# Leveraging The OECD Framework To Create Policies That Enable Eco-Innovation: A Case Study Of Neom Part II

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| ARTICLE INFO | ABSTRACT |
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| | This research explores the adaptability and efficacy of the OECD eco-innovation framework in guiding sustainable urban development within emerging urban centres, mainly through Neom, Saudi Arabia. It seeks to elucidate the framework's potential in facilitating eco-innovation in urban planning, contributing to the broader discourse on sustainable urban development. Employing a qualitative research design, the study engages with a cohort of experts through structured interviews, complemented by a thematic analysis of these discussions. This approach allows for an in-depth exploration of the application and impact of the OECD eco-innovation framework on Neom's urban planning and development strategies. The study also incorporates a systematic review of relevant documents to understand further the integration of eco-innovative practices in Neom's planning processes. The findings highlight the critical role of the OECD eco-innovation framework in driving eco-innovation within Neom's urban development. Key insights include the importance of financial incentives, regulatory frameworks, market mechanisms, and knowledge exchange in fostering urban eco-innovation. Additionally, the research emphasises the need for multisectoral collaborations and data-driven strategies to effectively integrate eco-innovation into urban development, underscoring the transformative potential of Neom as a model for sustainable urban planning. This study contributes original insights into utilising the OECD eco-innovation framework in emerging urban developments, explicitly focusing on Neom, Saudi Arabia. It enriches the sustainable urban development literature by demonstrating the framework's adaptability and relevance, offering valuable implications for policymakers, urban planners, and researchers. The research underscores the necessity of tailoring international frameworks to local contexts, enhancing their practical applicability and impact in promoting sustainable urban ecosystems.<br><br>**Keywords:** Neom, Urban Sustainability, Socio-technical Systems, Data-centric Urbanism, Local-Global Synthesis |

## 1 Introduction

In the dynamic landscape of sustainable urban development, integrating eco-innovation into city planning is increasingly recognised as essential for fostering environmental stewardship and advancing technological innovation (Filiou et al., 2023). The development of Neom, an ambitious flagship project in Saudi Arabia, exemplifies this trend. Neom is poised to redefine sustainability in urban design, standing as a testament to the potential of innovative urban initiatives to advance sustainability paradigms significantly. However, despite a burgeoning literature on sustainable urban development, a clear understanding of how international

frameworks, notably the OECD's eco-innovation framework, guide eco-innovative practices in new urban development still needs to be discovered (Miedzin et al., 2017)

This study aims to fill this gap, exploring the adaptability and application of the OECD eco-innovation framework within Neom's urban planning and development strategies. We investigate two critical questions: How can the OECD eco-innovation framework be tailored to foster sustainable urban development in pioneering cities like Neom? Moreover, what implications do these strategic adaptations hold for policy-making and urban planning?

Employing a qualitative approach through expert interviews and document analysis, this research delves into the intersection of urban sustainability, eco-innovation, and socio-technical systems theory. This comprehensive lens allows an in-depth understanding of incorporating sustainability into urban development processes.

Our findings underscore the OECD framework's potential as a novel blueprint for eco-innovation in Neom. They highlight the importance of financial incentives, regulatory frameworks, market mechanisms, and knowledge exchange. This study demonstrates the critical role of international frameworks in steering eco-innovation in new urban projects and enriches the dialogue on sustainable urban development.

Significantly, this research provides invaluable insights for policymakers, urban planners, and researchers. It underscores the challenges and benefits of applying the OECD eco-innovation framework to the unique contexts of emerging urban environments, emphasising the necessity of tailoring international frameworks to enhance their effectiveness and relevance.

Following the introduction, the structure of the paper is organised as follows: Section 2 delves into the Literature Review, where we identify existing gaps in the research and set the stage for our investigation within the domains of sustainable urban development and eco-innovation. Section 3, Methodology, outlines the qualitative research approach, including expert interviews and document analysis, employed to explore the adaptability and application of the OECD eco-innovation framework in Neom's urban planning. Section 4, Data Analysis, describes the processes and techniques used to analyse the collected data, setting the foundation for the insights presented in the subsequent section. Section 5, Findings and Discussion, presents the significant insights drawn from our analysis, discussing their implications for urban sustainability and the role of eco-innovation in Neom. Finally, Section 6 concludes the paper by summarising our contributions to the field, suggesting avenues for future research, and highlighting the significance of our findings in advancing the discourse on eco-innovation and sustainable urban development. This structure aims to provide a coherent flow from the initial exploration of the literature to the presentation of our findings and conclusions.

## 2  Literature Review

In escalating urbanisation and pressing environmental challenges, cities are pivotal for addressing global sustainability issues. This evolving landscape demands innovative approaches that harmonise development with ecological sustainability. Eco-innovation stands out as a crucial strategy, combining inventive solutions with environmental stewardship to mitigate the adverse effects of urban expansion and establish cities as vanguards of sustainable progress (Yousaf, 2021; Peyravi et al., 2023; Kemp & Pearson, 2007). The dialogue on urban dynamics and eco-innovation has grown increasingly significant, underscoring its potential to guide urban development towards achieving environmental goals (Abubakar & Alshammari, 2023).

Conceptualised initially for broader economic applications, the OECD eco-innovation framework has proven its utility in urban contexts by offering a structured sustainability approach through its foundational pillars (OECD, 2011). Cities like Copenhagen and Amsterdam have successfully utilised financial incentives to encourage green initiatives, whereas San Francisco has achieved notable carbon reductions through stringent regulatory measures (Ondiviela & Ondiviela, 2021). This framework highlights the importance of collaborative urban planning, emphasising mutual progress and knowledge sharing.

Building on Geels' socio-technical transitions theory, this review examines the intricate interplay between innovative sustainability solutions and established urban infrastructures. This theoretical lens helps understand the complexities of embedding eco-innovative practices within urban settings (van Lindert, 2016). Recent studies emphasise the importance of localised eco-innovation strategies, particularly in emerging Asian cities (Filiou et al., 2023). These findings underscore the need for tailored approaches that account for unique regional nuances, highlighting the challenges and opportunities inherent in developing urban infrastructures like Neom. This necessitates a thorough analysis to effectively transform sustainability goals into concrete achievements, especially when juxtaposed with economic considerations (Caprotti, 2014).

Recent research underscores the significance of aligning the OECD eco-innovation framework with localised needs and contexts. Khan et al. (2020) argues for integrating intelligent technologies in urban planning, emphasising the role of digitalisation in enhancing eco-innovation. Their study illustrates how smart city initiatives can catalyse eco-innovative practices, proposing a model where technological advancement and sustainability co-evolve (Martins, 2023).

Furthermore, Chaparro-Banegas et al. (2023) highlight the critical role of stakeholder engagement in fostering eco-innovation within urban projects. Their research demonstrates how participatory planning processes can significantly influence the successful implementation of eco-innovative strategies, stressing the importance of involving local communities and businesses in sustainability efforts.

This study explores the application of the OECD framework to newly developing urban areas and advocates for re-evaluating the framework to prioritise local knowledge and insights. Acknowledging that emerging cities could greatly benefit from region-specific approaches, this review suggests moving beyond universal benchmarks to embrace localised strategies (Margherita et al., 2023).

This literature review sets the stage for a comprehensive exploration of sustainable urban development by weaving together the OECD framework, socio-technical transitions theory, and recent empirical studies. It aims to meld theoretical frameworks with practical insights, offering a holistic guide to sustainable urban planning focusing on Neom's unique context.

## 2.1 Deep Dive into the OECD Eco-Innovation Framework

The Organisation for Economic Co-operation and Development's (OECD) eco-innovation framework represents a foundational approach to comprehending the intricate, multifaceted processes characterising environmentally driven systemic transitions (López et al., 2023). Established in 2015, this framework delineates a structured methodology grounded in four integral pillars, each contributing uniquely to the overarching goal of promoting urban sustainability through eco-innovation. These pillars encompass a range of strategies and mechanisms to foster an environment conducive to sustainable development and innovation.

Financial Incentives: This cornerstone of the framework highlights the critical role of fiscal policies and financial instruments in catalysing eco-innovative initiatives. By providing financial support through mechanisms such as green patents and subsidies, this pillar aims to reduce the economic barriers to eco-innovation, thereby encouraging investment in and adoption of sustainable practices and technologies. Metrics for evaluating the impact of these incentives include the number of green patents filed, the amount and efficacy of subsidies distributed, and the subsequent increase in eco-innovative activities within the urban context.

Prescriptive Regulations: This component emphasises the importance of legal mandates in shaping behaviours conducive to eco-innovation. By establishing laws and regulations that either compel or prohibit specific actions, this pillar seeks to direct both individuals and organisations towards more sustainable practices. The effectiveness of these regulatory measures can be assessed through metrics such as compliance rates and the penalties incurred for non-compliance, providing a quantitative measure of their impact on promoting eco-friendly behaviours.

Market Transformation Mechanisms: Acknowledging the power of market forces in driving innovation, this pillar focuses on creating platforms and processes that guide market dynamics towards sustainability. This approach encourages developing and adopting sustainable technologies and practices by fostering a market environment that values and prioritises sustainable offerings. Key indicators of success in this area include the adoption rates of sustainable technologies, reflecting the degree to which market transformation mechanisms have succeeded in shifting consumer and organisational preferences towards eco-innovation.

Knowledge Exchange Networks: This pillar recognises the importance of collaboration and knowledge sharing in advancing eco-innovation. It promotes establishing networks among stakeholders engaged in sustainable practices. These networks facilitate the exchange of ideas, experiences, and best practices, thereby accelerating the dissemination and implementation of eco-innovative solutions. Metrics such as the frequency of collaboration and the level of stakeholder engagement indicate the vitality and effectiveness of these knowledge exchange networks in promoting a collaborative approach to sustainability.

Collectively, these pillars articulate a comprehensive framework for understanding and promoting eco-innovation within urban environments. The OECD eco-innovation framework offers a holistic strategy for facilitating the systemic changes necessary for achieving urban sustainability by addressing financial, regulatory, market-based, and collaborative dimensions (Durán-Romero et al., 2020). Through its implementation, cities can navigate the complex landscape of environmental challenges, leveraging eco-innovation as a pathway to sustainable development.

## 2.2 Socio-Technical Transitions Theory: A Paradigm for Urban Eco-Innovation

The Socio-Technical Transitions Theory offers a nuanced understanding of the complex interplay between social systems, technological innovations, and regulatory frameworks, facilitating a comprehensive view of the pathways toward sustainable urban development. Originating from the work of Geels (2020), this theory employs a multi-level perspective to analyse the dynamics between emerging technological innovations and established socio-economic structures. It highlights the tensions arising from adopting niche innovations, such as decentralised energy systems, against entrenched traditional infrastructures like centralised energy grids. In the context of rapidly evolving urban landscapes, including the forward-looking development of Neom, the Socio-Technical Transitions Theory provides invaluable insights into the challenges and opportunities associated with embedding and scaling eco-innovative solutions within pre-existing urban frameworks. It underscores the critical need for an integrative approach considering technological advancements and social factors in pursuing sustainable urban planning.

## 2.3 Harmonising the OECD and Socio-Technical Perspectives

By synthesising the structural insights of the OECD Eco-Innovation Framework with the detailed analysis offered by the Socio-Technical Transitions Theory, a more comprehensive and nuanced understanding of urban eco-innovation emerges. This integrative approach allows for a dual analysis that identifies broad policy

directives and delves into the complex societal and technological adaptations required to promote eco-innovation within urban settings. For instance, the OECD framework's emphasis on green financial incentives can be complemented by insights from the Socio-Technical Theory, which sheds light on the social dynamics affecting the reception and integration of these incentives by different urban stakeholders.

The juxtaposition of these frameworks highlights their complementary nature while acknowledging their respective limitations. With its focus on policy and macro-level interventions, the OECD framework may overlook the grassroots movements and localised challenges critical to implementing eco-innovations. Conversely, the Socio-Technical Transitions Theory, which emphasises the interplay between technological and social factors, might need to be more mindful of the role of overarching policy structures in guiding urban eco-innovation.

To reconcile these perspectives and fully leverage their insights for sustainable urban development, particularly in the context of Neom, it is imperative to employ analytical tools such as benchmarking matrices. These tools facilitate the assessment of the relevance and applicability of both theories to Neom's sustainability initiatives, enabling a refined and dynamic understanding of eco-innovation in urban development. This harmonised approach underscores the importance of adopting a multi-faceted strategy that combines policy innovation with a deep knowledge of socio-technical dynamics to navigate the complexities of urban eco-innovation effectively.

## 3  Methodology

The developing phase of Neom's sustainable development underscores the need to examine its policies and practices critically. This study will use a robust qualitative research approach, focusing exclusively on Neom without comparing it with established urban counterparts. This focus aims to delve into Neom's unique sustainability paradigm and regulatory frameworks.

A cohort of 12 experts, deeply rooted in urban planning, policymaking, and sustainability consultancy specifically for Neom, will be engaged in structured interviews. These discussions, designed around the study's conceptual framework, will undergo a rigorous thematic analysis to uncover in-depth insights into Neom's approach to sustainability.

A set of sustainability metrics has been developed to complement these qualitative insights. These metrics, covering areas such as renewable energy penetration, allocation of green spaces, waste management efficiency, and water conservation, align with the OECD eco-innovation framework. They will serve as critical indicators for assessing the impact and effectiveness of Neom's sustainability initiatives.

Additionally, key documents relevant to Neom's sustainability strategies will be subject to a systematic qualitative coding process (Creswell & Creswell, 2017). This process will help identify themes that align with our theoretical framework and provide a nuanced understanding of Neom's regulatory environment and the effectiveness of its sustainability measures.

Data from interviews and document analysis will be synthesised through triangulation, ensuring a comprehensive and multidimensional view of Neom's sustainability efforts. This methodology is grounded in a commitment to ethical integrity, with all research activities conducted under strict adherence to voluntarism, confidentiality, and anonymisation protocols in line with institutional research ethics standards.

## 4 Data Analysis

This study's qualitative data analysis was meticulously designed to unpack the complexities of implementing the OECD eco-innovation framework within Neom's urban planning context. Following best practices in qualitative research (Braun & Clarke, 2023), the study employed a dual-analytical approach comprising Thematic Analysis and Comparative Analysis. This section outlines the analytical procedures and presents the emergent themes, supported by illustrative quotes from participants to substantiate the findings.

### 4.1  Thematic Analysis
*Objective:* The primary aim of thematic analysis was to identify, analyse systematically, and report patterns (themes) within the data. This process allowed for an in-depth exploration of the nuanced perspectives on eco-innovation shared by experts involved in Neom's development.
Procedure
*Preliminary Familiarization:* Initial engagement with the data involved reading and re-reading the interview transcripts to immerse in the details and understand the participants' perspectives.
*Coding:* The data was then processed through NVivo, a qualitative data analysis software, to facilitate a detailed and systematic coding process. This step involved tagging transcript excerpts with codes that signify insights or concepts related to eco-innovation practices and challenges (Bazeley & Jackson, 2019).
*Theme Development:* Subsequently, codes were grouped into potential themes, representing broader patterns across the data set. This stage involved an iterative process of refining themes to ensure they accurately captured the essence of the coded data.
*Review and Refinement:* Themes were reviewed and refined to ensure coherence and distinctiveness, focusing on how they collectively contributed to a deeper understanding of eco-innovation within urban planning.

## 4.2 Emergent Themes with Illustrative Quotes
### Strategic Eco-Integration
Quote: *"The essence of sustainability in Neom is to integrate environmental considerations into every aspect of urban planning, from energy to waste management,"* expert stated.

### Developmental Dialectics
Quote: *"We are constantly navigating the tension between rapid development and maintaining ecological integrity,"* expert noted.

### Remedial Imperatives
Quote: *"Our approach hinges on collaborative innovation, integrating traditional knowledge with new technologies to address environmental challenges,"* expert explained.

## 4.3 Comparative Analysis
*Objective:* To explore the alignment and variances in viewpoints among the interviewed experts, particularly about strategic formulations and perceived challenges of eco-innovation in urban planning.

### Procedure
Data from the interviews were systematically compared to identify convergent and divergent opinions on strategic directions and challenges, using NVivo to organise and facilitate this comparative analysis.

### Findings
*Consonance in Strategies:* There was a strong consensus on the necessity of data-driven approaches and integrating environmental sustainability into all facets of urban development.
*Divergence in Challenges:* Experts expressed varied perspectives on challenges, particularly balancing technological integration with preserving natural landscapes.
This research's thematic and comparative analyses underscore the complex and layered process of integrating eco-innovation within the urban planning paradigm. Through a meticulous examination of expert insights and the strategic implementation of eco-innovative practices, this study has revealed diverse themes central to advancing sustainable urban development. Identifying strategic, developmental, and remedial themes through thematic analysis has provided a nuanced understanding of the critical factors influencing eco-innovation. Furthermore, the comparative analysis has highlighted experts' rich diversity of perspectives, showcasing the breadth of thought and approach in this field. This diversity reflects the interdisciplinary nature of eco-innovation. It emphasises the importance of incorporating a wide range of expert opinions to fully grasp the complexities of fostering sustainable urban environments. By exploring these themes in depth, the research contributes significantly to the discourse on eco-innovation, offering a comprehensive overview of the strategic considerations, developmental challenges, and remedial actions necessary for successful implementation within urban settings.
Moreover, synthesising thematic and comparative analyses is a robust methodological foundation for understanding eco-innovation dynamics in urban planning. This dual-analytical approach facilitates a holistic exploration of the subject matter, enabling the identification of key leverage points for policy intervention and strategic planning. The richness of the analysis, derived from the convergence of multiple expert viewpoints, provides a solid basis for formulating targeted strategies to enhance eco-innovation's role in achieving sustainable urban futures. It underlines the critical need for adaptive and informed policy frameworks that can accommodate the diverse range of eco-innovative solutions required to address the unique challenges faced by urban areas. Consequently, this research advances our understanding of eco-innovations potential to drive sustainable development and underscores the importance of a collaborative and multidisciplinary approach in shaping the cities of tomorrow. Through this rigorous analytical process, the study illuminates the path forward for urban planners, policymakers, and stakeholders, offering actionable insights for integrating eco-innovation into urban development.

## 5  Findings and Discussion

Neom's trajectory, underscored by its sustainability imperatives, emerged saliently in the interview narratives in the kaleidoscope of urban developmental paradigms. An intelligent observation from an expert encapsulates this sentiment: *"Neom exhibits a forward-thinking approach. It recognises traditional economic assets and integrates ecosystem services and the long-term value of environmental conservation."* Such reflections profoundly align with Bulkeley's discourse on urban sustainability, wherein environmental priorities are woven intrinsically into the urban fabric (Bulkeley, 2006). Moreover, the contours of these reflections are further sharpened when viewed through the lens of the socio-technical systems theory, emphasising the symbiotic fusion of societal mores and technological progression (Bijker et al., 1994; Sepehr, 2024).
A recurrent leitmotif from the expert dialogues was the unmistakable emphasis on collaborative paradigms, championing integrative partnerships across diverse sectors. Amplifying this theme, an expert astutely posited,

*"Collaborations between the public and private sectors can foster sustainable innovations and drive economic growth."* This perspective on the power of collaboration aligns with scholarly insights that extol the transformative potential of synergistic efforts in crafting sustainable urban futures (Brown & Vergragt, 2008; Ning et al., 2023). The OECD's conceptualisation of social capital further nuances this perspective, spotlighting the essence of shared endeavours and coalescent visions (OECD, 2013).

However, beneath this veneer of shared objectives, there simmer inherent dialectics, most manifest in the tension between rampant urban growth and the sanctity of environmental custodianship. Capturing this nuanced interplay, an expert remarked, *"The eternal conundrum lies in reconciling rapid urban development with ecological conservation."* This dialectic finds an academic echo in White's musings on urbanity's dual imperatives juxtaposed against environmental guardianship (Alhejaili, 2023; White, 1994). The socio-technical systems theory offers a perspicacious perspective, revealing the inherent friction between ascending socio-economic aspirations and the inviolable commitment to environmental conservation (Hausknost & Hammond, 2021).

While the consensus underscored sustainability's paramountcy, the matrices and modalities to translate this vision into tangible outcomes elicited a spectrum of expert viewpoints. This nuanced diversity is evocative of Böhringer & Jochem's (2007) expositions, which delve into the multifaceted nature of sustainability benchmarks. Marrying these insights with the OECD pillars fosters a more holistic understanding, integrating economic, sociocultural, and ecological dimensions to forge a comprehensive sustainability metric (Zeug et al., 2020).

Positioned within the global urban tapestry, Neom's strategy veers toward anticipatory innovation rather than post facto rectifications (Aldusari, 2023). This proactive stance is emblematic of greenfield urban initiatives, which command unparalleled strategic advantages by anticipatory planning. Invoking the socio-technical systems theory, Neom emerges as a vanguard of sustainable evolution, synergising technological advancements with societal imperatives.

The dialogues further emphasised the epochal shift towards data-driven urbanism, evolving from traditional paradigms towards empirically informed strategies. An expert explained this transition, *"Adopting a data-centric approach is crucial. Periodic valuation of Neom's ecological assets can guide nuanced decision-making."* Such reflections dovetail with the intellectual contributions of Kitchin (2014), who champions the pivotal role of data in charting urban futures. Contextualising this within the socio-technical systems paradigm, the ascendancy of data-centric urban planning emerges as an inflexion point, marking the confluence of technological sophistication and societal governance.

The expert narratives also underscored the fascinating confluence of age-old wisdom with avant-garde practices. The fusion of indigenous ecological knowledge with state-of-the-art methodologies was championed as a potent alchemy. This melding finds an academic ally in Escobar's theorisations on "local-global interplay," propounding that globalised strategies achieve their zenith when harmonised with indigenous narratives (Escobar, 2001). Seen through the socio-technical paradigm, Neom's quest to blend cutting-edge technology with time-honoured wisdom sketches a promising trajectory towards sustainable equilibria.

In brief, the expert testimonies emphasised the quintessence of community immersion in Neom's developmental journey. Advocating for community-anchored initiatives, an expert insightfully navigated the nexus between top-tier governance and grassroots aspirations. Such perspectives are reminiscent of Forester's call for "participatory planning," which champions community-centric urban paradigms (Forester, 1999). This ethos of participatory planning, bolstered by the OECD's accent on social capital, emerges as a linchpin for Neom's sustainable narrative.

Drawing the threads together, the intricate interplay of expert insights juxtaposed against the edifice of scholarly literature sculpts Neom as an urban nexus of promise and paradoxes. With its visionary blueprint, galvanised by informed strategies, indigenised wisdom, and communal inclusivity, Neom stands poised to redraw the contours of global urban sustainability.

## 6   Conclusion

This research has endeavoured to illuminate the application of the OECD eco-innovation framework within the ambitious urban project of Neom, Saudi Arabia. It provides a nuanced understanding of how international sustainability and innovation frameworks can guide the development of new urban centres. By integrating eco-innovation principles into Neom's planning and development, this study contributes to the expanding discourse on sustainable urban development, particularly within emerging cities.

The findings from this study underscore the adaptability and relevance of the OECD eco-innovation framework in addressing the unique challenges and opportunities of sustainable urban development in Neom. This insight is pivotal for future research as it highlights the potential for international frameworks to be tailored to specific urban contexts, extending their applicability and impact. Future studies could build upon this work by exploring the implementation of similar frameworks in other urban development projects globally, comparing their efficacy and identifying best practices for eco-innovation in urban planning.

This study has its limitations. Its primary reliance on qualitative data from expert interviews and document analysis provides rich, in-depth insights but limits the findings' generalizability. Neom's development project's evolving nature means that some of the analysis may become dated as the project progresses. Furthermore,

focusing on the OECD eco-innovation framework may overlook other potentially relevant models or frameworks that could inform sustainable urban development.

The research implications are manifold. For policymakers and urban planners, the study suggests that integrating international sustainability frameworks like the OECD's can offer structured pathways to embed eco-innovation within urban development projects. It also emphasises the importance of customising these frameworks to local contexts to ensure their effectiveness and relevance. This study opens new avenues for researchers to examine the intersection of eco-innovation and urban sustainability, particularly in greenfield urban projects like Neom.

Moreover, the findings advocate for a multidisciplinary approach to sustainable urban development, combining insights from environmental science, urban planning, technology innovation, and policy analysis. This integrated perspective is crucial for addressing the complex challenges of building sustainable cities in the 21st century.

In conclusion, this research contributes to a deeper understanding of how the OECD eco-innovation framework can be leveraged to foster sustainable urban development, as Neom's case study exemplified. While recognising the limitations of our research, the insights gleaned offer valuable implications for both practice and future research. As urbanisation continues to accelerate globally, the lessons drawn from Neom's approach to eco-innovation can serve as a blueprint for other cities aspiring to combine urban development with environmental stewardship and technological innovation.

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