CITIES

The smart city revolution

Smart cities – with their highly connected infrastructures and drive towards decarbonisation – are being seen as key to tackling the environmental challenges of a soaring urban population. *Nicola Murnaghan* looks at some of the cities leading the charge in sustainable urban innovation.

With 70% of the world's population forecast to live in cities by 2050, smart cities are rapidly gaining status as key players in the fight towards a sustainable and low carbon future. Cities are currently responsible for around 75% of the world's energy demand and up to 80% of its carbon dioxide emissions, according to UN Habitat. With these figures has come increasing pressure on city governments to develop sustainable, technology-focused solutions to meet the energy demands of a booming urban population.

Indeed, smart cities have a vital role to play in 'actively accelerating the shift to a cleaner, more efficient and decarbonised energy supply to address increasingly urgent community concerns', according to DNV GL's recent report: *Energy Transition Framework for Cities*.

What makes a city 'smart'?

Among the various definitions for a 'smart city', many focus on the use of information technology to optimise how cities are run, and improve the quality of life for residents, whilst supporting innovation and a low carbon economy. Technology company Cisco defines smart cities are those which adopt 'scalable solutions that take advantage of information and communications technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life.'

An overarching feature of many smart cities is the use of IoT-enabled devices, including sensors, lights and meters to gather and analyse data about the movement of people and traffic across a city. This data is used by local governments and

Bristol, England

An ambitious drive to be Britain's 'first solar panel city', coupled with a wave of community-scale energy projects has seen Bristol crowned winner of the European Green Capital Award. In 2013, the then-Mayor George Ferguson pledged to install 1 GW of solar capacity in Bristol by 2020, with the intention to supply all the electricity for domestic properties in the city from solar. The goal, which is still in place, is part of an initiative being led by the Bristol Energy Collective (BEC).

The city also boasts two large-scale solar farms, which provide 9 GWh of electricity per year – enough to power about 2,220 homes, in addition to solar panels on eleven community buildings.

Bristol has also rolled out numerous community-scale renewable energy projects through the BEC, which are funded by a combination of private-public partnerships, traditional financing through banks, crowdfunding, and bond offers.

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Abu Dhabi, UAE

As the UEA's largest Emirate – and home to a large majority of its population and industry – Abu Dhabi has become the subject of the nation's 'aggressive targets for decarbonisation... aiming to reduce carbon dioxide emissions by 70% by 2050.' Renewable energy is a core focus of the Emirate's many energy plans, which include: accelerating the rollout of various energy efficiency initiatives, rooftop solar PV projects, the development of its own energy services company (ESCO) market, and installing electric vehicle charging stations around the city.

In 2017, Abu Dhabi's state-owned electricity and water company, ADWEA, set itself a goal to reduce electricity and water consumption 20% by 2030. To enable this ambitious plan, the city runs programmes to raise awareness of and promote efficient technologies.

High temperatures mean that air conditioning is a major contributor to the nation's electricity demand. District cooling, which can efficiently provide air conditioning to multiple buildings in urban environments, has been installed in various locations – a technology which is set to expand significantly in the coming years.

With its abundant year-round sunshine, Abu Dhabi is also increasing its drive to source more of its energy from solar PV. As well as implementing regulations to encourage the rooftop solar PV market, it has begun construction on a 1.17 GW desert-based solar PV farm. Large-scale battery storage is also being implemented across the city.

Photo: Wikimedia Commons

Curitiba, Brazil

Like many South American cities, Curitiba has experienced major growth – prompting the city to place major investment into its transportation and lighting, two significant contributors to urban energy use. A key development has been the city's pioneering Bus Rapid Transit, which is used daily by around 85% of its population and has undergone continual improvements to increase its energy efficiency. In a move to electrify the bus fleet, city officials have developed a test model with a range of 250 km and which consumes 75% less energy than its diesel counterpart.

Other efforts to make the city cleaner and greener have included the introduction of a programme which allows residents to exchange recyclable waste for vegetables and cooking oil, and expansion of green spaces, including city parks and gardens, to more than 50 m^2/person.

With more than 160,000 illumination points across Curitiba, lighting has been another core focus of the city's energy efficiency drive. Plans are underway to replace old lighting systems with LEDs for 6,500 bus stops, 100 squares of six municipal parks and more than 120 km of bike paths.


Photo: Wikimedia Commons

authorities to improve city infrastructure, services and public facilities, ranging from energy, traffic and lighting to waste management and public safety and security.

Across the world, a growing number of cities are integrating smarter energy solutions into their infrastructure, including Barcelona, which has implemented a sensor system to direct drivers to available parking spaces. The sensors, which are embedded in the road, have helped to reduce congestion and emissions. As part of its 'Smart Nation' plan, Singapore, an island-state with scarce water resources, has installed over 300 sensors in its water supply pipelines to detect water leakage.

Dozens of cities are also integrating renewable energy into their building, transport and industry infrastructures. Dubai, for example, plans to install solar panels on every rooftop by 2030, while Amsterdam is offering residents free advice and grants and low-cost loans for sustainable energy projects, in a drive to reduce energy usage per resident by 20% by 2020.

A growing phenomenon

According to IHS Technology, the number of smart cities worldwide is set to quadruple from 21 in 2013 to 88 in 2025, based on its definition of smart cities as those which have 'deployed – or are currently piloting – the integration of information, communications and technology (ICT) solutions across three or more different functional areas of a city.'

But which cities are leading the way to a greener, more efficient and decarbonised future? In its report, DNV GL identifies ten cities that are blazing a trail in sustainability. Here are three examples of mid-size cities that are driving forward the smart city revolution: ●