa) Smart Grid Station, inaugurated in January 2019, which links smart buildings through an AI and IoT-empowered approach to improve energy and water efficiency and subsequent reduction of water consumption. The station has over 2,000 sensors and numerous smart meters feeding it a constant stream of data on demand and consumption flows.

By finally seeing every part of the bigger picture, such systems can significantly improve the cost-effectiveness and sustainability of ongoing water operations.



TACKLING WATER WASTAGE AT THE SOURCE

AI can enable greater conservation of water from pump to tap

AI is becoming an essential tool in the fight against water wastage, in addition to accurately assessing and supplying water demand. This is of particular importance in water-stressed or water-scarce countries, like much of the Middle East and North Africa (MENA) region, for example, where 60% of the population has little to no access to clean drinking water. Every litre wasted through leaks, burst pipes and other anomalies is a litre that could be saving or improving lives.

This isn't merely a regional course, it's a global one. One recent report suggests that the US alone wastes 7 billion gallons of drinking water per day. With the imperative of reducing such drastic wastage in mind, AI is being employed more widely to analyse water flows real

time, sending alerts and shutting off systems automatically whenever leaks and anomalies are encountered. This approach prevents water wastage and saves on operational costs, as the system reacts in a fraction of the time it would take a human engineering crew to observe, find and fix the problem unaided.

2036 UAE Water Strategy:
21% less water consumption
95% increase in water recycling

Utilising AI in such a preventative manner is one of the aims of the UAE Water Security Strategy 2036, which was introduced in 2017 to ensure long-term sustainable access to water during both normal and emergency conditions by following the latest

guidelines from the World Health Organisation and by implementing the most advanced emerging technologies in the water industry. Since its induction, the strategy's policies have focused on enhancing water resources to steadily push towards its two main goals of reducing water consumption across the emirates by 21% by 2030 while increasing water recycling to 95%. The recent introduction of the Abu Dhabi Department of Energy's Recycled Water Policy highlighted the need for all sectors to consider the best and most appropriate ways to implement the latest water recycling technology, including advanced AI solutions.



3 ENABLING SMART FARMING

AI is at the heart of efficient water use in next-generation farms

According to the World Bank, agriculture is responsible for approximately 70% of all water withdrawals globally, making it our biggest water-using sector by far. Even more remarkably, reports from the UN Food and Agriculture Organisation (FAO) suggest that as much as 42% of said water withdrawals end up being wasted.

This startling and unsustainable level of inefficiency needs to change and is already prompting the acceleration of smart farming techniques powered by AI solutions. A widening range of systems and solutions are combining to create the digitally-empowered farm of the future, which utilises the minimum amount of water while minimising waste.

Typical emerging AI-based solutions include:

- 1 Precision-based AI analytics systems that use a range of data sets including satellite imagery, climate, temperature, humidity and weather predictions to suggest optimal crop management decisions that use and waste less water.
- 2 Soil and light sensors feeding data to an AI solution capable of delivering strategic insight on the most appropriate times to water crops, use fertilisers, etc.
- 3 Holistic, AI-controlled 'smart irrigation' systems capable of delivering highly precise water coverage for crops while pre-emptively handling leaks, etc.

A project which demonstrates the inherent value and potential of this approach is the [Virginia Tech SmartFarm Innovation Network](#). Virginia Tech University in the USA is building the farm of the future by connecting 120 locations across the region through a network capable of sharing real-time information on soil conditions, weather, pest advisories and much more. This data is collected by drones, satellites, autonomous farming robots on the ground and tens of thousands of individual sensors. This wealth of data is collected by the AI-based management solutions of the Innovation Network, which then advises human operators on the best course of action to optimise crop yields, water usage and the overall sustainability of the farms within the network.

Transforming the Future of Energy

Artificial Intelligence continues to spur on the widespread integration of innovative technologies throughout energy operations of every type, ranging from optimising hydrocarbon energy production, to the generation of renewable energy formats like solar and wind. The question that drives energy policy in the Middle East and beyond: how can AI allow us to satisfy our rising global demand for reliable electricity in a clean and sustainable manner?



AI in Energy

The three biggest impacts of AI are:

1

PREDICTING ENERGY SUPPLY
AND DEMAND

2

TACKLING SUPPLY AND
DEMAND IN A SMARTER
WAY

3

MAKING RENEWABLE
ENERGY PRODUCTION
MORE SUSTAINABLE

1 PREDICTING ENERGY SUPPLY AND DEMAND

AI can balance the equation

We have become used to the idea that whenever we flip a light switch, the lights will come on immediately and stay on. This is a more simplistic way of looking at the golden equation of the energy market, which is: demand of energy = energy produced. Despite its drawbacks, fossil fuel exploitation has always enjoyed the advantage of allowing for entirely plannable and predictable energy production rates. Sadly, this is not the case with energy produced from renewable sources.

While inherently clean and increasingly becoming cheaper, the most impactful renewables – solar and wind – aren't as predictable in terms of plannable output compared to hydrocarbon extraction, because they rely on meteorological factors beyond our control. This makes a big difference too, since incorrect predictions about long and short-term renewable production levels can quickly turn into major supply issues which will only become more severe as we move inevitably towards an energy future where renewables play a starring role.

Fortunately, AI is ideally suited to making renewable energy production predictable – and therefore more reliable

– in addition to being clean and cheap. It is capable of leveraging masses of historical meteorological data to help us predict future production levels more accurately. Furthermore, it can do the same for future demand-side predictions by analysing historical usage patterns. With AI making better use of the data we already possess, governments and energy providers can finetune their energy mix and production methods to ensure that demand is met while minimising the associated costs and carbon footprint at the same time.

Solar facilities can enjoy up to 6% greater yield when utilising AI and machine learning.

For example, NEXTracker has developed and integrated its TrueCapture smart control system within 2GW of solar facilities worldwide, to continuously optimise the tracking algorithm of each individual row of solar panels in response to site features and changing weather conditions. Through the combination of sensor, weather forecasting and machine-learning technologies, the energy yield of solar facilities using this

system can be boosted by as much as 6%. Another important development is the UK National Grid AI weather prediction models; having partnered with the Alan Turing Institute, the UK's National Grid Electricity System Operator (ESO) has developed new AI prediction models capable of improving solar forecasting by one-third. The operator says that improved solar forecasts are lowering bills for consumers, while also enabling more solar capacity. Ultimately, their ambition is to create a zero-carbon electricity system by 2025.

Data isn't only helpful for predicting demand, supply or investment trends. Data is also the lifeblood of daily energy production operations in the Digital Age, as vital as coal or oil in the heyday of hydrocarbon dominance. As with the previous examples, AI is ideally suited to providing faster and more accurate analysis of data to supply the strategic insight necessary to improve the efficiency of energy production operations. This concept applies to all energy-producing facilities – oil, gas and coal as well as renewables – as AI can provide a clearer path towards efficiency in each case.

2 TACKLING ENERGY SUPPLY AND DEMAND IN A SMARTER WAY

AI is powering the rise of the smart grid

Smart grids are expected to be the biggest emerging market in the world by 2025, as the need to optimise the demand and supply equation around the world's growing energy demand requires a smarter set of solutions. The critical difference between the energy grid of the past and the current (and future) capabilities of the smart grid is the capability of two-way communication between the grid and its customers. Remote digital devices in homes and industry facilities allow the grid and its customers to work together to ensure that demand is catered to reliably, efficiently and sustainably, without any wastage or unplanned fluctuations in supply.

Naturally, the collation and rationalisation of such huge and increasing volumes of consumer data

require the use of artificial intelligence. With AI, electricity providers can fully map the relationship between supply and demand in real time, powering more efficient and cost-effective improvements across the network.

Regional examples of this approach include the DEWA/Enabla Virtual Power Plant (VPP). Announced in April 2019, this joint venture between the Dubai Electricity and Water Authority and Canadian company Enabla will see the construction an AI-powered VPP which will function as a smart network made up of solar energy, battery storage, and flexible energy loads. The AI solution managing the VPP will be able to aggregate its various energy sources to supply Dubai's grid more effectively and sustainably. The UAE already has the world's largest VPP operating in Abu

Dhabi. The batteries are spread across 10 different locations but can be controlled as a single cohesive plant. With a capacity of 108MW/648 MWh, it stands testament to the potential of the technology's application in the Middle East.

8.3m smart meters worth \$3.6bn

to be installed in KSA before 2030

Looking ahead, Saudi Arabia is aiming to become the largest smart grid developer in the MENA region, and has begun the process of supplying advanced metering infrastructure (AMI) of 8.3 million smart meters to be installed over the next seven years with the overall Saudi smart grid market predicted to reach a value of \$3.6 billion before 2030.

3 MAKING RENEWABLE ENERGY PRODUCTION MORE SUSTAINABLE

AI can help from start to finish

Current manufacturing techniques used in the creation of solar panels require the use of rare earth elements and temperatures of 2,000°C, which is so high that it requires fossil fuel-generated power to achieve. So despite the clean and renewable energy it provides during its lifecycle, each solar panel is far from being emissions-free.

AI is set to change this, however, by boosting research into the development and usage of new materials suitable for solar panels. Experimentation into such questions is generally done through a rather torturous trial-and-error approach which may require thousands of individual tests before paying off with a big breakthrough. With AI in the picture, many of the mundane and even more complex trials and tasks can be automatically undertaken and analysed,

speeding up this vital process and forging the next generation of solar panels so they can be manufactured without incurring a huge ecological burden.

Additionally, looking to the end of any clean energy asset's lifecycle is as important as its beginning. If we are going to achieve a truly circular economy where sustainability is embedded into every major industry, then the recycling of solar panels, wind turbines and other clean energy hardware cannot be overlooked. This is another reason why leveraging AI for the purposes of testing for suitable materials to be used in next generation solar panels is essential. By alleviating the economic and ecological costs of their manufacture as well as their repurposing at the end of their life cycle,

AI will help make solar the truly green energy source it needs to be.

Already we can see this approach being utilised at [Ada: the world's first AI laboratory](#). Under the broader initiative of Mission Innovation, a global collaboration effort between 23 different countries, the Autonomous Discovery Accelerator (Ada) is the world's first self-driving laboratory. Ada aims to make solar panels more resilient, efficient and sustainable by autonomously testing materials using autonomous robots and machine learning systems. This process allows for a much higher volume of tests to be carried out in a fraction of the time it would take an unaided human team of researchers.

Transforming the Future of Waste Management

Waste – its generation and sustainable disposal – have always been a perennial problem that requires a much smarter and more ambitious solution as waste volumes increase through urbanisation and population growth. How can AI fundamentally improve the daily operations of waste management while reducing its long-term ecological impact? How will AI alter the way we handle our waste?



The three main impacts of AI are:

1

ACHIEVING THE
CIRCULAR ECONOMY

2

STARTING THE
SORTING AT
SOURCE

3

TAKING THE
WASTE OUT OF
WASTE DISPOSAL



ACHIEVING THE CIRCULAR ECONOMY

AI in recycling facilities

Perhaps one of the most exciting possibilities provided by the fourth industrial revolution is that the concept of a circular economy is now an attainable prospect rather than a sustainability pipedream. By eliminating waste through process refinement and improved recycling, the complete transformation of industries is possibly only a decade or even years away.

However, with approximately 1.3 billion tons of waste generated worldwide every single day, it is difficult to predict the scale of the challenges currently involved in attaining a viable level of

recycling worldwide. Successfully sorting different types of waste is one of the stickiest (often quite literally!) problems that municipal recycling facilities (MRFs) face and it's an area where AI is ideally suited to make a big difference in a short space of time.

1.3bn tons of waste
generated worldwide every single day

Think facial recognition, but for waste, as AI systems successfully sort rubbish items with the kind of accuracy and economy of effort previously undreamt of. Already, solution providers are

developing AI systems which have the capacity to improve their understanding and recognition of different types of material via machine learning. The ability to successfully identify and separate a far greater range of material types is essential for improving the efficiency and long-term sustainability of MRFs, leading in turn to the realisation of the circular economy. This is particularly true regarding waste streams that are difficult and/or complex to separate out into various types, such as wet and organic waste.



2 STARTING THE SORTING AT SOURCE

AI can power smart bins

The smartbin is already making waves in advanced urban setups. In the Middle East, integrated environmental, recycling and waste management company Bee'ah rolled out Wi-Fi supported, solar-powered bins in Sharjah back in mid-2016. This served as the start of a months-long plan to install several hundred smartbins across the UAE. The bins' sensors allowed the Bee'ah control room to know exactly when they were full, allowing for optimally efficient collecting times and scheduling. Additionally, solar panels also provided energy to an internal compactor, which allows the bins to collect five times more refuse before needing to be emptied.

However, the advent of the true "smartbin" is coming closer to commercial realisation. Solution providers are looking to develop

intelligent waste receptacles with sufficient sensory and AI computing power to analyse the rubbish items that are thrown into them, and then feed the data back to a central system which can then identify all of the elements in the smartbin, ready for sorting and appropriate processing once the bin is picked up.

AED13bn annual cost of food waste to the UAE

While it may be some time before we see such sophisticated smartbins deployed in homes on an impactful scale, the ambition behind this concept shows how much more efficient AI can make the entire waste management process.

Already the UAE is leading this effort regionally. Food waste costs the UAE 13 billion dirhams annually, not to mention

the environmental costs associated with the generation and disposal of such volumes of waste. To reduce food waste in restaurants, the [UAE Ministry of Climate Change and Environment](#) has [partnered with start-up Winnow](#) to introduce its signature AI-powered solution into some of the country's biggest hotel groups, such as EMAAR and Majid Al Futtaim. The device utilises a combination of advanced cameras and machine learning to analyse what chefs are throwing away before their dishes reach the customer, ultimately providing the data to create sustainability-focused changes in the kitchen. Winnow's ambition is to save the equivalent of three million meals in the UAE by the end of 2020, and during 2018 they already managed to save one million.



3

TAKING THE WASTE OUT OF WASTE DISPOSAL

AI can make waste trucks smarter

If the rubbish bin and the sorting centre can become smarter, it's essential that the transporter – the midway point – becomes smarter as well. This is the impulse behind several initiatives to create AI-empowered smart waste management and disposal vehicles, including the [Intelligent Internet of Things Integration Consortium \(I3\)](#), launched by the University of Southern California (USC). I3 want to be able to hook up waste trucks to a city-wide system of sensors and cameras so that they are not only informed of the most reliable and efficient routes to take, but

also have the data necessary to carry out further strategic actions. I3's future applications for smart waste trucks include tagging graffiti for clean-up squads and detecting waste that has been left outside of bins.

Bee'ah, first in the region to have
50 electric waste trucks fleet

In the Middle East, Bee'ah is once again leading the way when it comes to integrating technology to improve each stage of the waste management process. Bee'ah was the first company

in the region to place an order for Tesla-made electric lorries for long-haul waste collection, adding 50 to its fleet of 1,200 collection vehicles. When AI is inevitably added to the mix in the near future, the waste collection process will achieve an unprecedented level of sustainability. By utilising AI for automating and extending the operations of waste disposal vehicles, another crucial step in the waste management cycle can be massively and permanently improved.

Transforming the Future of Smart Cities

The interconnected nature of the smart city ideal requires the processing of truly vast quantities of data and the control of millions (soon to be billions) of interconnected devices. Naturally, AI is a technology that is wholly embedded in the future of smart city design and delivery, as it will give human operators in smart city government, services and utilities the means to navigate and harness the true power of connectivity. But how does AI impact on current smart city projects and future designs?



AI in Smart Cities

There are six major areas where AI is helping to realise the smart city ideal:

- 1** KEEPING THE SMART CITY GOING
- 2** SECURING THE SMART CITY
- 3** PROTECTING THE SMART CITY
- 4** DELIVERING TRULY SMART INFRASTRUCTURE
- 5** ENABLING ENERGY EFFICIENCY
- 6** PROMOTING SUSTAINABLE URBAN PLANNING



1 KEEPING THE SMART CITY GOING

AI can shorten the journey

Cities across the world are suffering from worsening traffic due to rapid urbanisation outstripping the city's capacity to absorb cars and commuters in such quantities. Mobility challenges go beyond mere congestion, as city inhabitants also need easy, reliable and efficient connections between home, work and other areas that are important to them. Therefore, smart city planners and operators need to be able to deliver smart mobility networks that have the scale to absorb the user population, but also the reach and sophistication to provide 'last-mile' connectivity that makes it easy and enjoyable for people to get around.

The combination of AI and IoT provides the data analysis necessary to accurately assess how, when and why people are travelling, ultimately unlocking the kind of insights required to develop true smart mobility networks that work for everyone. Not only can this approach lead to the design of better transportation networks, it can alleviate parking issues and improve the efficiency of maintenance and upgrade works while minimising their negative impacts on the city's busy population.

In the Middle East, and in other regions with smart city aspirations, the need for smart mobility capable of keeping

expanding cities on the move is leading to the creation of ever more impressive and technologically advanced transport systems. From flying taxis, to autonomous city centre cabs, unibikes, the Hyperloop and smart parking initiatives, the near future of travel is set to be a much more convenient and environmentally-friendly prospect.

AED 22bn annual savings expected to be generated by automating 25% of all journeys in Dubai by 2030

Dubai is particularly visible when it comes to regional efforts to make smart mobility a reality. The Dubai Autonomous Transportation Strategy was launched by the Dubai Future Foundation in conjunction with Dubai's Roads and Transport Authority (RTA) to completely overhaul urban congestion and bring about true smart mobility via the use of autonomous vehicles to service 25% of all journeys conducted across the emirate by 2030. By this time, the project's initiators predict that AI-controlled autonomous transport systems will handle more than 5 million trips per day, freeing up time for Dubai's citizens and visitors while increasing their safety and saving AED 22 billion

annually into the bargain. Critical to this vision is the widespread adoption of smart mobility measures designed to banish the current chronic traffic jams to the past, as AI-powered solutions come take the stress, expense and pollution out of city-wide travel. 2019 has seen the trailing of driverless taxis in the Dubai Silicon Oasis area. If successful in their test runs, autonomous cabs will provide an essential 'last-mile' solution to be layered in with Dubai Metro and Tram systems. Also this year, the RTA began testing two models of "Sky Pods" in partnership with Skyway Greentech Co. The first is small, lightweight Unibike designed for two riders and can attain a top speed of 150kmph. The second, larger model is the Unicar, designed for longer journeys. Both types of Sky Pod will hang from specially designed rails connected across high-rise buildings of Dubai, offering an autonomous, traffic-free alternative means of travel.

Perhaps the most exciting innovation in this area is the Abu Dhabi/Dubai Hyperloop, which will begin construction in Q3 of this year, with the first 10km due to open in 2020. Connecting Dubai to Abu Dhabi with a journey time of just 12 minutes, the Hyperloop will undoubtedly cement the 'smart' status of both cities.



SECURING THE SMART CITY

AI can strengthen cybersecurity efforts

The entirely interconnected nature of the smart city is the foundation of its strength, yet it also continues to pose worrying questions about potential vulnerabilities should malicious actors manage to breach the city's security and carry out attacks on its infrastructure. Globally, cybercrime continues to rise in frequency and severity, with reported data security breaches by 42% from 2018 and the annual cost of cybercrime reaching \$608 billion globally between 2014 and 2017.

\$608bn annual worldwide cost of cybercrime between 2014 and 2017

This present and evolving threat has been carefully considered by the UAE Government for years and the end of June saw the launch of its National Cybersecurity Strategy as a means to keep its growing smart city infrastructure safe. This comprehensive strategy has been developed in collaboration a team of international experts drawn from

10 leading countries in cybersecurity systems. It aims to deliver no less than 60 separate yet mutually reinforcing cybersecurity initiatives, whose aims include: enhancing cybersecurity laws and regulations, securing existing and emerging technologies, mandating cybersecurity implementation certification for government suppliers and protecting SMEs by developing essential cybersecurity standards.



3 PROTECTING THE SMART CITY

AI can strengthen policing efforts

As well as a growing range of threats in cyberspace, cities face all manner of physical threats on a daily basis too. By enabling real-time monitoring, analytics, and decision-making, AI is already proving an invaluable asset in aiding police and other security organisations in their continual efforts to combat crime and other threats. By collating data taken from the city's ever-increasing network of interconnected devices – cameras, sensors, drones and more – AI solutions can provide human

operatives with the intelligence they need in a fraction of the time it would take them to gain such insight unaided. Looking further ahead, increasingly sophisticated AI solutions will be able to assess and then act independently when human interdiction would be too slow.

The presence of AI is already being felt on the streets of major cities in the Middle East as police forces look for a new edge against crime. For example, the Dubai Police force has been at the

forefront of integrating technological innovation into its police work for well over a decade. From drones to actual robot police officers, the latest innovation from the Dubai Police headquarters artificial intelligence department is that AI-supported hoverbikes may enter the field as early as 2020. The bikes are said to be capable of reaching 96 kilometres an hour and can hover up to five metres above the ground.



4 DELIVERING TRULY SMART INFRASTRUCTURE

AI is creating the next generation of buildings and services

While the power of the smart city lies in its interconnected nature, with all elements sharing data and informing the strategic decisions of a central network, AI and associated technologies are also driving significant efficiency and sustainability improvements in individual buildings and infrastructure elements as well. The ability for an AI-controlled network to oversee and analyse the usage of every light, water tap, HVAC (heating, ventilation and air conditioning)

unit and even the very façade of a building gives it the ability to satisfy the needs and preferences of the occupants while eliminating wasteful or dangerous situations by shutting off elements that are not currently in use. Not only does AI provide a big sustainability boost to the buildings it controls, it also represents the latest in fire prevention and safety assistance, as well as monitoring for other threats as well. With AI in control, the smart city will be a

safer, healthier and greener place. For example, set to open by the end of 2019, the headquarters of UAE-based sustainability pioneer Bee'ah will be one of the smartest buildings in the world. Powered by a range of Microsoft's latest AI and smart building solutions, the building features digital workspaces to smart back-office integration, smart lobby-visitor management to smart security and, of course, smart environmental controls.



5

ENABLING ENERGY EFFICIENCY

AI is pooling our energy resources for better use

On average, cities – which represent 65% of global energy demand – use a higher percentage of renewable electricity than countries. Dotted around the world there are over 100 cities that maintain a 90-100% renewable electricity usage rate. However, this is only one part of the sustainable smart city energy equation. The presence of renewable energy in cities needs to be paired with the right controlling systems that are capable of minimising waste and reliably satisfying demand in the most sustainable manner possible.

\$10bn infrastructure investment savings for the GCC alone by 2020 with smart grids integration

In this report we have already highlighted the many and growing uses of AI in the energy industry, from creating and running smart grids, to accurately predicting output and citywide demand, to forging better renewable energy solutions and materials. Added to these invaluable applications is the ability of AI to create not just a citywide but a

wide integrated smart energy grid. A recent report estimated that in the GCC alone, governments could save up to \$10 billion in infrastructure investment in 2020 by deploying and integrating smart grids for additional efficiency gains across multiple cities. According to the International Energy Agency, by 2040, there may be upwards of one billion households and 11 billion smart appliances capable of actively participating in interconnected citywide or even nationwide electricity systems, run by AI solutions.



6

PROMOTING SUSTAINABLE URBAN PLANNING

AI is helping us design the smart cities of our dreams

The effective collection and analysis of the vast wealth of data sources in cities existing today is powering the improved design of tomorrow's smart cities. With more raw data than humans could ever hope to review by themselves, city designers are turning to AI to unlock the secrets of sustainable urban planning that are held within the everyday activities of millions of city inhabitants. AI can seamlessly integrate data from traffic cameras, smart meters, sensors and monitoring equipment of every variety to build a more accurate picture

of how people use cities. AI can read license plates and recognise faces by the hundreds of thousands every hour. In short, AI can track the movements, interactions, needs and preferences of a city's residents and visitors to help us fully appreciate how to design and build better urban setups that work for everyone while minimising their environmental impact.

In the UAE, the government office Smart Dubai has built a [first-of-its kind AI lab to help achieve its citywide smart transformation vision](#) to empower, deliver and

promote an efficient, seamless and safe city experience for all. The lab is working with a growing network of partners from across governmental and private sectors, providing the essential tools and go-to-market support that enables them to implement AI services and applications within their respective fields. The ultimate aim of AI Lab is to provide the urban planning blueprints for infusing AI into the fabric of the city and its operating systems.

01 Water



AI will combat predicted water shortages

affecting 5 billion people by 2050.

While AI usage across the water industry globally is still in its infancy, its potential is compelling to the point of undeniable necessity as we need to get smarter about our shared water usage, fast. For the water industry, the ability to use AI solutions to learn and problem-solve at an unprecedented pace will be critical for tackling water scarcity issues brought on by climate change and increasing population growth. Expect the following uses of AI to become increasingly common in the water sector worldwide:

- 'Digital water' – predictive and prescriptive analytics capable of satisfying water utility demands more efficiently
- Automated solutions for the early detection and repair of leaks in water utility/farming infrastructure
- Smart farming solutions ranging from smart irrigation to integrated crop management

02 Energy



\$300bn of O&G operations value

expected to be gained from AI improvements by 2025

The future of energy lies in creating facilities that can live up to their sustainability targets necessary to combat climate change and other environmental issues, while at the same time ensuring that the grid remains reliably powered and stable at all times.

AI is a cornerstone technology for developing the next generation of renewable power plants as well as optimising existing hydrocarbon facilities to minimise their ecological impact as they are phased out. This extends to the offshore oil and gas industry's activities too: even in the relatively short term, AI improvements are expected to add \$300 billion in value to MENA O&G operations by 2025.

With AI assistance, the dream of a 100% renewable and sustainable power plant is finally within reach. Expect AI to become more deeply integrated into the foundations of energy industries in the Middle East and across the world, particularly in nations with smart city ambitions, as clean, renewable energy is the literal driver of the smart city ideal. Just by looking towards Saudi Arabia's \$500 billion NEOM project – where the aim is to power the city entirely through AI-empowered solutions using 100% renewable energy – we can see the shape of AI's influence on how we power our future urban environments.

03 Waste Management



AI is predicted to create \$127Bn

savings from food waste alone by 2030

Effective waste management is an essential element in bringing us closer to a truly circular economy where the maximum value of every resource is extracted along with the minimum of waste and long-term ecological impact. In every case, closing the gap between current recycling and waste disposal efforts and this target state for the industry requires a holistic overview of the data involved in every operational step, and AI is beginning to help us get there. With a much deeper understanding of the data at hand, operators in every part of the waste management ecosystem can make the right decisions about how we deal with waste in all its forms.

With its early adopters already displaying viable cost savings and reduced ecological impacts, AI is forcing a complete rethink of how we deal with our waste, how we can manage it better and, crucially, generate less of it. In terms of food waste alone, AI is predicted to create savings of \$127 billion globally by 2030.

04 Smart Cities



\$20 trillion

economic development potential of smart cities worldwide by 2026

Recent reports attribute a concrete monetary value to the smart city concept, claiming that it could potentially boost the economic development of cities worldwide by more than 5%, delivering over \$20 trillion in additional economic benefits by 2026. AI is a natural fit for the design and delivery of smart city solutions from transport to utilities to cybersecurity, meaning that its continued and growing presence in the cities of the future is all but assured. As AI innovations progress, we can expect to see increasingly large-scale autonomous public transport systems, smarter and greener buildings, cheaper and less wasteful utilities and more, all protected by ever-evolving cybersecurity solutions.



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