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THE CITIES OF TOMORROW

The background image is a composite of two parts. The top part shows a city skyline with several skyscrapers, including the Willis Tower in Chicago. One prominent building is covered in lush greenery, representing a vertical garden. The bottom part shows an aerial view of a sustainable urban development with green spaces, a river, and a bridge. The text is overlaid on a blue semi-transparent band across the middle of the image.

# THE FUTURE OF SUSTAINABLE CITIES: TRANSITIONING TO LOW-CARBON, INCLUSIVE, AND RESILIENT URBAN SYSTEMS

VISION FRAMEWORK BY UNIDO



# The Future of Sustainable Cities: Transitioning to Low-Carbon, Inclusive, and Resilient Urban Systems

*Vision Framework\**

## Introduction

As urbanization continues to accelerate, cities have become the epicenters of global economic and social activity. Today, more than 55% of the world's population lives in urban areas, a figure that is expected to rise to 68% by 2050<sup>1</sup>. While cities are hubs of opportunity and innovation, they also face mounting challenges, including rising carbon emissions, inadequate infrastructure, social inequality, extreme weather events caused by climate change, and unsustainable resource use. In response to these pressures, cities must undergo a significant transformation to become sustainable, resilient, and inclusive environments. This vision outlines key areas of focus for the future of sustainable cities, backed by concrete strategies and statistical trends that highlight the urgency for action.

## 1. Transitioning to Low-Carbon Solutions and Safeguarding the Climate in Urban Areas

Approximately 70% of global carbon emissions originate in cities, primarily from energy consumption in buildings, transportation, and industry<sup>2</sup>. The ever-growing metropolis in the Global South have a particularly high impact on carbon emissions, due to population density and poor infrastructure<sup>3</sup>. To address the climate crisis, cities must prioritize transitioning to low-carbon solutions.

### Key Challenges

- Cities account for more than two-thirds of the world's energy consumption, with fossil fuels supplying over 80% of urban energy demand<sup>4</sup>. This reliance on fossil fuels drives global carbon emissions and exacerbates climate change.
- Urban areas face increasing vulnerability to climate impacts, such as heatwaves, flooding, and air pollution, threatening infrastructure, ecosystems, and human health<sup>5</sup>.

### Potential Solutions

- **Renewable Energy Adoption:** Expanding renewable energy capacity is critical. Cities like Copenhagen are leading the way, aiming to be carbon neutral by 2025 by relying on wind and solar energy<sup>6</sup>.
- **Energy Efficiency:** Buildings represent 40% of energy use in cities. Retrofitting older buildings and implementing energy-efficient design in new ones can cut energy use by 30-50%<sup>7</sup>. Incentivizing energy efficiency upgrades should be a priority for both national and local governments.
- **Smart Energy Management:** The use of AI and smart grids can optimize energy consumption. Barcelona, for instance, reduced peak-hour electricity usage by 30% through AI-driven energy management<sup>8</sup>.

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<sup>1</sup> UN DESA, *World Urbanization Prospects*, 2018.

<sup>2</sup> C40 Cities, *Climate Action Planning Framework*, 2020.

<sup>3</sup> World Bank, *Cutting global carbon emissions: where do cities stand?*, 2022.

<sup>4</sup> IEA, *World Energy Outlook*, 2021.

<sup>5</sup> IPCC, *Sixth Assessment Report*, 2021.

<sup>6</sup> City of Copenhagen, *2025 Climate Plan*, 2019.

<sup>7</sup> Global Alliance for Buildings and Construction, *Global Status Report*, 2020.

<sup>8</sup> Smart Cities World, *Barcelona's Smart Energy Management Systems*, 2021.



## 2. Enhancing Transportation Systems and Mobility

Transportation is a significant contributor to urban emissions, responsible for nearly 25% of global energy-related CO<sub>2</sub> emissions<sup>9</sup>. Improving urban mobility systems is essential for reducing emissions and creating sustainable, livable cities.

### Key Challenges

- Urban sprawl and reliance on private vehicles lead to higher emissions, longer commute times, and worsening air quality. As of 2020, private vehicles contributed to 60% of urban transportation emissions<sup>10</sup>. Over 50% of global commutes are still by car, with peaks of over 90% in North America.<sup>11</sup>
- Public transportation infrastructure remains inadequate in many cities, both in developed and developing countries, pushing more people toward car ownership.

### Potential Solutions

- **Electric Vehicle (EV) Infrastructure:** Expanding EV infrastructure, especially roll-out of electric charging networks, is essential for boosting EV adoption and reducing private vehicle emissions. Cities like Oslo have achieved 54% electric car sales due to investments in charging stations and incentives for EV ownership<sup>12</sup>.
- **Public Transportation Systems:** It is crucial to build and expand environment-friendly public transport systems, such as electric buses, metros, light rails, and maglev trains. Bogota's bus rapid transit system reduces carbon emissions by 350,000 tons annually<sup>13</sup>.
- **Active and Shared Mobility:** Promoting cycling, walking, and shared mobility can help reduce congestion. Amsterdam, where 38% of commutes are by bicycle, demonstrates the potential of cycling infrastructure to lower transportation emissions<sup>14</sup>.

## 3. Combating Poverty and Leveraging Industrialization's Role

Urbanization has often been accompanied by rising inequality. More than 1 billion people currently live in informal settlements, lacking access to essential services like clean water and sanitation<sup>15</sup>. Sustainable industrialization, when inclusive, can play a critical role in poverty reduction and have a positive spillover effect on cities as a whole.

### Key Challenges

- Urban poverty rates remain high, with 24% of city residents globally living in slums<sup>16</sup>. These communities are disproportionately affected by inadequate infrastructure and limited economic opportunities.
- The shift to automation and digitalization risks exacerbating inequality by displacing low-skill jobs. The consequential increase in unemployment rate may further grow into a factor of social instability.

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<sup>9</sup> IEA, *Global CO<sub>2</sub> Emissions from Transport*, 2022.

<sup>10</sup> McKinsey & Company, *The Future of Mobility* 2022.

<sup>11</sup> Environment International, *The ABC of Mobility*, March 2024.

<sup>12</sup> Norwegian EV Association, *Electric Vehicle Sales Report*, 2021.

<sup>13</sup> ITDP, *Bus Rapid Transit Systems in Latin America*, 2020.

<sup>14</sup> Dutch Cycling Embassy, *Cycling Facts and Figures*, 2020.

<sup>15</sup> UN Habitat, *World Cities Report*, 2020.

<sup>16</sup> UN Habitat, *World Cities Report*, 2020.



## Potential Solutions

- **Job Creation in the Green Economy:** The green economy offers substantial job creation opportunities. The International Labour Organization estimates that green transition will create more than 10-fold the jobs that are lost because of automation, provided a meaningful investment in re-skilling.<sup>17</sup>
- **Inclusive Industrial Development:** Investments in sectors such as renewable energy, recycling, and sustainable manufacturing can drive job creation and urban growth, particularly for marginalized populations.
- **Vocational Training and Skill Development:** With 75% of future jobs likely to require skills in digital literacy and sustainable practices, vocational training programs must be a priority. Establishing centers for vocational training can ensure that urban workers, particularly in developing cities, are equipped to participate in new industries<sup>18</sup>.

## 4. Ensuring Efficient Water Management, Sanitation, and Waste Disposal

Cities face growing pressure on water resources, sanitation infrastructure, and waste disposal systems. By 2025, 1.8 billion people will experience absolute water scarcity<sup>19</sup>, while global waste generation is expected to rise to 3.4 billion tons annually by 2050<sup>20</sup>.

### Key Challenges

- Urban water demand is projected to increase by 80% by 2050, putting severe stress on already scarce water supplies<sup>21</sup>.
- Cities generate over 2 billion tons of solid waste each year, and less than 20% of it is recycled<sup>22</sup>.

### Potential Solutions

- **Smart Water Management:** AI-powered systems can optimize water usage, detect leaks, and improve distribution efficiency. Singapore's smart water management system reduced non-revenue water losses to 5%, compared to the global average of 30%<sup>23</sup>.
- **Circular Waste Management:** Cities must adopt circular economy principles to minimize waste. San Francisco diverts 80% of its waste from landfills through comprehensive recycling and composting programs<sup>24</sup>.
- **Water Recycling and Conservation:** Water-stressed cities like Windhoek, Namibia, provide a model for recycling wastewater, which supplies 35% of the city's drinking water<sup>25</sup>.

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<sup>17</sup> International Labour Organization, *World Employment and Social Outlook, 2020*.

<sup>18</sup> International Labour Organization, *Skills for a Greener Future, 2019*.

<sup>19</sup> WHO, *Global Water Shortage Projections, 2019*.

<sup>20</sup> World Bank, *What a Waste 2.0, 2018*.

<sup>21</sup> OECD, *Water Outlook to 2050, 2012*.

<sup>22</sup> World Bank, *What a Waste 2.0, 2018*.

<sup>23</sup> PUB Singapore, *Smart Water Management Case Study, 2020*.

<sup>24</sup> SF Environment, *Zero Waste Case Study, 2018*.

<sup>25</sup> UN Water, *Water Reuse Case Study: Windhoek, 2021*.



## 5. Improving Governance and the Application of Artificial Intelligence (AI)

With increasing urban complexity, effective governance is essential to manage resources and deliver services efficiently. AI, along with other digital technologies, offers immense potential for enhancing urban governance, enabling data-driven decision-making, and improving public services. Overall, the global market size for smart city systems and solutions was valued at \$648.36 billion in 2020, and is estimated to reach \$6,061.00 billion by 2030.<sup>26</sup>

### Key Challenges

- Fragmented governance systems and the absence of integrated planning limit cities' ability to manage rapid urban growth effectively<sup>27</sup>.
- A lack of real-time data and transparency hinders effective resource allocation and service delivery.

### Potential Solutions

- **AI-Driven Governance:** AI can optimize city management processes by automating administrative tasks and improving service delivery. Hangzhou's AI-based traffic management system reduced congestion by 10%, improving air quality and reducing travel times<sup>28</sup>.
- **Data-Driven Urban Planning:** AI tools enable cities to analyze growth patterns and plan infrastructure efficiently. Barcelona's AI-driven waste collection routes cut fuel consumption by 25%<sup>29</sup>.
- **Public Participation Platforms:** AI-powered platforms for citizen engagement can improve transparency and ensure that urban governance is more responsive to residents' needs. Such platforms facilitate feedback on urban policies and services, making cities more inclusive.

### Conclusion

The future of cities lies in their ability to transition toward low-carbon, inclusive, and resilient environments. By adopting renewable energy, developing sustainable transportation systems, managing resources efficiently, and using AI to improve governance, cities can become sustainable hubs of economic opportunity and social well-being. With smart planning and investment in green sectors, cities can ensure a more equitable and sustainable future for all.

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<sup>26</sup> Allied Market Research, *Smart Cities Market Statistics*, 2022.

<sup>27</sup> UN-Habitat, *Global Urban Monitoring Framework*, 2020.

<sup>28</sup> Smart Cities World, *Hangzhou AI Traffic System*, 2019.

<sup>29</sup> Barcelona City Council, *Waste Collection and AI Systems Report*, 2021.



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