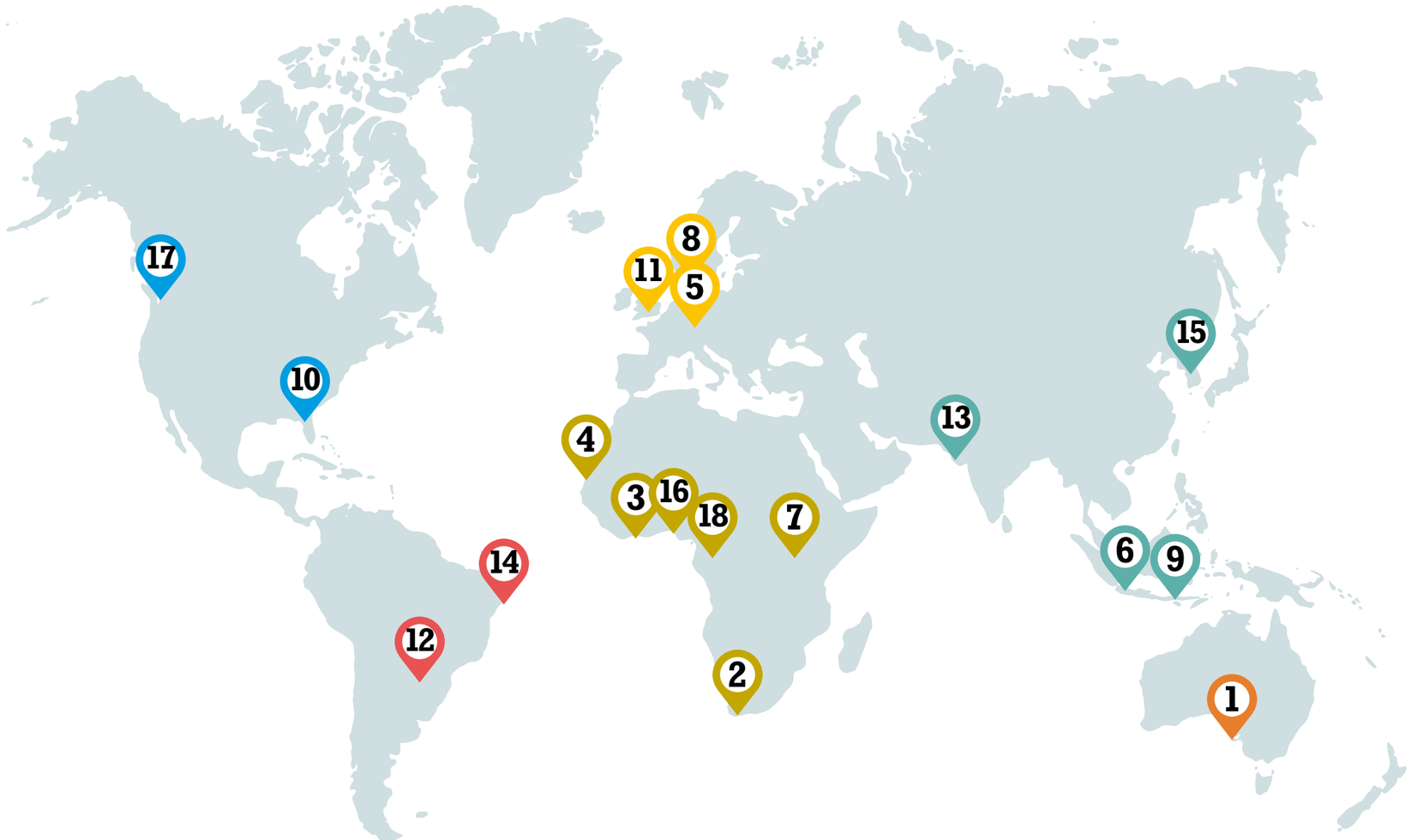
REN21
RENEWABLES NOW

# RENEWABLES IN CITIES
# 2021 GLOBAL STATUS REPORT

## CASE STUDIES

# RENEWABLES IN CITIES
# 2021 GLOBAL STATUS REPORT

## CASE STUDIES




## TABLE OF CONTENTS


Adelaide, Australia ..... 1
Cape Town, South Africa ..... 2
Cocody, Côte d'Ivoire ..... 3
Dakar, Senegal ..... 4
Heidelberg, Germany ..... 5
Jakarta, Indonesia ..... 6
Kampala, Uganda ..... 7
Malmö, Sweden ..... 8
North Lombok Regency, Indonesia ..... 9
Orlando, United States ..... 10
Oxford, United Kingdom ..... 11
Palmas, Brazil ..... 12
Rajkot, India ..... 13
Recife, Brazil ..... 14
Seoul, Republic of Korea ..... 15
Tsévié, Togo ..... 16
Vancouver, Canada ..... 17
Yaoundé IV, Cameroon ..... 18

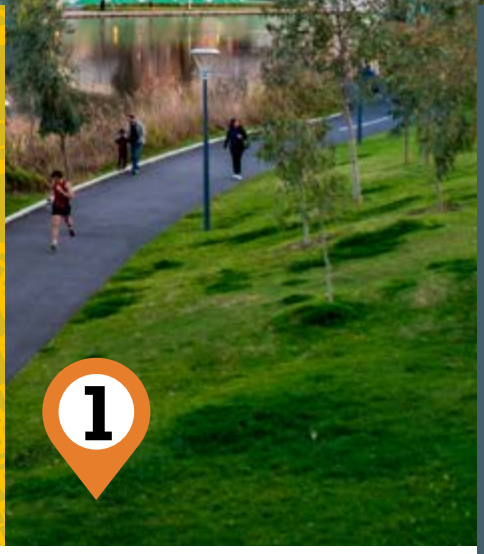

For further details and access to the full report and references, visit www.ren21.net/cities

See Endnotes and Methodological Notes in the full REC for further details on the information presented in this document.


**REPORT CITATION** | REN21 (2021), *Renewables in Cities 2021 Global Status Report* (Paris: REN21 Secretariat).

# ADELAIDE

## AUSTRALIA



1

| Land area ($km^2$) | Population size (2019) | Greenhouse gas emissions ($CO_2$ equivalent) |
|---|---|---|
| 15.6 | 1.3 million | 360,759 tonnes |

As part of a power purchase agreement, the City of Adelaide's municipal operations have been powered by 100% renewables since July 2020, using electricity generated from wind farms in mid-north South Australia and new solar PV farms on Eyre Peninsula and in the South East. This long-term commitment supports the Adelaide Carbon Neutral Strategy 2015-2025, which sets a target for carbon neutrality by 2025.

As a step towards achieving this goal, the City adopted the Carbon Neutral Adelaide Action Plan 2016-2021 to reduce greenhouse gas emissions. The plan sets out 104 actions for council and local government under several low-emission pathways: energy-efficient built form, promoting walking and cycling, hybrid and electric vehicles for individuals and businesses, "zero-emission" transport, towards 100% renewables with solar PV and solar hot water, reducing emissions from waste and water use, and offsetting carbon emissions. The projects under the 100% renewable pathway generate cost savings for residents and businesses along with reducing emissions. In total, the city had installed 8.3 MW-peak of solar PV capacity as of 2019, including 2,362 kilowatts (kW) at city-owned and -operated sites.

Local government investments in energy storage support the deployment of new affordable storage technologies. For example, the Hornsdale Power Reserve, referred to as South Australia's Big Battery, was established in 2017 with 100 MW-peak, and another 50 MW-peak had been added in early 2020. Located next to the 316 MW Hornsdale Wind Farm, the Power Reserve is one of the world's largest lithium-ion batteries, providing grid services that enable the penetration of variable renewable energy sources like wind and solar power.

In addition, the Carbon Neutral Adelaide Action Plan provides incentives to create new economic opportunities and to support the business sector. Building upgrade finance provided by private financiers in partnership with the local council helps to improve the energy, water and environmental efficiency of non-residential buildings and infrastructure. This mechanism offers loans from the financier to building owners, which are repaid by the local council. Upgrading the infrastructure provides financial returns and has the potential to reduce electricity use 43% by 2030.

The Sustainability Incentive Scheme and the CitySwitch Green Office support city residents with financial incentives for the uptake of sustainability practices, technology and trends for low-carbon living. Rebates of up to AUD 5,000 (USD 3,831) are available for households, businesses and car parks for the installation of energy-saving technologies, solar PV systems, EV charging, solar hot water systems and energy storage systems.

The City of Adelaide also is assessing adaptation actions to increase the energy self-sufficiency of its wastewater treatment plants by harnessing biogas to generate renewable electricity. A total of 39,000 megawatt-hours (MWh) was generated from wastewater biogas in 2018-19. In parallel, the local government has been exploring the potential of carbon offset projects. In 2017, a demonstration carbon sequestration site was established near Adelaide High School to provide the community with a practical example of a carbon sink.

Source: See endnote 24 in the *Urban Policy Landscape* chapter.

# CAPE TOWN

## SOUTH AFRICA

| Land area (km²) | Population density (per km²) | Population size | Total final energy demand (million GJ) |
|---|---|---|---|
| 400 | 1,700 | 4.2 million | 145.3 |

Cape Town is South Africa's second largest economic hub, with a population of around 4.2 million in 2018 and a land area of more than 400 square kilometres. Cape Town contributed 9.8% of the national economic output in 2018 and is dominated by the service sector, with significant finance, insurance, real estate and business activities.

Coal contributed 83% of South Africa's electricity generation capacity in 2016 (latest available data), with nuclear power and natural gas representing 4% and 5% respectively and renewable energy making up the remaining 8%. The government aims to increase the renewable share in the generation mix to around 40% by 2030 through various policy instruments, as promulgated in the Integrated Resource Plan (IRP)[i] of 2019.

The City of Cape Town has taken an active leadership role in renewable energy deployment, emphasising not just technology change but also the need to improve governance and institutions and to engage key players in the energy transition, from national government to business and civil society. The decoupling of electricity demand from economic growth in the Metropolitan Municipality over the last decade is attributed to energy efficiency and renewable energy interventions in the face of soaring electricity prices and insecure electricity supply in South Africa.

The transport sector, which relies almost exclusively on petrol and diesel, accounts for 62% of Cape Town's total final energy demand and contributes a third (32%) of the Metro area's greenhouse gas emissions. The sector's high energy use is largely a result of the city's sprawling and segregated form, which reflects the legacy of apartheid's spatial planning. The commercial sector is the second most energy-intensive sector (14% of total final energy demand) followed by households (12%) and industry (12%).

Electricity is the main energy carrier in Cape Town's non-transport sectors, and because most of the electricity in South Africa comes from high-carbon coal-fired power plants, the built environment accounted for 55% of the city's greenhouse gas emissions in 2018. Residential electricity use in Cape Town is split largely across cooking, lighting and space heating applications, while in the commercial sector electricity use is dominated by lighting, heating and ventilation in office buildings.

The City of Cape Town has been a pioneer in providing more affordable and secure energy access and in reducing the city's carbon footprint while also tackling rapid urbanisation and associated energy poverty, urban sprawl and vulnerability to climate change. Cape Town's long history of renewable energy efforts includes the establishment of a dedicated energy and climate change unit. As early as 2000, an energy advisor was seconded to the City as part of the Sustainable Energy for Environment and Development (SEED) programme of Sustainable Energy Africa (SEA), bringing an energy lens to City operations and service delivery. In 2003, with technical support from SEA, Cape Town completed its first *State of Energy* report, and in 2006 it became the first African city to approve a municipal Energy and Climate Change Strategy, setting an initial target for 10% renewable and clean energy by 2020.

The city benefited from learning by doing. Catalysed by the Energy Efficiency and Demand Side Management Programme, launched by South Africa's Department of Mineral Resources and Energy, Cape Town began an extensive and ambitious drive in 2008 to improve the energy efficiency of municipal operations, saving a cumulative ZAR 225 million (USD 16 million) through 2019. The City began supporting small-scale "embedded generation" in 2011, making it

i The IRP provides a medium-term plan for expanding electricity generation in South Africa. It aims to guide sector investment to allow the country to meet its forecasted electricity demand at the least cost and accounting for considerations such as environmental sustainability and water use. The plan incorporates objectives such as affordable electricity, reduced greenhouse gas emissions, diversified generation sources, localisation and regional development.

South Africa's first city to develop tariffs and rules for distributed renewables and serving as a blueprint for the rest of the country.

In 2013, when South Africa had no national standards in place for solar PV on buildings, Cape Town published guidelines[i] promoting the safe and legal installation of distributed renewables in commercial and residential settings. By 2019, the City had the highest concentration of registered rooftop solar PV systems nationwide. In total, between 2011 and 2020, Cape Town approved the installation of nearly 42 MW of rooftop solar PV and installed 0.6 MW on City buildings through its rooftop PV programme. These systems feed into the local electricity distribution network, helping to reduce reliance on coal-fired power from the national grid. Similar processes, guidelines and tariffs have since been adopted in more than 40 other South African municipalities.

Building on earlier roll-outs of solar water heaters in low-income communities, in 2013 Cape Town implemented a programme to promote this technology more widely, helping to reduce energy from one of the highest electricity-consuming end-uses for city households, water heating. By 2015, some 46,000 solar water heaters had been installed city-wide, saving 128,000 MWh per year, creating employment equivalent to 1,300 job-years[ii], contributing more than ZAR 380 million (USD 27 million) to the local economy and reducing more than 132,000 tonnes of carbon emissions per year.

In 2015, the Cape Town Energy 2040 Vision, developed through an extensive process of energy modelling and stakeholder engagement, set ambitious city-wide targets for increasing energy access, improving energy efficiency and reducing carbon emissions. It also set a target to achieve at least 500 MW of renewable and clean energy capacity by 2040. To help achieve this ambition, the City of Cape Town elevated the role of energy institutionally, combining its two energy-related divisions (one focused on energy and climate change and the other on electricity generation and distribution) into a single new Energy and Climate Change Directorate.

This change also signaled Cape Town's intention to expand its role in local electricity supply. In 2017, the City entered into a court challenge with the national government to enable it to purchase electricity from independent power producers (IPPs) and not be confined to procuring coal-fired power from Eskom, the centrally controlled national energy utility. In a landmark step in October 2020, South Africa's Department of Mineral Resources and Energy amended the country's electricity regulations to enable municipalities in good financial standing to develop their own power generation projects, as a way to ensure security of energy supply in a co-ordinated manner aligned to the national IRP and the municipal Integrated Development Plans (which guide overall planning and development for municipalities in South Africa).

The City of Cape Town has taken an **active leadership role** in renewable energy deployment.

The City of Cape Town has begun laying the foundations for supplying renewable energy at scale. Based on a legislative change in late 2020, the municipal government is exploring the commercial, legal and technical aspects of a municipal-level Renewable Energy Independent Power Procurement Programme (REIPPP) and is developing a guide on how to engage with industries in procuring energy from IPPs. As of 2020, the City was working on a Zero Carbon 2050 action plan (and related policies) as well as developing low-income energy services, a framework for electric vehicles and innovative financing opportunities for engaging households in small-scale rooftop solar PV.

Cape Town is also honouring its international commitments to climate action. It is a signatory to various initiatives including the Mexico City Pact, CDP, the carbon*n* Climate Registry, the Covenant of Mayors in Sub-Saharan Africa and the C40 Cities Leadership Programme. The City also has committed to achieving carbon neutrality by 2050, recognising that this will require ambitious actions across all sectors. To translate these commitments into action, Cape Town has woven them into its Integrated Development Plan for the period 2017-2022.

The City's transport plan includes exploring the potential production and use of biofuels in transport, using renewables for infrastructural facilities such as depots and transport interchanges, and replacing the municipal diesel bus fleet with electric buses (which eventually would be powered with renewables). In a pilot project in early 2018, the City's "MyCITI" bus rapid transport service added 11 locally manufactured electric buses to its fleet.

Cape Town is working to prepare its power grid for high EV penetration in the near future. The Electric Vehicle Framework includes leveraging EV roll-out and charging to increase the share of renewables in final energy consumption, and is considering requiring public EV charging stations that exceed a specific demand threshold to operate on renewable energy. This energy is expected to be either generated from local solar PV capacity or purchased through a contractual arrangement.

Source: See endnote 24 through 59 in the Feature: *Renewable Energy in Sub-Saharan African Cities* chapter.

i The guidelines, which are non-binding, outline a comprehensive list of City-approved suppliers of inverters, the steps for installing solar systems and the application process for registering and selling electricity to the City.

ii A job-year refers to one of year of work for one person.

# COCODY

## CÔTE D'IVOIRE

3

Land area ($km^2$)

135

Population size (2018)

800,000

The City of Cocody, located north of Abidjan on the coast of Côte d'Ivoire, released its Green City Plan in 2017, pledging to reduce carbon emissions 70% by 2030 to combat climate change. The city established the pledge to complement efforts to achieve the national goal of 42% renewable electricity generation by 2030, as put forward in Côte d'Ivoire's 2016 Nationally Determined Contribution towards reducing emissions under the Paris Agreement. Achieving the city's emissions reduction target will be challenging due to Cocody's rising energy demand, which is caused largely by rapid urban development and economic growth.

Cocody Green City is an ambitious plan that aims to minimise local greenhouse gas emissions while also creating 100,000 direct jobs and 400,000 indirect jobs, promoting women's empowerment and increasing citizen participation in adopting sustainable living. This community-based climate action plan aims to reduce $CO_2$ emissions by up to 90% by 2030, using renewable energy and carbon sequestration efforts. The city has set up a Reforestation and Carbon Sequestration Program that includes the development of green spaces and the restoration and replanting of 2 million mangrove trees to protect local climate health.

The Green City plan takes a holistic approach towards upgrading energy use and generation, transport, habitat restoration and land use, conservation and protection of water resources, community sensitisation and adoption. As of 2017, 23 measures were under development, including using solar energy to power large public buildings, installing 5,000 solar lamp posts, installing 1,600 solar traffic lights at 400 crossroads and supplying 200,000 solar PV power kits to households. Other measures to reduce carbon emissions include distributing to households 300,000 efficient cook stoves that run on ethanol procured locally from sugarcane manufacturers, producing 1,000 solar dryers for community women, distributing solar water heaters and setting up four wind farms on the banks of Ebrie lagoon.

The Cocody Green City plan also emphasises the development of sustainable transport and mobility plans through a Transport Demand Management scheme that aims to remove 1,000 old vehicles annually from city roads to improve local air quality and eliminate some 50 million tonnes of $CO_2$ emissions per year. In addition, a used vehicle repair centre has been created to provide 100,000 catalytic exhaust systems for polluting vehicles.

Source: See endnote 36 in the *Markets and Infrastructure* chapter.

# DAKAR

## SENEGAL

| Land area (km²) | Population density (per km²) | Population size | Total final energy demand (million GJ) |
|---|---|---|---|
| 83 | 15,278 | 1.3 million | 28.6 |

4

Dakar is the capital of Senegal in West Africa and is located at the western tip of the country. It is an Atlantic port city covering an area of 83 square kilometres with an estimated population of more than 1.3 million inhabitants. As of 2016, the greater Dakar region was home to 50% of Senegal's urban population, 95% of its industrial and commercial companies, 80% of its infrastructure and services and 87% of its formal employment; as a consequence, Dakar contributed an estimated 68% of the country's gross domestic product (GDP).

As of 2019, Senegal had around 864 MW of total installed electricity capacity, 13% of which was renewable (7% from hydropower and 6% from solar PV). The National Energy Development Plan (Lettre de Politique de Développement du Secteur de l'Energie, or LPDSE), signed in 2012, targets increasing the renewable share in power generation from 10% in 2016 to 15% in 2020[i]. The country's national economic and social development plan (Plan Senegal Emergent, PSE 2025) aims for a 23% share of on-grid renewables in power generation by 2030.

The City of Dakar reinforces these objectives through municipal policies and strategies such as the Environmental Action Plan (P.ACT.E.) and the Master Plan for Urban Development of Dakar and Its Surroundings (PDU 2035). The PDU aims to achieve 15% local electricity production from renewables by 2035 and to reduce reliance on diesel power generation from 90% in 2013 to 5% in 2035. The City intends to finalise (by March 2021) its Plan Climate Energie Territorial (PCET), which will be the integrated energy and climate change development plan informing Dakar's short- and long-term renewable energy roadmap. The PCET is being developed as a result of Dakar's commitment under the C40 Cities Leadership Programme to be net-zero carbon by 2050.

The transport sector dominates the city's energy demand – accounting for 55% of total energy consumption – followed by the industrial (34%) and residential (8%) sectors. Despite Dakar's high electrification rate of more than 95%, household electricity use remains low at around 153 kWh per capita annually (compared to 10,649 kWh per capita in the United States), with lighting as the main end-use application. Liquefied petroleum gas (LPG) is the primary energy source for cooking (averaging 12 kilograms per month per household), followed by charcoal (0.2 kilograms per person per day) and some use of firewood.

The high energy demand for transport reflects Dakar's deteriorating road infrastructure, inefficient public transport networks and ageing vehicle fleet, with 80% of on-road vehicles estimated to be more than five years old. This has led to urban mobility challenges, including permanent traffic jams at peak hours that contribute to high air pollution and negatively affect residents' economic competitiveness, health and well-being, and quality of life. In response, the national transport entity, Conseil Exécutif des Transports Urbains de Dakar (CETUD), piloted the city's mobility and urban planning strategy, the PDUD 2008-2025. The plan articulates three ambitious infrastructure projects – the Express Transit Train (TER), bus rapid transit and renewal of the on-road transport fleet – with a common goal of increasing the share of electrification and reducing fossil fuel dependence across these three transport modes while also reducing air pollution from on-road transport emissions by 2030.

Although the local authority has control over municipal buildings only, the City recently completed a pilot energy audit of all municipal and public buildings, as the first phase of an ambitious target to equip more than half of municipal buildings with grid-connected distributed rooftop solar PV by 2030, as envisaged in the PCET.

See endnote 60 through 74 in the *Feature: Renewable Energy in Sub-Saharan African Cities* chapter.

i As of late 2020, no reporting had been identified to verify that this renewable energy target had been met.

# HEIDELBERG

## GERMANY


Land area (km²)
108

Population size (2019)
160,000

Heidelberg is a German frontrunner on energy and climate issues. The city aims to become climate neutral by 2050, and in 2019 it was one of the first cities in the country to declare a climate emergency. In part in response to this climate emergency declaration, Heidelberg passed its Climate Action Plan, complementing the city's 2014 masterplan for 100% climate protection.

The Climate Action Plan sets out 30 actions for the city to achieve its climate protection goal. These actions include a focus on energy-efficient buildings and on renovation of old building stock; passive house standards and renewable energy requirements for new neighbourhoods; scaling up renewables in district heating and the municipal power utility; improving public transport and increasing green spaces; and sustainable consumption.

Despite facing challenges from the COVID-19 pandemic, Heidelberg was able to realise several of these actions in 2020.

Since early in the year, the municipal district heating network has run on 50% renewable energy, with the goal of achieving climate-neutral district heating and phasing out the use of coal by 2030. In addition, the city aims to produce a third of its heating capacity locally by 2025.

Due to land scarcity within Heidelberg, in 2020 the municipal utility started co-operating with utilities in other municipalities to expand the city's solar PV and wind power supply. Thanks to this co-operation, Heidelberg plans to achieve its goal of adding 25 MW of renewables by 2030, with an interim goal of 14 MW by 2024.

To further scale up solar PV within city boundaries, in late 2020 the city council passed a policy to provide financial support for distributed solar PV on all residential and commercial buildings (up to EUR 250, or USD 307, per kW-peak, depending on the building size and type). In addition, the city government passed a mandate requiring solar PV on all new buildings built on municipal plots, and requiring it on existing buildings in some neighborhoods. With this mandate, Heidelberg joins other German cities such as Amberg, Freiburg, Hamburg, Konstanz and Waiblingen that have similar solar PV requirements.

To decarbonise the transport sector, Heidelberg has joined the C40 Fossil Fuel-Free Streets Declaration and pledged to reduce the number of polluting vehicles on its streets and to transition away from fossil fuel vehicles. The city offers financial support for hydrogen vehicles as well as electric and hybrid vehicles. In 2020, the municipal utility started building up EV charging infrastructure throughout Heidelberg. To further support decarbonisation, the city also has expanded bike infrastructure and bike parking facilities.

Source: See endnote 126 in the *Urban Policy Landscape* chapter.

# JAKARTA

## INDONESIA

Land area ($km^2$)

**7,639**

Population size (2019)

**10.1 million**

Greenhouse gas emissions ($CO_2$ equivalent)

**34.5 million tonnes**




As the capital of Indonesia, Jakarta is taking effective action to reach its goal of reducing the city's greenhouse gas emissions 30% by 2030, a target set in 2012. The local action plan serves as a means to help achieve Indonesia's national emission reduction target of 29% by 2030, with a focus on renewable energy. Jakarta also committed in 2016 to reducing its water and energy consumption 30% and to achieving 30% renewables in its energy mix by 2030. To meet this latter target, the municipal government plans to increase its solar panel capacity by 600 kW-peak per year and to develop waste-to-energy plants.

The local government also is actively engaging citizens and stakeholders in the formulation of the Ikhtiar Jakarta ("city promise") initiative, which outlines Jakarta's commitments in the areas of energy, green buildings, transport, clean water, waste and disaster management. Six public consultations with a total of 300 attendees were conducted in 2018-19 to promote sustainable lifestyles and support the initiative. Jakarta also is developing a Regional Energy Plan (RUED-P), which contributes to achieving the targets set in the National Energy General Plan (RUEN) and the National Energy Policy (KEN).

In 2019, Jakarta implemented Governor Instruction No. 66, which mandates the city's Transmigration, Manpower and Energy Agency to install rooftop solar on large public buildings, including all schools, sport facilities, hospitals and government buildings during 2019-22. In 2019, a total solar capacity of 2,060 kW-peak was installed on 98 schools, bringing the combined rooftop solar capacity on schools and government buildings to 2,675 kW-peak and showcasing the great potential to minimise local carbon footprints.

Source: See endnote 100 in the *Citizen Participation* chapter.

In Jakarta

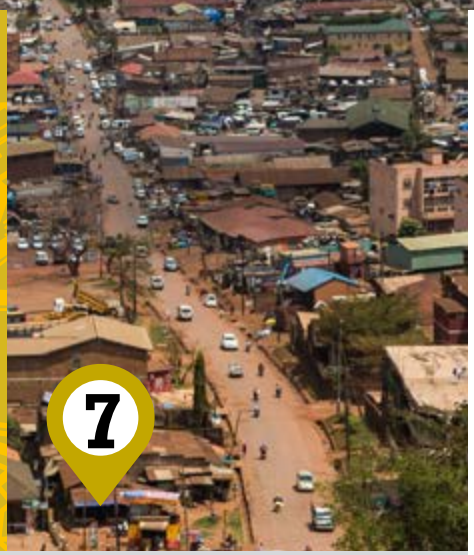
**citizens have actively helped**

shape the city's climate action plan.

# KAMPALA

## UGANDA

| Land area ($km^2$) | Population density (per $km^2$) | Population size | Total final energy demand (million GJ) |
|---|---|---|---|
| 189 | 8,021 | 1.7 million | 35.8 |




Kampala is the capital city and largest urban centre of Uganda, with more than 1.7 million inhabitants in 2020. As the country's economic hub, it accounted for 80% of Uganda's industrial and commercial activities in 2016 and generated around 65% of national GDP that year. City operations fall under the responsibility of the Kampala Capital City Authority (KCCA).

KCCA is a pioneer signatory to the Covenant of Mayors in Sub-Saharan Africa (joining in 2015), through which the city developed its first energy and climate action plan – the Kampala Climate Change Action Strategy – in 2016. This strategy frames KCCA's approach to furthering the deployment of renewables through assessing the local renewable energy potential, supporting the city's green economy, promoting the implementation of a feed-in tariff system and reducing the use of individual motorised transport in favour of non-motorised mobility and green and public transport. KCCA's strategy is consistent with the Draft National Energy Policy of 2019, which promotes the deployment of non-hydropower renewable generation sources to diversify the energy mix and thereby mitigate Uganda's over-reliance on hydropower, which accounted for 90.5% of the national electricity supply in 2018.

The transport sector dominates Kampala's energy demand, accounting for 45% of the total in 2016, followed by the residential (23%), industrial (21%) and services (11%) sectors. The majority of this energy demand is fuelled by fossil fuels used in transport (55%) and by (mainly traditional) biomass used for cooking and water heating (36%). After biomass, electricity (90% of which comes from hydropower) is the second largest non-transport energy carrier, accounting for 17% of total final energy consumption; it is used across the industrial, services and residential sectors, mainly for lighting, cooling and the powering of heavy machines.

The transport sector's large share of energy consumption is seemingly in contrast with Kampala's service-based economy. However, the service sector has low energy intensity, in part because 57% of businesses in the city were informal as of 2017, focused mainly on non-tradeable services such as retail, transport and restaurants. Informal roadside vending has added to city congestion, and significant passenger travel also occurs through inefficient transport modes such as motorcycles (boda boda) and private cars, which together accounted for 70% of total passenger transport energy demand in 2016.

These transport and mobility challenges helped shape KCCA's Climate Change Action Strategy 2016 and the Kampala City Strategic Plan 2025, which hinges on the principle of SMART mobility[i] to improve the efficient movement of people and goods within and through Kampala City. The City established an air quality monitoring and assessment system and is promoting electric mobility to gradually replace conventional commercial motorcycles as a way to reduce noise and air pollution, petrol demand and traffic jams.

KCCA's leadership has enabled successful public-private partnerships, and by 2020 start-ups such as Bodawerk and Zembo had resulted in the use of more than 200 new and retrofitted electric motorcycles for public transport in the city (charged mostly from the hydropower-dominant grid). Electric mobility through e-motorcycles provides a framework for KCCA to contribute to national and international climate change mitigation efforts by deploying renewables in the transport sector. Because electric motorcycles require little infrastructure, are silent and produce virtually no emissions (thereby improving air quality levels), they hold promise for successful uptake among boda boda riders.

Source: See endnote 74 through 87 in the *Feature: Renewable Energy in Sub-Saharan African Cities* chapter.

i The SMART mobility strategy, detailed in the Transport Master Plan for the Kampala Metropolitan Area, supports the construction and operation of a Mass Rapid Transit System based on buses, rail and cable cars by 2040.

# MALMÖ

## SWEDEN

Land area (km²)
76.8

Population size (2018)
344,000

Greenhouse gas emissions ($CO_2$ equivalent)
GHG
52.7 million tonnes

The City of Malmö has a track record of urban development initiatives that have led to its recognition as a pioneering sustainable city. The most well-known examples in the city are the Western Harbour district (Västra Hamnen), which has operated on 100% renewables since at least 2012, and Augustenborgin, an industrial area that has 450 square metres of solar thermal panels connected to the central heating system.

Malmö's goal is to make all city government activities climate neutral by 2020 and to ensure that the entire city runs on 100% renewables by 2030. Malmö plans to achieve its 100% renewable energy goal from a mix of renewable sources, waste-to-energy and recycled energy. As of 2020, around 43% of Malmö's energy was from renewable sources[i], primarily wind energy.

The city has identified two challenging sectors that need to be addressed to stay on track to achieving the 2030 goal: transport and district heating. Sweden's substantial district heating network was built in the 1950s, and many cities in the country have extensive systems. Malmö's district heating system runs on a combination of biomass and fossil fuels. To help reduce fossil-based energy use, all of the municipalities in southern Sweden send their waste to Malmö, where it is processed and converted to heat that is fed into the district heating network. For example, at the Sysav waste-to-energy facility, the waste is reduced through thermal treatment processes to produce energy in the forms of electricity and heat.

Additionally, Malmö is constructing a 50 $MW_{th}$ geothermal deep-heat plant[ii], which is expected to start operation in 2022. The city plans to build a total of five geothermal heat plants by 2028, each with an installed capacity of 50 $MW_{th}$, to replace the use of biofuels and biogas for heat generation. The estimated budget for this pilot project is EUR 5.4 million (USD 6 million), with the Swedish Energy Agency providing EUR 1.2 million (USD 1.34 million). The city's partners include E.ON, a privately owned energy supplier that is investigating the geological conditions, as well as the Swedish Geological Survey and the University of Uppsala.

Malmö is replacing the use of biofuels and fossil fuels in heat generation with **geothermal heat** in order to achieve its energy and climate goals.

Source: See endnote 137 in the *Markets and Infrastructure* chapter.

i This includes organic waste incineration and industrial waste heat.

ii Boreholes will be in the range of five to seven kilometres deep, and the temperature of around 160°C is expected to be sufficient to directly enter the district heating network. This project will be one of Europe's first geothermal power plants to extract heat from such a depth at the industrial level.

# NORTH LOMBOK REGENCY

## INDONESIA

9

Land area ($km^2$)

776.3

Population size

200,000

North Lombok is the youngest regency (municipality) in the Indonesian province of West Nusa Tenggara, located on Lombok Island. Energy demand in West Nusa Tenggara totalled more than 1,950 GWh in 2019 and was growing by 5.9% annually. With increased economic development in the region, energy demand is expected to continue to grow rapidly to 2030.

To reduce greenhouse gas emissions in the city and to support the provincial target to generate 35% of electricity from renewable sources by 2025, the local government has set ambitious goals to deploy renewables in a cost-efficient and sustainable manner. North Lombok has rich potential for cheap biomass residues and opportunities to harness wind and solar energy. Out of 8.97 MW of operating power plant capacity in North Lombok, 8.82 MW is derived from renewables, primarily micro-hydropower (the 7 MW Segara and 1 MW Santong plants) and solar energy in Gili Islands.

To support local communities, the North Lombok government developed a Cost-sharing Financing Scheme for Household-scale Biogas to simultaneously reduce dependence on traditional biomass and cut greenhouse gas emissions in the residential sector. Although this scheme was originally an initiative of the provincial government, the North Lombok government has taken measures to adopt it in the city region. The cost is shared between the local government and Hivos / Yayasan Rumah Energi, along with the household users of the biogas, who pay a small amount to ensure citizen participation and ownership.

As of 2020, some 1,152 household-scale biogas units using organic waste had been installed in the North Lombok region through this scheme. The cost of one unit of biogas is IDR 13 million (USD 933), and the local government shares this amount by contributing IDR 4-5 million (roughly USD 290-360) per unit (30-40%). To support the technical portion of the project, Hivos / Yayasan Rumah Energi provide high-quality biogas digesters to the users as well as three years of after-sales service for civil buildings and one year for pipe and stove installations.

Source: See endnote 29 in the *Financing and Investment in Cities* chapter.

# ORLANDO

## FLORIDA (UNITED STATES)

Land area ($km^2$)
295

Population size (2020)
over 280,000

Greenhouse gas emissions ($CO_2$ equivalent)
6,994,170 tonnes

10

The City of Orlando has a strong reputation for its city-wide achievements in sustainability and resilience. Over the last decade, the Green Works Orlando initiative has revolutionised the city by adding a sustainability chapter to the local municipal code. The implementation of sustainability policies and plans has made the city a leader in developing environmentally friendly communities.

In 2020, the Orlando Utilities Commission (OUC) began developing its Electric Integrated Resource Plan, with the aim of becoming carbon neutral by 2050 (with interim $CO_2$ emission reduction targets of 50% by 2030 and 75% by 2040). The plan also acts as a pillar to achieve the mayor's ambitious goal of 100% renewable electricity generation[i] in the city by 2050. It supports the phase-out of coal by 2027 and provides a roadmap to diversify the city's existing electricity mix. Although solar PV will remain the main source of new energy, Orlando will invest in energy storage and other related technologies to ensure reliability and resilience.

The OUC has a major role in making solar energy affordable and accessible in the city and has found innovative ways to harness power from the sun. In 2017, it established long-term power purchase agreements to buy power from the 12.6 megawatt (MW) Kenneth P. Ksionek Community Solar Farm, the first in the country to include a solar PV array that sits atop a by-product landfill. In 2020, the OUC backed the construction of two new solar PV farms – the Harmony Solar Energy Center in St. Cloud and the Taylor Creek Solar Energy Center in east Orange County[ii], together capable of powering 30,000 homes – and started purchasing power from them.

Orlando also is home to more than 1 MW peak of floating solar PV and has been a pioneer in this new application since 2017. The OUC will to continue to study the performance and scalability of floating solar PV in collaboration with the National Renewable Energy Laboratory thanks to a USD 1 million grant from the US Department of Energy. In 2020, the City of Orlando unveiled the new "floatovoltaics" at its international airport, showcasing this unique solar application. The local government has installed several "solar sculptures" and "solar trees" in the city to generate electricity and educate customers on the benefits of solar power.

Source: See endnote 5 in the *Urban Policy Landscape* chapter.

i According to the CDP-ICLEI Unified Reporting System, the share of renewables in electricity generation in Orlando was 2% (no date specified).

ii These are two of five projects being developed in the context of the Florida Municipal Solar Project, a partnership between the Florida Municipal Power Agency and 16 Florida public power utilities, including the OUC.

# OXFORD

## UNITED KINGDOM

11

| Land area (km²) | Population size (2019) | Greenhouse gas emissions ($CO_2$ equivalent) |
|---|---|---|
| 45.6 | 152,450 | 718,082 tonnes |

In January 2019, Oxford City Council unanimously declared a climate emergency in Oxford and agreed to create a Citizens' Assembly to help consider new carbon targets and additional measures to reduce emissions in the city. As a result, Oxford aims to become a net-zero carbon emitter by 2030, a full 20 years ahead of the UK national target. In addition, Oxford City Council pledged to achieve net-zero carbon emissions in its own operations by the end of 2020, after the Citizens' Assembly requested such a move. Oxford City Council is a member of Low Carbon Oxford, a network of 40 public and private organisations that aimed to reduce city-wide emissions 40% below 2005 levels by 2020. Oxford also is part of the UK100, a network of local government leaders who have pledged to shift to 100% clean energy by 2050.

To decarbonise energy in transport and heat systems (the major sources of carbon emissions in Oxford) and to achieve the 40% emission reduction, the City Council has facilitated an energy storage project, the Energy Superhub Oxford (ESO). It expected to be the world's largest hybrid energy storage system, with a 50 MW grid-scale battery[i] that will support a 10-kilometre network of EV charging points and ground-source heat pumps for around 300 households.

The ESO project, which started construction in 2020, will help reduce 20,000 tonnes of $CO_2$ annually by 2021 and 44,000 tonnes of $CO_2$ annually by 2032. The project will be capable of integrating multiple sources of energy to manage energy demand, including renewables. Because Oxford is part of the UK100 network, by 2050 the ESO is to run entirely on renewable energy.

The GBP 41 million (USD 53.8 million) project will help accelerate the use of electric vehicles in Oxford, by providing charging points powered by the spare capacity of the battery to City Council depots and key businesses including local bus companies, taxi providers and commercial fleet depots. The project also aims to develop the first rapid charging hub in Oxford, making available around 20 ultra-rapid EV chargers for public use. Charging speeds will range between 10 and 30 minutes.

The project scope also includes a "Trial before you buy" programme by the City Council for taxi drivers in Oxford. This will help the taxis transition from 100% diesel to 100% electric by 2025. In total, the ESO pilot project will last for 36 months; once successful, the technology is to be expanded to up to 44 other sites across the United Kingdom.

Source: See endnote 248 in the *Markets and Infrastructure* chapter.

i The battery, connected to the Cowley sub-station in Blackberry Lane, South Oxford, will store and deliver electricity (including renewable electricity) to electricity suppliers and help balance the local requirements for the grid. Electricity will be stored at times of low demand and then resupplied back to the grid when demand peaks. The technology is capable of shifting demand to periods of low prices, minimising consumers' energy bills and overcoming local network constraints.

# PALMAS

## BRAZIL

Land area (km²)
100.6

Population size (2020)
306,000

12

Palmas City, the capital of the state of Tocantins in north-central Brazil, aims to generate 100% of its electricity from solar power by 2022 and to have 100% of its local electricity energy supply based on solar energy by 2035 (foregoing the use of hydropower from the regional grid). Hydroelectric dams located on the Tocantins River account for nearly 97% of the electricity consumed in the city, in addition to providing power elsewhere in the country. However, electricity bills in Palmas are among the highest in Brazil, and growing uncertainties about hydropower's stability and climate and environmental risks have heightened interest in exploring the local solar resource.

The Palmas Solar project, established in 2015, provides tax incentives for companies and households to install solar PV panels and to feed surplus generation to the electricity grid. The benefits include reducing the city's dependence on hydropower and non-renewable energy sources, improving air quality and reducing greenhouse gas emissions. The main drivers for reducing hydropower are rising energy bills and the environmental risks of this generation source.

At first, the project focused on solar PV installations only in new buildings, but it has since extended city-wide. Users are encouraged to install solar panels in exchange for a discount of up to 80% on two municipal taxes – the Property and Urban Land Tax and the Real Estate Transfer Tax – for a period of five years. The costs for private users are drastically reduced, as the solar power they generate is fed into the grid and discounted from their energy bills. The local utilities maintain the distribution infrastructure, for which users pay a minimal equipment cost.

For Palmas, the tax incentives did not affect public revenue because the project was launched right after a tax increase, foreseeing that a share of municipal revenue would be allocated to this project. Three private banks, Banco da Amazônia, Banco do Nordeste and Banco do Brasil, have helped finance any remaining costs. The programme has led to the creation of a solar PV market with more than 20 local enterprises selling and installing imported or locally manufactured solar panels. As of October 2020, the city had granted discounts totalling BRL 415,785 (around USD 103,000) and supported 3.8 MW of installed decentralised generation capacity under the Palmas Solar programme.

In parallel, Palmas implemented the Parque Solar project. During phase 1 of the project in 2018, the government-owned bank Caixa Econômica Federal provided financing to install solar panels on public schools, saving the municipality an estimated BRL 5,000 (USD 1,240) per month. Phase 2 involves building a 5 MW solar farm to power all municipal buildings with solar energy, although funding is yet to be secured.

Source: See endnote 6 in the *Financing and Investment in Cities* chapter.

# RAJKOT

## INDIA


| Land area ($km^2$/2015) | Population size (2018) | Greenhouse gas emissions ($CO_2$ equivalent) |
|---|---|---|
| 129.2 | 1.8 million | 1,887,684 tonnes |

Rajkot, the fourth largest city in the western Indian state of Gujarat, has committed to reducing its greenhouse gas emissions 14% by 2022-23 (from 2015-16 levels). Energy consumption in residential buildings totalled 606 million kWh in 2015-16, accounting for around half of all electricity consumption and contributing 35% of greenhouse gas emissions from economy-wide activities in the city. Recent efforts have focused on reducing energy consumption and enhancing energy efficiency in residential buildings. The Capacity Building for Low Carbon and Climate Resilient City Development project (CapaCITIES) has helped maximise the use of renewables in the city, reducing the need to tap into the predominantly coal-based national grid.

The Krantiveer Khudiram Bose social housing complex (known as 11A) consists of five buildings with a total of 140 dwelling units. At full occupancy, common amenities (lifts, lights, pumps, etc.) consume 3,000 kWh of electricity per month. To encourage the adoption of solar PV, a 31.5 kW-peak grid-connected solar PV system is being installed on-site and will be operated and maintained by the contractor/developer for a period of 10 years. The system consists of 100 polycrystalline solar PV panels of 315 watt-peak capacity each, mounted on a frame at a 21-degree panel tilt. It will generate around 3,780 units of electricity per month (45,360 kWh per year) and has the potential to reduce 37 tonnes of $CO_2$-equivalent greenhouse gas emissions annually. Overall responsibility for the safety, security and periodic cleaning of the panels will lie with the township's Residential Welfare Association, which has been trained on panel maintenance.

Because of its efforts in low-carbon action and community engagement, Rajkot Smart City was selected as the national winner of WWF's Global One Planet City Challenge in 2020. Other noteworthy initiatives in Rajkot that support this award include: the installation of 9,629 kWh of grid-connected solar PV systems on residential buildings (with a further proposed 500 kWh on municipal buildings); retrofitting of 63,178 public street lights with light-emitting diodes (LEDs), resulting in annual energy savings of 11.5 million kWh; the implementation of Smart Ghar III, an affordable green home concept aimed at maintaining indoor thermal comfort with minimal climate impact; and plans to replace diesel buses with electric ones, along with the provision of solar PV charging.

Source: See endnote 124 in the *Urban Policy Landscape* chapter.

# RECIFE

## BRAZIL

Land area (km²)
218

Population size (2018)
1.6 million

Greenhouse gas emissions ($CO_2$ equivalent)
2.9 million tonnes

14

Recife, an Atlantic seaport in north-eastern Brazil, is the first city in the country to formally declare a climate emergency. According to the Intergovernmental Panel on Climate Change, Recife is the 16th most vulnerable city in the world to climate change. Drastic changes in the local weather have motivated the local government to make commitments towards a low-carbon future. In 2019, in response to its climate emergency declaration, Recife committed under the City Climate Action Plan to becoming carbon neutral by 2050. The local government also aims to achieve 100% renewable energy in city-wide operations by 2037.

In 2013, Recife created two municipal fora, Comclima and Geclima, to formulate climate change and sustainability policies. As a part of the Urban LEDS project, the city also has developed measures to reduce its greenhouse gas emissions. Under the Urban LEDS network, Recife was selected to receive support from the climate finance laboratory to install a pilot 17 kW-peak solar PV system at the Women's Hospital of Recife (HMR), which is expected to be operational by 2021. In addition, Recife City has approached a local energy company, Companhia Energética de Pernambuco (CELPE), to finance an initial investment of EUR 200,000 (around USD 225,000) to help define model financing for energy efficiency measures, distributed generation and replicability of actions in other buildings in the municipality.

To assist the city's sustainable development efforts, the Energy Efficiency Program (PEE) – promoted by CELPE in the regulations

of the National Electrical Energy Agency (ANEEL) – provides 0.4% of the net operating revenue of local energy companies to fund research and development projects and the implementation of energy efficiency and renewable energy measures in the city. To promote greater citizen participation, CELPE holds public hearings where it presents the plans and results of renewables and efficiency projects in the region. Through public calls, it seeks partners to promote the development of new technologies, transform energy efficiency markets and create rational habits and practices for the use of electricity.

Source: See endnote 139 in the *Citizen Participation* chapter.

# SEOUL

## REPUBLIC OF KOREA


| Land area ($km^2$) | Population size (2020) | Greenhouse gas emissions ($CO_2$ equivalent) |
|---|---|---|
| 605 | 9.9 million | 46,685,000 tonnes |

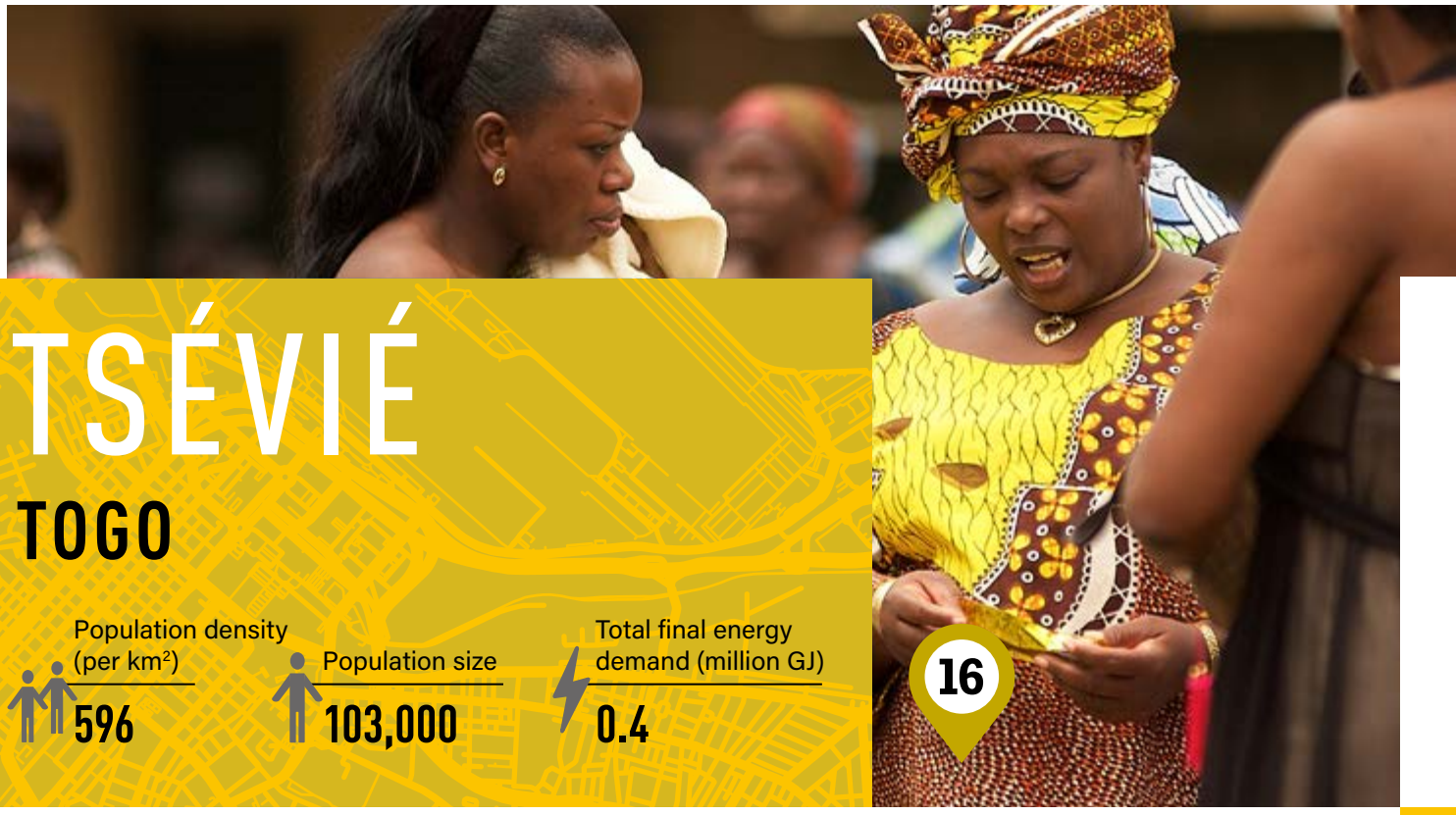
In July 2020, Seoul, the capital of the Republic of Korea, responded to the country's commitment to achieve climate neutrality by 2050 by developing an integrated policy approach focused on five key areas: buildings, mobility, forestry, clean energy and waste management. Seoul's vision is to be a sustainable city where "human, nature and future co-exist".

The Republic of Korea's policy approach towards climate neutrality mirrors the EU's Green Deal to achieve net-zero emissions and respond to climate change. By 2025, the Korean government will invest around USD 37 billion in Green New Deal policies and a further USD 7 billion in carbon-cutting measures. Seoul has put forward two intermediate goals ahead of the 2050 climate-neutrality goal: to achieve 40% emission reduction by 2030 and 70% emission reduction by 2040 (compared to 2005 levels).

Since 2012, Seoul has adopted policies to reduce its dependency on nuclear energy through two phases of the One Less Nuclear Power Plant Project. In 2017, Solar City Seoul was launched with the goal of adding 1 GW-peak of solar power capacity by supplying PV panels to 1 million households by 2022. The programme, which has a budget of around USD 1.46 billion (funded mostly by public investment), aims to reduce $CO_2$ emissions by 544,000 tonnes annually and to add 4,500 new jobs by 2022. The programme exceeded its intermediate goal by installing a total of 357.1 MW of solar panels for 285,000 households by 2019.

One of the challenges facing the Solar City Seoul programme is securing enough space at buildings and public facilities to install solar panels. As part of the green energy initiative of the Seoul 2050 climate neutrality plan, Seoul is identifying new installation sites (including urban infrastructure); increasing the standards for solar generation in zero-energy buildings; providing subsidies for building-integrated PV; extending the feed-in tariff system to on-site solar power generators and supporting new solar PV technology.

Source: See endnote 137 in the *Urban Policy Landscape* chapter.



# TSÉVIÉ

## TOGO

Population density (per km²)
596

Population size
103,000

Total final energy demand (million GJ)
0.4

16

Tsévié, a small town 35 kilometres north of Togo's capital Lomé, had a population of around 103,000 in 2017, growing at a rate of 2.8% annually. The town has minimal industrial activity, and its economy is built largely on agricultural activities centred on crop production and livestock farming, generating a low annual economic output of USD 519 per capita.

Togo's electricity infrastructure development plan, as outlined in the national Electricity Sub-Sector Strategic Plan of 2010, is based on a least-cost electricity supply and demand balance, taking into account security of supply and the environment. This led to the development of the Togo National Action Plan for Energy Efficiency (PANEE) and the Togo National Renewable Energy Action Plan (PANER), which respectively define the country's objectives for energy efficiency and renewable energy deployment by 2030. The national objective for renewables is to increase the share of solar PV in total final energy consumption to 10% in 2030, including both on- and off-grid PV.

Due to Tsévié's low levels of industrialisation and electricity access (estimated at 24% in 2017), traditional biomass in the form of wood and charcoal is the single most important fuel in the peri-urban settlement. Traditional biomass accounts for 64% of total final energy consumption and is used to meet household cooking and water heating needs. The residential sector is responsible for 73% of total final energy consumption, followed by the transport sector (25%) and the town's few commercial facilities (2%). Because of the low levels of electrification, the town's street network is largely unilluminated, limiting potential economic activity in the evenings.

To boost local energy access and development, Tsévié implemented a three-year municipal energy programme (2017-2020) under the Covenant of Mayors in Sub-Saharan Africa, with the goal of developing a community-wide energy and climate action plan (the Plan d'Action en faveur d'un Accès à l'Energie Durable et du Climat (PAAEDC) de la commune de Tsévié). Under this flagship programme, the municipality aims to achieve its sustainability ambitions in four strategic areas: 1) sustainable biomass use, 2) deployment of distributed rooftop solar PV, 3) increased adoption of electric motorcycles and 4) a modal shift to public transport.

Under the PAAEDC framework and with funding from the European Union, Tsévié led a series of pilot projects in 2018-2020 to boost energy access and development and increase the share of renewables in energy consumption. To improve access to clean cooking facilities, the municipality distributed 8,200 improved and efficient cook stoves in the town and its environs as a means to limit the prolific household use of traditional biomass for cooking and water heating (and thus improve indoor air quality and human well-being). The city also sought to bridge the electricity access gap and to improve lighting solutions by installing 75 solar street lamps for public lighting, distributing 95 solar home systems to the most vulnerable households and installing five community solar kits in schools.

To boost local energy access and development, Tsévié implemented a

**three-year municipal energy programme.**

Source: See endnote 88 through 100 in the *Feature: Renewable Energy in Sub-Saharan African Cities* chapter.

# VANCOUVER

## CANADA

| Land area ($km^2$) | Population size (2017) | Greenhouse gas emissions ($CO_2$ equivalent) |
|---|---|---|
| 115 | 675,000 | 2,440,000 tonnes |

17

The City of Vancouver has gained global attention for its sustainable urban development strategies in recent decades. Many cities have attempted to transfer the "Vancouver model" – comprising an integrated policy approach to sustainable urban development – to their local contexts. Vancouver aims to generate 55% of its total energy from renewables by 2030 and 100% by 2050. Currently, the share is 31%, primarily from hydropower and a small percentage of biomass, biofuels, wind and solar energy.

Vancouver's integrated policy approach links energy use and improved infrastructure with sustainable urban development. The Renewable City Strategy, published in 2015, addresses the energy question in the context of environmental, economic and social sustainability. The urban development goal of the City of Vancouver is to plan a liveable and sustainable city, and energy use is an integral part of it. To achieve this, the City has implemented complementary strategies such as the Neighbourhood Energy Strategy (2012) and the Climate Emergency Response (2019).

The Neighbourhood Energy Strategy aims to accelerate several measures, including: reducing the number of trips via single-occupancy vehicles and shifting to more sustainable modes of travel; building public EV charging infrastructure; and improving energy efficiency in buildings through green building policies, bylaws, plans and design standards. The Neighbourhood Energy Strategy is aligned with the city's overall plan for 100% renewable energy by 2050, which calls for all district energy systems to run on 100% renewables by 2050. The Strategy has helped develop additional neighbourhood energy systems supplying centralised heating, hot water and cooling for multiple buildings throughout Vancouver. Vancouver's climate work also relies on a Climate and Equity Working Group to ensure that new policies strive to support the local economy and improve equity[i].

As part of its Climate Emergency Response, the city also adapted a long-term climate target of being carbon neutral before 2050, complementing its 100% renewable energy target. In 2020, the city council approved a ban on fossil fuel appliances for all residential buildings. The bylaw requires zero-emission space and water heating for all residential buildings of three storeys or less as of January 2022.

Also in Vancouver, the Sewage Heat Recovery Expansion Project will increase the capacity of the Neighbourhood Energy Utility[ii] to provide buildings in the False Creek area with low-carbon heat and hot water using waste thermal energy captured from sewage. The project recycles waste heat and uses a mix of renewable and conventional natural gas to reduce emissions[iii]. Expansion plans approved in 2018 would result in 2.1 million square metres of city building space being served, with an expected reduction of 14,000 tonnes of $CO_2$ equivalent per year by 2021.

Source: See endnote 184 in the *Urban Policy Landscape* chapter.

i To support the city's climate targets, in 2020 the Vancouver City Council approved an ambitious CAD 500 million (USD 383 million) climate action plan that aims to reduce natural gas heating in existing buildings, discourage vehicle use and explore less-polluting ways to produce and transport construction materials.

ii The utility is self-funded, simultaneously providing a return on investment to city taxpayers and affordable rates to customers. The utility began operations in 2010 and as of 2019 had served 534,000 square metres of building space.

iii This mix eliminates more than 60% of the greenhouse gas pollution associated with heating buildings in the city.

# YAOUNDÉ IV

## CAMEROON

| Land area ($km^2$) | Population density (per $km^2$) | Population size | Total final energy demand (million GJ) |
|---|---|---|---|
| 59 | 13,445 | 793,000 | 7.6 |




Yaoundé IV is one of the seven communes of Yaoundé (Cameroon), with an estimated 793,000 inhabitants in 2018 spread over an area of around 59 square kilometres. Yaoundé IV is primarily a service-oriented city, with a major informal economy that includes unlicensed street vendors (locally referred to as "sauveteurs") and small neighbourhood boutiques. This translates to a low annual economic output (GDP) of around USD 1,632 per capita, comparable to the Sub-Saharan African average of USD 1,585 per capita.

Renewable energy (exclusively from hydropower) makes up 73% of the power generation mix in both Cameroon and Yaoundé IV, with oil and gas constituting the remaining 27%. Based on the national Economic Emergence Plan 2035, the country has ambitions to deploy increasing amounts of renewable energy, particularly hydropower and solar PV, to reduce its greenhouse gas emissions by 32% by 2035.

Although the national government does not allow municipalities to undertake electricity generation and distribution projects, a number of decrees provide local authorities with the ability to receive technical and financial support towards climate action.

Yaoundé IV's residential sector is the second most energy-intensive sector (accounting for 30% of total final energy consumption) after transport (35%). An estimated 86% of households cook and heat their water with LPG, which represents 51% of the total residential final energy use. Household electricity consumption averages 507 kWh per capita per year, above the national average of 280 kWh, and is used mostly for lighting and water heating services.

As a signatory city of the Covenant of Mayors in Sub-Saharan Africa, Yaoundé IV in 2020 adopted its short-term energy and climate action plan (Plan d'Action Communal en faveur d'un Accès à une Energie Durable et du Climat, or PACAEDC), which sets out the municipality's ambitions to reduce greenhouse gas emissions and increase energy access by 2030. As part of the plan, the city aims to increase the renewable energy share through multiple cross-sectoral actions, such as installing 3,000 solar streetlights in the 65 neighbourhoods, installing distributed rooftop solar PV on 30 municipal buildings, distributing 3,600 solar kits to poor households and incentivising increased adoption of electric motorcycles (to 5% by 2030, running mostly on electricity from the hydropower-dominant grid).

The city aims to increase renewable energy, installing 3,000 solar street-lights and distributing **3,600 solar kits** to poor households.

Motivated by studies suggesting that switching to biogas to offset just 20% of household LPG use could reduce residential greenhouse gas emissions by more than 12%, the municipality (through the PACAEDC) rolled out a demonstration project in 2019 to build nine micro biogas plants, each with a capacity of 20 cubic metres. As of 2020, six of the systems were operational, meeting the cooking energy demand of 135 low-income households with biogas. The success of the project has paved the way for similar programmes, notably ENERGIE PLUS, a municipal energy programme which in collaboration with relevant national entities and international donors seeks to build an industrial-scale biogas plant to supply electricity to Yaoundé IV and its environs.

Source: See endnote 101 through 114 in the *Feature: Renewable Energy in Sub-Saharan African Cities* chapter.

## RENEWABLE ENERGY POLICY NETWORK FOR THE 21st CENTURY

REN21 is the only **global renewable energy community** of actors from science, governments, NGOs and industry. We provide up-to-date and peer-reviewed facts, figures and analysis of global developments in technology, policies and markets. Our goal: enable decision makers to make the shift to renewable energy happen – now.

The most successful organisms, such as an octopus, have a **decentralised intelligence** and "sensing" function. This increases responsiveness to a changing environment. REN21 incarnates this approach.

Our more than **2,000 community members** guide our co-operative work. They reflect the vast array of backgrounds and perspectives in society. As REN21's eyes and ears, they collect information and share intelligence, by sending input and feedback. REN21 takes all this information to better understand the current thinking around renewables and change norms. We also use this information to connect and grow the energy debate with non-energy players.

**Our annual publications**, the *Renewables in Cities Global Status Report* and the *Renewables Global Status Report*, are probably the world's most comprehensive crowd-sourced reports on renewables. It is a truly collaborative process of co-authoring, data collection and peer reviewing.

# ABOUT REC 2021

REN21's *Renewables in Cities Global Status Report (REC)* series provides an overview of the status, trends and developments of renewable energy in cities, using the most up-to-date information and data available. The REC's neutral, fact-based approach documents in detail the annual developments in policies, markets, investments and citizen action, with a particular focus on renewables in public, residential and commercial buildings as well as public and private urban transport. The REC complements REN21's *Renewables Global Status Report*, which covers renewable energy market, industry and policy trends. Jointly, these reports contribute to making renewable energy visible in the global debate, drawing decision makers' attention to renewables and continuously providing better data and tracking to inform energy decisions worldwide.

REC 2021 is the result of a collaborative effort, building on REN21's unique data and reporting culture, with more than 330 data contributors and peer reviewers and over 30 individual interviews from around the world. The report is endorsed by an Advisory Committee of more than 20 organisations, including major renewable energy players and city networks. In this collaborative process, data are collected on hundreds of cities, ranging from mega-cities to small and medium-sized cities and towns. Collectively, this report aims to inform decision makers and to create an active exchange of views and information around urban renewable energy.

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
of the Federal Republic of Germany

Covenant of Mayors in Sub-Saharan Africa

This programme is co-funded by

European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

MINISTERIO DE ASUNTOS EXTERIORES, UNIÓN EUROPEA Y COOPERACIÓN
aecid