

# A Comparative Study of Policy Instruments for Urban Green Transition: The Cases of Shenzhen and Stockholm

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## **Abstract:**

Amid accelerating global climate change, cities have emerged as pivotal arenas for advancing sustainable development and carbon neutrality. As hubs of population, industry, and innovation, they serve as crucial drivers of green transformation, where local policy instruments underpin the achievement of broader national and global environmental goals. Shenzhen, representing China's rapid urban modernization and technological dynamism, and Stockholm, renowned for its advanced environmental governance and social sustainability, exemplify two distinct yet leading pathways toward urban green transition. This study compares the policy instruments employed by these two cities to promote low-carbon development and ecological innovation. Through a systematic literature review and qualitative comparative analysis, the research identifies how regulatory, economic, and informational tools have been differentially combined and prioritized within each governance context. The findings indicate that while Shenzhen's approach relies heavily on state-led regulation and fiscal incentives, Stockholm emphasizes participatory governance and market-based mechanisms. The comparison underscores that effective urban green transition depends on adaptive policy mixes tailored to local institutional and socio-economic conditions.

**Keywords:** Urban Green Transition, Policy Instruments, Shenzhen, Stockholm, Comparative Policy Analysis

## **1. Introduction**

Urban green transition has garnered growing scholarly attention as cities worldwide strive to balance rapid development with environmental sustainability. Existing research has explored the diverse policy

approaches that facilitate this transition [1]. For instance, Li and Zhang [2] analyzed China's urban ecological modernization and emphasized that administrative regulation remains the dominant policy tool for promoting low-carbon transformation. Johansson [3] examined Sweden's environmental governance

and highlighted the effectiveness of participatory mechanisms and green innovation policies. Meanwhile, Chen [4] compared sustainability strategies across cities and noted that local institutional capacity plays a decisive role in determining the success of green policies. However, limited comparative research directly contrasts Eastern and Western cities under divergent governance systems, leaving a gap in understanding how policy instrument mixes adapt to distinct political and socio-economic contexts.

This study addresses that gap by taking Shenzhen and Stockholm as two representative cases. It focuses on two key dimensions: first, the similarities and differences in their policy instruments for promoting urban green transition; and second, the broader insights and implications derived from this comparison for future policy design. Employing a qualitative comparative analysis based on literature review and policy documents, the study interprets how regulatory, economic, and informational tools interact within each city's governance framework. The research aims to enrich comparative policy studies by revealing how contextualized policy mixes can facilitate sustainable urban transformation and to provide valuable reference for other cities pursuing low-carbon development.

## **2. Comparative Analysis of Policy Instruments in Urban Green Transition**

### **2.1 Energy Sector**

Shenzhen's energy policy reflects a state-led approach, characterized by top-down regulatory and fiscal support. The municipal government has incorporated renewable energy expansion into its Five-Year Development Plans, prioritizing solar photovoltaic deployment and clean industrial transformation. The Shenzhen Clean Energy Action Plan [5] combines mandatory standards for energy efficiency with subsidies for renewable projects and enterprises engaging in technological innovation. These policy instruments demonstrate how Shenzhen leverages regulatory and economic tools to accelerate the decarbonization of its energy system. Nevertheless, over-reliance on administrative oversight may constrain market vitality and hinder long-term behavioral shifts among energy consumers [6].

In contrast, Stockholm's energy transition relies predominantly on market-based and informational policy instruments. Sweden's national carbon tax, introduced in

1991, has served as a cornerstone for reducing fossil fuel dependence. Within this national framework, Stockholm has promoted district heating powered by bioenergy and waste-to-energy systems. The city also employs public awareness campaigns and voluntary agreements to encourage household-level energy conservation. This combination of taxation, market incentives, and participatory governance demonstrates how transparent institutions and public trust can facilitate sustained low-carbon practices [7].

### **2.2 Transportation Sector**

Transportation stands out as the most visible areas of Shenzhen's green transition. By 2018, the city had achieved full electrification of its bus fleet and over 99% of its taxi fleet, largely driven by extensive subsidies and coordinated urban planning. Fiscal tools, including purchase incentives and infrastructure investments, reduced cost barriers for operators and manufacturers. However, Shenzhen's heavy reliance on fiscal instruments raises concerns about financial sustainability once subsidies are gradually phased out.

Stockholm, by contrast, focuses on reducing car dependency through behavioral and economic instruments. The city introduced a congestion tax in 2007 to mitigate peak-hour traffic and emissions, with tax revenues reinvested into public transport and cycling infrastructure. This approach has facilitated a shift in travel behavior toward sustainable modes. Complementary informational campaigns have raised public awareness of environmental benefits, strengthening social acceptance of the policy. Stockholm's approach shows how cities can achieve significant environmental outcomes through relatively targeted interventions when public institutions enjoy high levels of trust.

### **2.3 Building and Urban Design**

Shenzhen's building sector policy centers on regulatory enforcement and financial incentives. The city mandates strict energy efficiency standards and integrates the Three-Star Green Building Rating System into urban planning approvals. Developers meeting higher certification levels are eligible for tax deductions and subsidies. However, inconsistent enforcement across districts undermines policy effectiveness, and voluntary participation among private developers remains limited.

Stockholm's urban design strategy emphasizes participatory planning and voluntary compliance. The Hammarby

Sjöstad eco-district exemplifies a holistic system that integrates energy, water, and waste management through cooperation between the municipality, private firms, and residents. Rather than relying on command-and-control regulation, Stockholm adopts performance-based contracts and shared responsibility mechanisms. This participatory model not only fosters innovation activity but also strengthens the sense of community ownership regarding sustainability outcomes.

## 2.4 Green Industry and Innovation

Shenzhen's green industry policy is closely intertwined with its innovation-driven economic model. The city provides R&D funding, low-interest loans, and tax exemptions to green technology enterprises, particularly those specializing in electric vehicles, batteries, and renewable materials. These measures embody a developmental-state approach, wherein the government steers industrial upgrading via targeted policy interventions. The establishment of green technology clusters, such as the Pingshan New Energy Industrial Park, further enhances collaborative dynamics between enterprises and research institutes. Stockholm's green industry policy, by contrast, centers on fostering entrepreneurship and advancing circular economy practices. Initiatives like Smart City Sweden and Stockholm Cleantech facilitate collaboration between public agencies and small enterprises. Rather than direct subsidies, the city relies on knowledge sharing, sustainable public procurement, and innovation competitions to motivate firms. This reflects a governance style where environmental objectives are embedded within market mechanisms and civic networks.

## 3. Discussion and Insights

### 3.1 Lessons for Developing and Developed Countries

The comparison between Shenzhen and Stockholm underscores the role of governance structures in shaping policy effectiveness. Shenzhen's centralized governance framework enables the rapid mobilization of resources and large-scale infrastructure deployment—an advantage for developing economies with strong governmental capacity. However, this top-down model carries risks of bureaucratic rigidity and insufficient citizen engagement. Stockholm's decentralized and participatory governance framework prioritizes transparency, inclusiveness, and

innovation. Its adoption of carbon pricing and voluntary agreements demonstrates how environmental outcomes can be achieved through collaboration rather than top-down control. For developing countries, incorporating selective components of this approach, such as public consultation mechanisms and knowledge-sharing platforms, could enhance policy legitimacy and adaptability.

### 3.2 Policy Integration and Governance Innovation

The two cases illustrate that green transition success depends not only on the variety of instruments but also on their integration. Shenzhen faces challenges in coordinating among multiple departments, where overlapping mandates can occasionally cause inefficiencies. Stockholm, by contrast, excels at institutional coordination but must balance environmental ambition with social equity. Rising energy and transport taxes can disproportionately burden low-income households. Thus, complementary redistributive measures, such as targeted subsidies or green social welfare programs, are essential for sustaining social acceptance of green transition efforts. Enhancing inter-agency collaboration and leveraging digital monitoring systems could strengthen policy coherence [8].

## 4. Broader Implications and Future Prospects

### 4.1 Implications for Global Urban Sustainability

The comparative analysis of Shenzhen and Stockholm underscores a fundamental principle: there is no one-size-fits-all model for urban green transition. The effectiveness of sustainability policies is deeply contingent on local governance capacity, economic structure, and civic culture. Shenzhen's state-led innovation paradigm offers invaluable lessons for rapidly industrializing cities, demonstrating how centralized authority can mobilize resources at scale to deploy clean technologies. Its success in electrifying public transport and creating green industrial clusters provides a blueprint for technological leapfrogging in developing economies. Conversely, Stockholm exemplifies how trust-based governance, underpinned by high social capital and transparent institutions, can foster durable sustainability through market mechanisms and participatory approaches. Its long-standing carbon tax and circular

economy initiatives show that environmental goals can be achieved through collaboration rather than coercion. The key insight for global urban sustainability lies in the synergistic potential of these contrasting models. City-to-city learning networks, such as C40 Cities, can facilitate the cross-pollination of best practices, enabling cities to blend Shenzhen's capacity for rapid implementation with Stockholm's strengths in building public consensus and ensuring long-term behavioral change. This integrated approach could accelerate decarbonization globally by allowing cities to adopt policy mixes tailored to their unique institutional contexts.

## 4.2 Future Research Directions

To build upon these findings, future research should evolve in several critical directions. Methodologically, there is a pressing need for mixed-methods approaches that combine quantitative performance indicators with qualitative contextual analysis. Longitudinal studies tracking key metrics—such as emission reduction trajectories, green innovation indices, and citizen satisfaction levels—over extended periods would provide more robust evidence of policy effectiveness. Expanding the comparative scope is equally crucial. Future studies should incorporate a more diverse set of cities, such as Singapore (representing technocratic governance in a city-state), Copenhagen (showcasing Nordic collaborative models), and Seoul (illustrating transition in a post-industrial Asian metropolis). This would help unravel how varying political cultures, technological capacities, and development stages influence the choice and efficacy of policy instruments. Furthermore, deeper investigation into micro-level dynamics is warranted. Research should explore the role of citizen participation in shaping policy outcomes, the innovative behaviors of private sector actors responding to different regulatory environments, and the influence of transnational corporations in local sustainability transitions. Finally, as digital technologies reshape urban governance, future work could examine the transformative potential of tools like blockchain for enhancing transparency in carbon trading or artificial intelligence for optimizing policy simulations. These avenues of inquiry would yield more nuanced and actionable insights for designing the next generation of urban sustainability policies.

## 5. Conclusion

This comparative study investigated how Shenzhen and

Stockholm deploy distinct combinations of policy instruments to advance urban green transitions. By analyzing four major sectors—energy, transportation, buildings, and green industry—the research revealed the distinct underlying logics of each city's governance model. Shenzhen demonstrates the effectiveness of a centralized, state-driven system that rapidly mobilizes resources and advances technological innovation via targeted fiscal and regulatory tools. Stockholm, in contrast, exemplifies a participatory and market-oriented approach that relies on transparency, collaboration, and citizen engagement to sustain environmental progress. Collectively, these findings indicate that successful urban green transitions hinge on the integration of diverse policy instruments—regulatory, economic, and informational—tailored to local institutional capacities and social contexts. More broadly, the study advances the understanding that there is no one-size-fits-all “optimal model”; rather, adaptive policy mixes balancing state coordination and civic participation are pivotal to attaining long-term sustainability.

While this study offers valuable insights, it is not without limitations. The comparative scope is confined to two representative cases, which may not fully encompass the diversity of urban governance patterns across varied regions. Data availability also hindered more in-depth empirical validation of policy outcomes. Future research could expand the analysis to include additional cities such as Singapore, Copenhagen, or Seoul to examine how varying political cultures and technological capacities shape the selection and efficacy of policy instruments. Furthermore, integrating quantitative data such as emission reduction metrics and citizen satisfaction indices would strengthen the robustness of comparative findings and offer more actionable guidance for global urban sustainability policies.

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