



MOSCOW
ECONOMY



MOSCOW DEPARTMENT
FOR ECONOMIC POLICY
AND DEVELOPMENT



城市创新
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BRICS Urban Climate Agenda Report



August 2024



Results by Category



Energy Sources

Increased electricity production has a direct correlation with economic growth and industrial expansion, as confirmed by studies conducted in many countries, including BRICS members [46]. However, **power generation from fossil fuels is the largest contributor to climate change**, accounting for about 44% of global energy-related CO₂ emissions [8]. By comparison, the share of carbon emissions from fuel combustion by all modes of transport is about 23% [8].

Over the past decades, **the BRICS countries have demonstrated accelerated growth in electricity production**. Between 1990 and 2021, annual power generation volumes in the countries of the organization increased by more than 5 times, while global generation over the same period increased by only 2.4 times [8].

Given that electricity production is vital for economic growth, **the key solution for the BRICS countries on their way to low-carbon development is the decarbonization of the electricity sector**, in particular, by abandoning coal generation and increasing the share of renewable energy.

Large cities as the main consumers of energy play an important role in this process. Even in cases where electricity supply management issues fall beyond the control of city governments, they can **promote renewable energy through financial incentives, regulatory measures and mechanisms for purchasing electricity for their own needs**.

Indicators

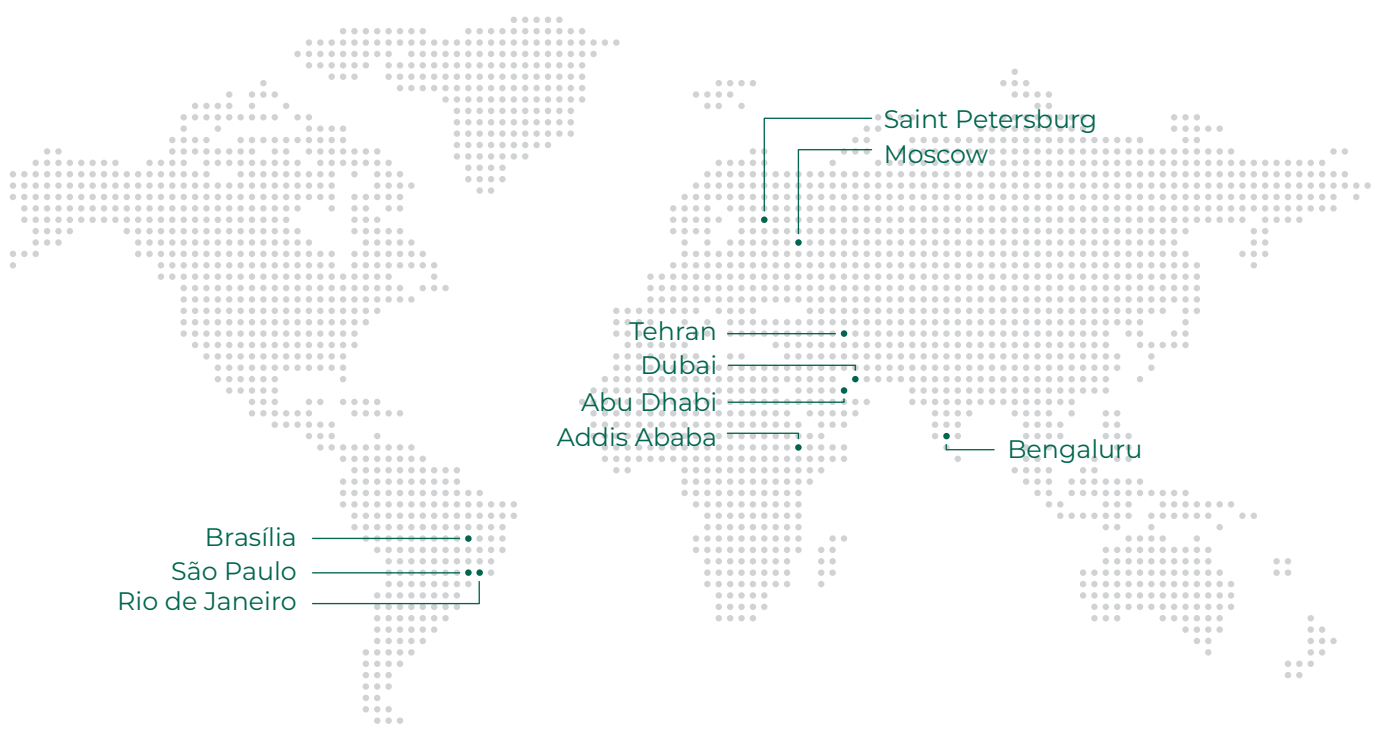
- Carbon intensity of city's electricity consumption

The greater the share of electricity generated by the combustion of fossil fuels (in particular, coal as the most carbon-intensive one) in a city's consumption mix, the higher the value of the indicator.

- Targets to increase generation and consumption of renewable energy


Leaders

1. In three cities from the leading group – **Brasília, São Paulo and Addis Ababa** – more than 90% of the consumed energy is produced from renewable energy sources. Most of the electricity consumed in these cities is generated by hydroelectric power plants located outside their borders. Since the electricity consumption in these cities largely depends on supplies from other regions, **the energy goals in their climate plans focus on the development of decentralized generation by equipping city buildings with solar panels and collectors (São Paulo, Addis Ababa) and installing photovoltaic systems in undeveloped areas (Brasília).**
2. **Abu Dhabi, Dubai, Moscow, Saint Petersburg and Tehran**, which are also in the group of leaders, **have natural gas as the dominant source of consumed electricity and have no coal generation.** The highest share of alternative sources of energy (renewable energy and nuclear energy) among the cities in this group is in Saint Petersburg and Dubai due to their proximity to large nuclear (Saint Petersburg) and solar (Dubai) power plants. In the other three cities, the share of such sources in the generation of their electricity supply is insignificant. **Goals to increase the proportion of alternative sources** in the energy balance **up to 2050** are set by **Abu Dhabi, Dubai and Tehran. In Moscow and Saint Petersburg**, the potential for the development of renewable energy sources is limited because of natural climatic conditions, and therefore they **don't have long-term goals to increase the capacity of renewable energy.**
3. The relatively low carbon intensity of the power sector in **Rio de Janeiro** and **Bengaluru**, where coal generation is present, has been made possible by a high share of renewable energy sources.





Energy Consumption

In terms of energy consumption growth rates and share in the global structure of final energy consumption over the past 30 years, electricity has significantly outpaced other traditional energy sources, including coal, petroleum products and natural gas. When compared with 1990, **global electricity consumption in 2021 increased by 2.5 times, and its share grew from 13% to more than 20%**, exceeding the share of natural gas and being second only to oil products, which are primarily used as fuel for transport [8].

Given the growing importance of electricity for the global economy, its **efficient use** not only helps reduce the anthropogenic impact on climate, but also **creates additional incentives for economic growth**.

Improving energy efficiency at the national and global level is impossible without the contribution of large cities, where a significant proportion of energy is consumed. Thus, **the 20 cities represented in the study account for more than 2% of the total electricity consumption in BRICS countries**, and in some cities (Abu Dhabi, Addis Ababa, Dubai, and Cairo) the volume of electricity consumption is more than 10% of the total electricity consumption in their respective country [8].

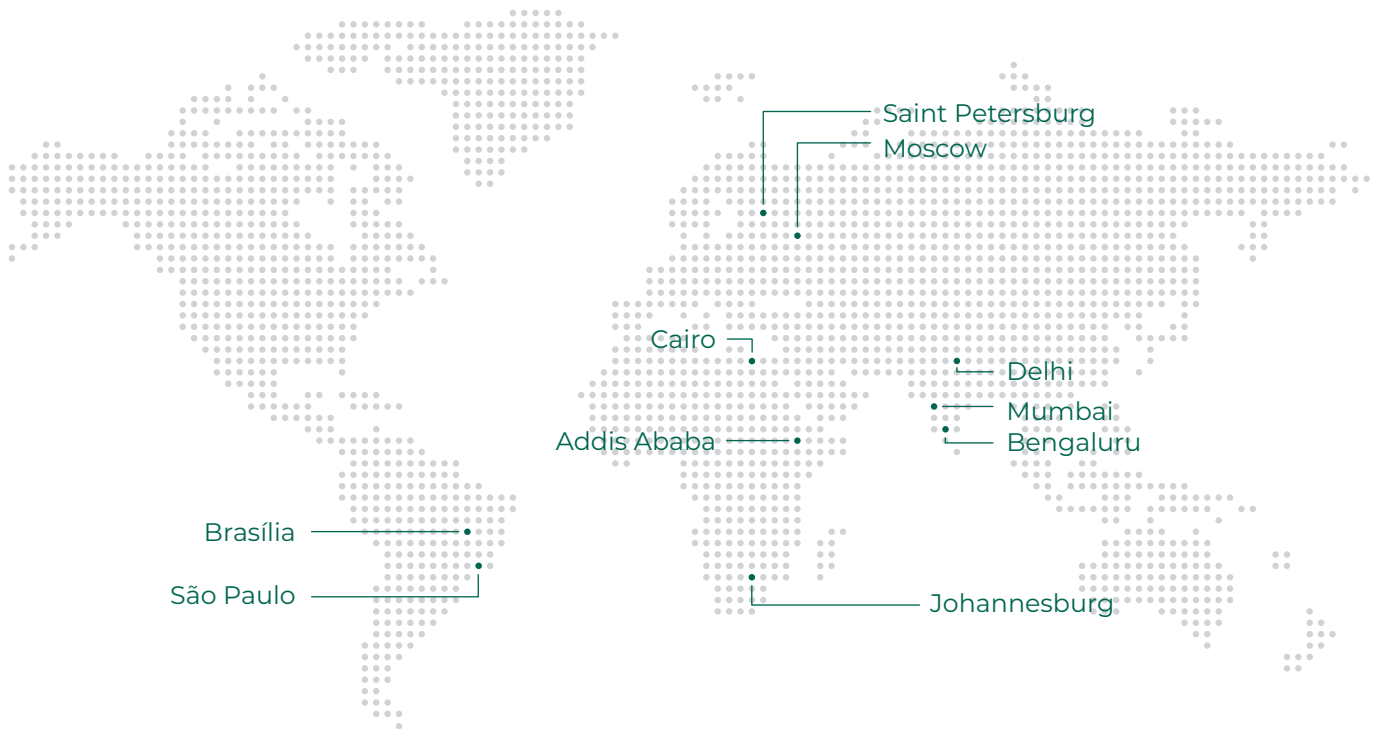
Indicators

- Electricity consumption per unit of city's GDP

In order to ensure comparability, the volume of urban electricity consumption per unit of city's GDP is adjusted for temperature.

- Targets to reduce energy consumption and increase energy efficiency of the city's economy or its individual sectors

Leaders



1. There is **a lot of variances among the cities in terms of electricity consumption per unit of city's GDP**. Even before temperature adjustment, the volume of electricity consumption by cities per thousand dollars of city's GDP varies in the range from less than 50 kW*h to more than 200 kW*h. The average electric intensity of city's GDP for the 10 leading cities in this category is 2.5 times lower than the average for the cities from the second ten.
2. Most of the cities in the study have **lower values of electricity consumption per unit of city's GDP than the national level**. This pattern is observed both in the cities from the leading group and in the 9 cities that rank lower, including Shanghai and Guangzhou, where the bulk of electricity consumption falls on industrial enterprises, while households and the commercial sector together account for only about a half of total electricity consumption. This means that **the differences in electricity intensity indicators are not fully determined by the structure of the economy, but largely depend on the level of energy efficiency of the urban economy**.





Transport

Since transport emissions are concentrated in cities, measures to reduce the negative impact of this sector on climate are a priority for the urban climate agenda.

For large BRICS cities, the issues of decarbonizing the transport system are of particular relevance, since in recent decades these cities have seen **a rapid increase in the number of private motor vehicles**, first of all associated with rising prosperity [47]. In 2021, out of the top 10 cities with the highest value of the TomTom Traffic Index, which measures the level of road congestion, 5 were located in BRICS countries [48].

The Intergovernmental Panel on Climate Change (IPCC) estimates that **the transport sector accounts for about a quarter of global carbon emissions** related to energy consumption, and has seen the highest growth rate among all fuel combustion sectors over the past decade [49].

Indicators

- Share of city residents who regularly travel to places of work or study using clean modes of transportation, which include public electric transport, private electric vehicles, and personal mobility devices (PMDs), walking or work from home
- Targets to increase the share of clean transport in the city's vehicle fleet and reduce the number of trips by private cars

Leaders



1. In the top 10 cities in this category, **more than a third of city residents regularly use clean modes of transportation**, with their share exceeding 50% in 5 of them (Guangzhou, Moscow, Beijing, Saint Petersburg, and Shanghai). By contrast, in the cities of the second ten, the average share of residents getting to work or school by clean transport is about 16%.
2. In the leading cities, despite their size and relatively high income levels, **personal transport is not the main means of transportation**, and most city residents use public transport for regular trips or travel on foot. At the same time, **the usage of PMDs is relatively low**, which is a typical feature of most of the cities in the study. Thus, only in 2 cities — Bengaluru and Mumbai — the proportion of residents who regularly use bicycle exceeds 10%.
3. Another important **factor contributing to the gap** between the leaders and the other cities **is the level of electrification of ground public transport**. In this area, China's cities stand out from the rest, with the share of electric vehicles in the city bus fleet ranging from 60% to more than 90%, with the average for the top 10 cities in the study being only 31%.

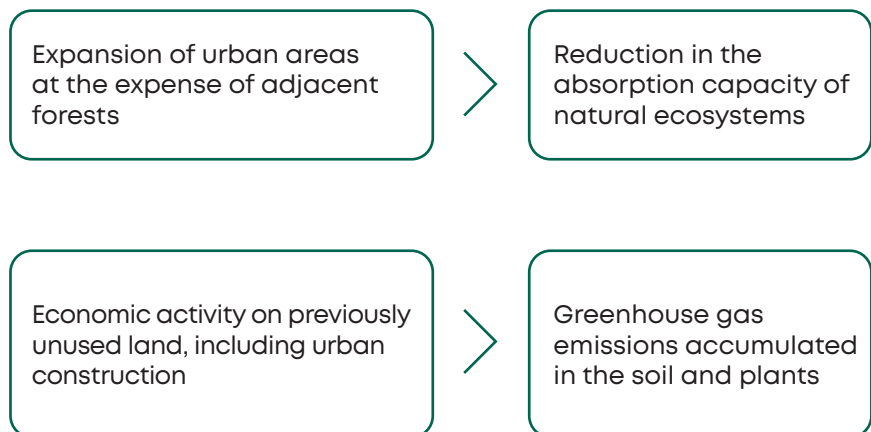




Green Spaces

Rapid population growth and economic development of cities lead to the expansion of their boundaries and an increase in the area of urbanized territories. **Between 1990 and 2015, the area of land occupied by urban development increased by almost 40% worldwide [50]. In BRICS countries, the growth rate over the same period was over 45%, and in Ethiopia and the UAE, the area of urban territories increased more than twice [50].** According to the existing estimates, if current trends continue until 2050, the increase in the area of urbanized territories will proceed at a higher rate than the growth of the urban population [51].

Urban sprawl, especially if uncontrolled, **can cause serious damage to surrounding ecosystems** by destroying the habitats of biological species and damaging biodiversity [52]. In addition to its impact on the environment, this process **can also have negative consequences for the climate [53, 54].**

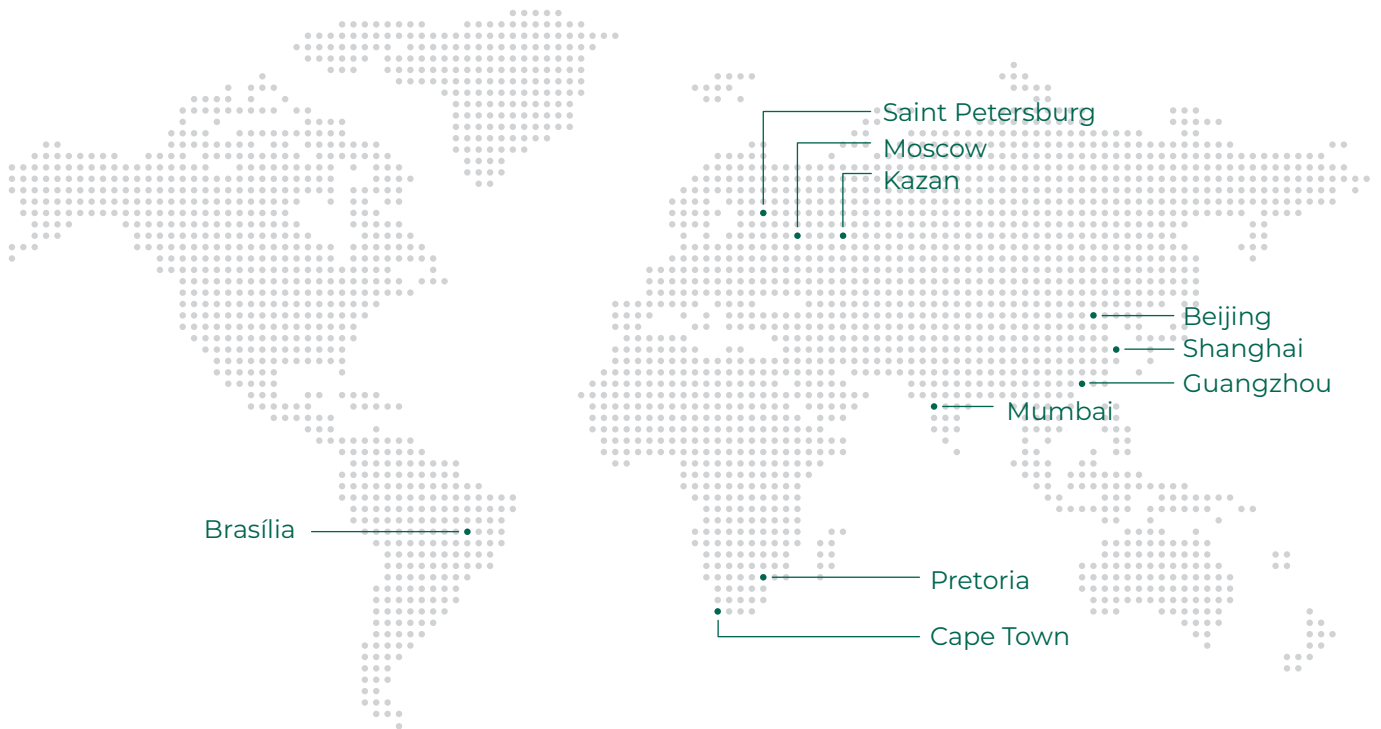


Therefore, the goals of increasing the area of urban green spaces and preserving existing natural ecosystems should be an integral element of a comprehensive climate policy at the city level.

Indicators

- Ratio of green space area to the total area of the city
- Targets to increase / keep the share or area of green spaces in the city, for example, by planting trees or expanding zones with nature protection status

Leaders



1. **In 8 out of the 10 cities** that took the top positions in this category, **the ratio of green spaces to the total area** inside the municipal boundaries **is more than 50%, and in some cases** (Brasília, Beijing, and Guangzhou) **undeveloped areas with natural landscapes occupy more than 2/3 of the urban area.** At the same time, the average value of the ratio in the cities that are not among the leaders in the category is only about 18%, which is associated, among other things, with climatic factors - 4 of these 10 cities (Abu Dhabi, Dubai, Cairo, and Tehran) are located in arid subtropical climate.
2. A distinctive feature of most cities from the leading group is the fact that they have **large forested areas within their administrative boundaries.** Such forests form the bulk of their green spaces. Most often, these areas are located in vast territories outside the urban development zone (Brasília, Guangzhou, Kazan, and Saint Petersburg), but in some cities (Moscow and Mumbai) urban forests are wedged into built-up areas, forming the basis of their environmental framework.
3. **In their climate plans and environmental strategies,** the governments of such cities with large forests define **the protection of these natural territories as one of their priorities.** More detailed policy measures in this area usually include reforestation and giving such areas a protected status, which limits the activity on their territory that may harm the ecosystem. In some cases (Guangzhou and Beijing), municipal strategy documents specifically state that achieving reforestation goals are aimed, among other things, at increasing greenhouse gas absorption rates.





Waste

According to the World Bank estimates, **the amount of solid waste generated in the world will increase more than one and a half times by 2050 compared to the 2016 level**, with the highest rates of waste production growth expected to be in low- and middle-income countries [55]. The prime causes of increased municipal solid waste (MSW) generation are population growth and higher income levels, and the dynamics of socio-economic development require that governments adopt clear policy goals in the field of waste management to prevent serious negative consequences for the environment and the climate.

After agriculture and energy, **waste is the third largest source of anthropogenic emissions of methane**, a major greenhouse gas that contributes about 30% to global temperature rise [56]. Reducing the climate impact of this sector requires a comprehensive approach aimed at both reducing waste production by stimulating more efficient consumption and developing alternative waste management methods, the most preferable ones being recycling to obtain secondary materials and composting [57].

Cities play a leading role in the transition to sustainable waste management, as **they produce about 70% of the world's MSW [58]**, and in most countries waste management issues are the responsibility of local authorities [55].

Indicators

- Annual per capita mass of municipal solid waste (MSW) generated by businesses and households

MSW is defined as waste produced by households through the consumption of products and goods, and similar waste generated by businesses.

- Share of municipal solid waste (MSW) generated by businesses and households, which is disposed of in landfill

Instead of landfilling, cities can use other waste management methods to reduce the sector's negative impact on the climate, such as recycling, composting, and incineration of waste to generate energy.

- Targets to reduce the mass of generated waste or to reduce the proportion or volume of waste that ends up in landfills

Leaders



1. **In 6 out of 10 leading cities in this category** (Guangzhou, Delhi, Mumbai, Beijing, Tehran, and Shanghai), **the values of both indicators** — per capita mass of MSW generated and the share of MSW disposed of in landfills — **are lower than the average for the 20 cities analyzed in the study.** In these cities, most of the waste that does not end up in landfills is incinerated to produce energy or, in the case of organic waste, is composted. Recycling of waste into secondary raw materials is less common, but the climate plans of Mumbai and the Chinese cities have targets to promote this MSW management method.
2. **Addis Ababa and Bengaluru** have some of the lowest per capita MSW generation levels, but they are not among the top-performers in terms of waste management. **Over 70% of MSW** generated in these cities **ends up in conventional landfills with no off-gas collection systems.** The targets set in their climate plans call for a dramatic reduction in the proportion of waste sent to landfills by 2050 by increasing organic waste composting and paper and plastic recycling capacity.
3. **In Brasília and Moscow, the per capita mass of waste generated is higher than the average for the 20 cities in the study.** These two cities are in the group of leaders mainly because a relatively low proportion of their waste is disposed of in landfills – it is less than 2/3 in Brasília and less than 50% in Moscow. As in the case with the other leading cities, the main alternative methods of handling waste (other than landfill disposal) they use are **energy recovery (Moscow) and composting (Brasília).**

