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Bangkok Cooling Initiative:

Incentivizing Private Investment for Urban Heat Mitigation in Bangkok, Thailand

Final Proposal

Junya Eriguchi

Emily Murnane

Bradley Murray

Taishin Noble

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Urban Heat Island Mitigation in Bangkok

1. Problem Identification

1.1 Defining the Problem

Areas across the globe are facing an imminent surge in temperatures as outlined in the Intergovernmental Panel on Climate Change's assessment Report 6 (IPCC AR6).¹ The report found that population exposure to heat is increasing in frequency, duration, and magnitude - putting billions of people at risk. Between 2000 and 2016, the number of people exposed to harmful levels of heat increased by around 125 million.² Furthermore, in 2003, 70,000 people in Europe died due to heat related illnesses. The rising heat often impacts the most vulnerable communities and accentuates existing disparities.

Amidst these challenges, the Urban Heat Island (UHI) effect emerges as a critical facet of the urban climate predicament. UHI, is a phenomenon where dense urban areas experience significantly higher temperatures than the neighbouring areas or those located in suburbs.³ Whist several factors may contribute to exacerbation of UHI effect it is primarily caused by human modifications to land surfaces. Some examples include the replacement of trees and vegetation with asphalt which absorb and retain heat. These surfaces can become significantly hotter than natural surfaces, leading to increased temperatures in urban environments. Buildings and infrastructure, tall buildings can create "canyon effects," trapping and reflecting heat within streets. Additionally, the materials used in construction, such as concrete and steel, have high thermal mass and can retain heat, contributing to increased temperatures. Waste heat generated by cars, factories, and air conditioners accumulate in urban areas and contribute to the increasing temperatures.⁴ All these factors contribute to altered thermal characteristics of urban landscapes that exacerbate the intensity and duration of heatwaves. This amplifies the risk of heat stress and related health issues. By 2050 it is expected 68% of the world's population will live in urban areas, which puts billions of people at risk to this heat related morbidity and mortality.⁵

¹ Lee, Hoesung, Katherine Calvin, Dipak Dasgupta, Gerhard Krinner, Aditi Mukherji, Peter Thorne, Christopher Trisos, José Romero, Paulina Aldunce, and Alexander C. Ruane. "CLIMATE CHANGE 2023 Synthesis Report Summary for Policymakers." *CLIMATE CHANGE 2023 Synthesis Report: Summary for Policymakers* (2024).

² Dunne, Daisy. "Impact of Climate Change on Health Is 'the Major Threat of 21st Century.'." (2017)

³ Kotharkar, Rajashree, Aparna Ramesh, and Anurag Bagade. "Urban heat island studies in South Asia: A critical review." *Urban climate* 24 (2018): 1011-1026.

⁴ Mohajerani, Abbas, Jason Bakaric, and Tristan Jeffrey-Bailey. "The urban heat island effect, its causes, and mitigation, with reference to the thermal properties of asphalt concrete." *Journal of environmental management* 197 (2017): 522-538.

⁵ Kundu, Debolina, and Arvind Kumar Pandey. "World urbanisation: Trends and patterns." *Developing national urban policies: Ways forward to green and smart cities* (2020): 13-49.

As temperatures soar, the risk of heat-related stress and mortality escalates, unveiling a pervasive threat to public health.⁶ Heat is the primary weather-related cause of death in the United States. Heat related morbidity includes but is not exhaustive too heat stroke, cardiovascular issues, respiratory problems and renal issues (kidney problems).⁷ Vulnerable demographics, including the elderly, children, and socioeconomically disadvantaged groups, are disproportionately affected. Another major economic impact is reduced labour productivity. The effectiveness of workers dwindles under the oppressive heat, significantly impacting productivity. Some studies such as those by Gosling et al., (2019) provide framework that indicates mean annual global GDP losses could reach 0.2% in the 2030s and 0.6% by the end of the century.⁸ The escalating temperatures also amplify the strain on healthcare systems and infrastructure.

This policy proposal is a proactive response to this urgent problem, aiming to address the impacts of climate change-induced heat and the UHI effect on vulnerable communities. By breaking down the complexities of these issues, our goal is to establish a strong foundation for comprehensive solutions. These solutions will help alleviate the negative effects of the UHI effect and promote a more resilient and sustainable future for all.

1.2 Bangkok, Thailand: Vulnerable Population and Territory

With the concept of 'vulnerability' being a critical part of the prompt it is important to grasp the definition of it. The IPCC defines vulnerability as a system's (such as a community, region, or ecosystem) predisposition to adverse effects and its lack of capacity to cope with climate change.⁹ In this paper, 'climate vulnerability' pertains to a system's susceptibility to climate impacts and its coping and adaptive capacity. 'Vulnerable population' includes those at higher risk due to socio-economic status, health, age, geography, or other factors.¹⁰

Southeast Asia is a region considered by the Asian Development Bank (ADB) as highly vulnerable due to 'a combination of geography, population and poverty'.¹¹ As Southeast Asia's population is expected to grow by approximately 150 million by 2040, it is essential that policy

⁶ Honda, Yasushi, Masahide Kondo, Glenn McGregor, Ho Kim, Yue-Leon Guo, Yasuaki Hijioka, Minoru Yoshikawa et al. "Heat-related mortality risk model for climate change impact projection." *Environmental health and preventive medicine* 19 (2014): 56-63.

⁷ Riley, K., Wilhalme, H., Delp, L., & Eisenman, D. P. (2018). Mortality and morbidity during extreme heat events and prevalence of outdoor work: an analysis of community-level data from Los Angeles County, California. *International journal of environmental research and public health*, *15*(4), 580.

⁸ Gosling, S., Zaherpour, J., & Szewczyk, W. (2019). Assessment of global climate change impacts on labour productivity.

⁹ Brooks, Nick. "Vulnerability, risk and adaptation: A conceptual framework." *Tyndall Centre for climate change research working paper* 38, no. 38 (2003): 1-16.

¹⁰ Sharma, Richa, and R. Srikanth. "The consequences of climate change on vulnerable populations." *Climate Change and the Health Sector: Healing the World* (2021): 10.

¹¹ Asia, S. E. "The economics of climate change in Southeast Asia: a regional review." (2009).

makers in this region take the opportunity to plan sustainably and progressively to account for the increasing urbanization and the warmer future.¹²

In Southeast Asia, our case study on UHI mitigation focuses on Bangkok, Thailand. This is because during the dry season, the city experiences an urban heat island intensifying temperatures by up to 6-7°C, ranking it the fourth highest globally for heat exposure.¹³. Causes include limited green space, poor urban design, extensive air conditioning, and high vehicle emissions. While some high-risk cities in other countries have initiated heat mitigation measures, the Thai and Bangkok governments have not, influenced by weak governance, economic priorities, and bureaucratic obstacles. ¹⁴ This disparity highlights unequal vulnerability, disproportionately affecting low-income communities. Targeted UHI mitigation in this region could yield numerous socio-economic benefits.

¹² United Nations, Department of Economic and Social Affairs, Population Division (2022). *World Population Prospects 2022 - Special Aggregates, Online Edition.* https://population.un.org/wpp/Download/SpecialAggregates/Geographical/.

¹³ Cascade Tuholske et al., 'Global Urban Population Exposure to Extreme Heat', *Proceedings of the National Academy of Sciences* 118, no. 41 (12 October 2021): e2024792118, https://doi.org/10.1073/pnas.2024792118.

¹⁴ Nishant Saxena, 'Heat Officer: If Bangladesh Can, India Should, Uttar Pradesh Must!', *The Times of India*, 15 September 2023, <u>https://timesofindia.indiatimes.com/blogs/the-write-wing/heat-officer-if-bangladesh-can-india-should-uttar-pradesh-must/</u>.



- Figure 1. Changes in land use and land cover in Bangkok from 1991 to 2016



- Figure 2. Changes in land surface temperature in Bangkok from 1991 to 2016

Sourced from Dararat Khamchiangta and Shobhakar Dhakal, 'Time Series Analysis of Land Use and Land Cover Changes Related to Urban Heat Island Intensity: Case of Bangkok Metropolitan Area in Thailand', *Journal of Urban Management* 9, no. 4 (1 December 2020), Fig. 2 and Fig. 5.

1.3 Policy Background in Thailand

Measures to mitigate UHI can vary depending on the condition of each city, and how much the country allocates resources to tackle this issue. Common ways for city planners to approach UHI are Urban Morphology Design, Green Infrastructure Developments, Highly Reflective Pavements, and Phase-Changing Materials.¹⁵ In doing so, local and national government should take the initiative to come up with measures depending on the local context.

In Thailand, the national government has expressed a passive view towards UHI mitigation. An Official from the Department of Public Works and Town & Country Planning (DPT) which governs land use planning at the national level once admitted that 'our department focuses more on economic rather than environmental priorities'.¹⁶ Therefore, it is unlikely that the national government will take the initiative and take proactive measures to prevent UHI. In Thailand where UHI awareness is less prevalent, the government is focusing more on short-term economic gains.

The Bangkok Metropolitan Agency (BMA) has several policies that can potentially address extreme heat in the city, although it has not specifically developed policies to tackle UHI. Currently, three divisions of agencies are working on projects that are related to heat adaptation, but there is scarce collaboration among them and the effect on UHI is insufficient.¹⁷ For instance, heat adaptation is included in climate mitigation and adaptation policies.

In order to restrict unplanned urban development, the City Planning Department of the BMA set forward a 'comprehensive' land use plan in 2013.¹⁸ However, due to issues with cross-departmental communication and permissively low fines for breaches of zoning requirements, little impact was made in protecting remaining green space in the city.¹⁹

Furthermore, some argue that it is the nature of BMA that limits the capacity of its project. There is criticism over the implementation of policies of the BMA. Additionally, some scholars point out that the lack of explicit division or leadership to engage with improving people's lives (including UHI measures) within BMA is limiting its ability to deliver effective policy. Policies that cannot be directly measured by their short-term economic effects are less prioritized within the governmental body. The private sector is also not interested in engaging with environmentally

¹⁵ Ardalan Aflaki et al., 'Urban Heat Island Mitigation Strategies: A State-of-the-Art Review on Kuala Lumpur, Singapore and Hong Kong', *Cities* 62 (February 2017): 131-45, https://doi.org/10.1016/j.cities.2016.09.003.

¹⁶ Marks, Danny, and John Connell. 2023. "Unequal and Unjust: The Political Ecology of Bangkok's Increasing Urban Heat Island." Urban Studies, January, 004209802211409. <u>https://doi.org/10.1177/00420980221140999</u>.

 ¹⁷ Sigit D. Arifwidodo et al., 'Exploring the Effects of Urban Heat Island: A Case Study of Two Cities in Thailand and Indonesia', *APN Science Bulletin* 9, no. 1 (2019), <u>https://doi.org/10.30852/sb.2019.539</u>.
¹⁸ Bangkok Metropolitan Administration, 'Executive Summary: 20-year Development Plan for Bangkok Metropolis, Phase 1 (2013-2017)', BMA, Bangkok, (2013)

¹⁹ Marks, Danny, and John Connell. 2023. "Unequal and Unjust: The Political Ecology of Bangkok's Increasing Urban Heat Island." Urban Studies, January, 004209802211409. https://doi.org/10.1177/00420980221140999. p.13

friendly building projects.²⁰ Therefore, it is crucial for the government to take the lead to change the situation and give the private sector incentive to work on UHI countermeasure projects, to bring long-term benefit to the region.

Figure 3 below presents a causal map of Bangkok's political landscape, analysing the contributing causes and effects of UHI severity in the city.

²⁰ Marks, Danny, and John Connell. 2023. "Unequal and Unjust: The Political Ecology of Bangkok's Increasing Urban Heat Island." Urban Studies, January, 004209802211409. <u>https://doi.org/10.1177/00420980221140999</u>.

- Figure 3. Causal Map of Urban Heat Island effect in Bangkok



The Urban Heat Island Effect in Bangkok, Thailand



2. Proposed Solution

2.1 Solution Requirements

To effectively address the scale of the challenges in Bangkok's policy environment and the limited success of previous initiatives, a new approach is needed. A successful solution should aim to overcome the dilemma of misaligned objectives among stakeholders; it must prioritise the involvement and engagement of private developers, who have a critical role to play in building green infrastructure that mitigates the worst effects of UHI. It is also critical to ensure policy coherence within the Thai government, particularly between national and local levels. This solution should be designed in recognition of the political, economic and societal drivers that can shape the partnership dynamics between private developers, government agencies and local communities. By incorporating these factors, our solution will be well placed to address the contextual issues that have hampered previous environmental policies.

2.2 Overview of the Bangkok Cooling Initiative (BangCool)

Our proposal is to promote green infrastructure throughout the city, starting with the government and eventually involving private sector companies. While the projects undertaken by the government are important and critical, ultimately involving the private sector is essential and is at the core of this policy. The ideal is to start a movement from the government, allowing the policy to naturally spill over, propagate in society, and continue in its own positive direction. The solution starts with establishing a pilot initiative that will create the conditions for local stakeholders to work together effectively on green infrastructure development. This pilot can serve as a model for public-private partnerships in Bangkok that are conducive to implementing proven measures to mitigate UHI.

The initiative consists of two phases.

Phase 1 will focus on a pilot study and on raising awareness.

The first step is to spread awareness of the problems with UHI, its benefits, and solutions. A new task force will be formed in the government under the executive branch and given authority to work on UHI mitigation measures primarily and they will initiate the pilot projects. The project will demonstrate to people the benefits of the mitigation and put momentum to the issue in society. The pilot project is also a way to see which direction is best suited for Bangkok in practice. It is also the most vulnerable popular approach. Depending on cities with different conditions and landscapes can change what is the most effective method to deal with the situation. This will involve improving stakeholders' knowledge of the scale of the problem and technical solutions, as well as the network of interested parties and how to develop effective partnerships. This will include a participatory pilot study between local authorities and private developers to demonstrate inclusive, targeted collaboration focused on UHI effective green infrastructure, and the creation of a dedicated UHI Task Force with staff drawn from across the BMA.

Phase 2 will build on the foundations of the previous phase through the use of targeted **incentives**.

These incentives will drive behavioural change in areas that can be shown to have a high impact within the Bangkok policy context. These include the establishment of a rating system for sustainable buildings, subsidies for measures such as painting roofs white and planting vegetation, and revised purchasing criteria for public procurement.

2.3 Objectives / Goals

The establishment of the Bangkok Cooling Initiative has the following objectives:

- 1. Create the conditions for effective partnerships between the BMA and private developers on UHI mitigation measures.
- 2. Improve institutional awareness of UHI within the Thai public and private sector.
- 3. Overcome bureaucratic fragmentation between national and local government agencies.
- 4. Improve the living conditions of Bangkok residents living in the most affected areas of the city, as measured by relevant urban liveability indicators.²¹
- 5. Successfully implement pilot projects that can serve as proof-of-concept for local stakeholders and as a model for future collaboration.
- 6. Improve transparency in the planning process of green infrastructure development, and the reduction of non-compliance with existing green building codes.
- 7. Provide evidence to local policymakers on which financial incentives have a demonstrable impact on UHI metrics and are contextually appropriate for Bangkok.
- 8. Facilitate greater local community involvement and oversight of the infrastructure development process.

See Figure 9 in the Monitoring and Evaluation section for a more detailed analysis of outputs, short-term results and long-term impacts.

2.4 Relevance of Solution

The Bangkok Cooling Initiative represents a comprehensive strategy aimed at addressing overcoming critical challenges in the UHI mitigation landscape. Its relevance is underscored by its strategic alignment with the specific needs and dynamics of Bangkok, addressing key obstacles that have hindered success in the past. This includes addressing the misalignment of interests among key government and private sector players, limited collaboration between private sector and public, and a lack of understanding and awareness of the UHI effect. By recognising these shortcomings from past policy initiatives and understanding the current environment of Bangkok, our proposal endeavours to bridge these gaps and spark a

²¹ Alderton, Amanda, Carl Higgs, Melanie Davern, Iain Butterworth, Joana Correia, Kornsupha Nitvimol, and Hannah Badland. 'Measuring, monitoring and translating urban liveability in Bangkok: An international case study with implications for Australian cities.' Centre for Urban Research, RMIT University: Melbourne, Australia. (2022) 10.25439/rmt.20113526.

transformative change in UHI mitigation strategies. Our proposal strategically focuses on three key areas to fortify its impact: Infrastructure, Government Capability, and Community Outreach.

Urban Transformation

With Thailand experiencing a surge in public construction and substantial investment in megaprojects, the national government's commitment to modernising Bangkok is evident. Leveraging this momentum, we advocate for an extension of existing public procurement rules to encompass land use planning and development in the city. The sustainable building rating system will hopefully add competition to the market and incentivise businesses to adopt UHI mitigating practices into their infrastructure projects. This expansion empowers the government to effectively monitor projects for compliance with green regulations while facilitating the fair distribution of financial incentives for green infrastructure proposals.

Governance Innovation

By revising procurement by including UHI measures such as white roofs, the aim is to allow for more efficient implementation of green initiatives. The establishment of clear lines of responsibility between national government ministries and the Bangkok Metropolitan Administration (BMA) is anticipated to fill gaps in decision-making authority, discouraging developers from circumventing land use planning regulations. Furthermore, centralizing information on land use and infrastructure projects in the city will provide the BMA with valuable insights. Integrating this data with advanced technologies such as remote sensing and satellite imagery will enable local authorities to pinpoint areas of Bangkok at higher risk from UHI, facilitating targeted intervention strategies.

Public Awareness and Local Community Engagement:

Initiate a comprehensive awareness campaign and participatory pilot study to engage the local community. The focus is on raising awareness about UHI issues, its benefits, and potential solutions. The goal is to foster a sense of ownership and concern among the public, creating a foundation for greater local community involvement in UHI mitigation efforts. This involvement will include oversight of the infrastructure award process, ensuring compliance with green building codes, and encouraging community participation in the decision-making process. This addresses the lack of awareness and understanding of UHI that has hindered progress in the past.

2.5 Role of Key Stakeholders

To start the project, the BMA should lead the way and reach out to other stakeholders as the first move. However, as highlighted previously, the government is not cohesive and existing efforts to resolve the issue regarding UHI have faced setbacks. Therefore, the establishment of one dedicated interministerial task force for UHI mitigation is crucial. Another significant party in revising Bangkok's unchanged environmental situation is the local community. It is essential to involve the local population in the movement since the governments are compelled to change once the public is more concerned and aware of the issue. From this perspective, the pilot projects that will be conducted by the task force will have greater social implications. Government measures are expected to increase interest in heat island reduction measures by

showcasing the benefit of taking UHI mitigation measures to people and by cultivating awareness among its people for the problem. In order to overcome potential opposition or lack of interest from the private sector, it would be beneficial if the government and the public were aligned about UHI. Private developers will be sensitive to changes in public perceptions and any correlating effect on market conditions; it is assumed that developers will be more likely to engage in the development of green infrastructure if it presents business opportunities. To further persuade the private sector, local BMA departments can begin involving them at an early stage in the establishment of procurement regulations and rating system for buildings while being mindful of policy capture. By following this approach, our solution will be wellplaced to address the contextual stakeholder issues that have hampered previous environmental policies in Bangkok.

2.6 Functions

The BangCool initiative would provide the following functions:

-	Figure 4: I	Functions of	f BangCool	Initiative
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Function	Description
Information Hub	All Government procurement of infrastructure projects would be located on one platform. In addition, all landowners in Bangkok would only be required to submit land use and development proposals to one system, instead of communicating with several government agencies.
Transparent Reporting	Documentation of infrastructure proposals and procurement decisions would be systemically required by relevant stakeholders and made publicly accessible.
Community Engagement	Local communities can be informed of new proposals being considered for their area, and easily participate in public consultations for infrastructure projects.
Financial Incentives	Funding from national and local government along with grants from international donors can be made visible to developers. Clear financial rewards to green infrastructure development and adherence to green building code will reduce levels of non- compliance. ²²
Revised Procurement Criteria ²³	Implementing relevant design measures into the procurement criteria for government infrastructure projects will utilize government market power to promote heat-resilient infrastructure.

²² Jere Lehtinen et al., 'The Grand Challenge: Effective Anti-Corruption Measures in Projects', International Journal of Project Management 40, no. 4 (May 2022): 347-61, <u>https://doi.org/10.1016/j.ijproman.2022.04.003</u>.

²³ Walker, Helen, and Wendy Phillips. 2009. "Sustainable Procurement: Emerging Issues." International Journal of Procurement Management 2 (1): 41. <u>https://doi.org/10.1504/ijpm.2009.021729</u>.

Education	The system can be used to promote guidance on best practices for green infrastructure development, as well as highlight cases of successful projects in Bangkok.
Sustainability Certification	Introduce a sustainability certification program for buildings and infrastructure projects. This program would assess and certify projects based on their adherence to green building standards, energy efficiency, and UHI mitigation measures, encouraging developers to aspire to higher sustainability standards.
Youth Engagement	Establish programs to engage and educate youth on UHI and environmental sustainability. This could involve partnerships including schools and universities, youth-led community projects, and educational campaigns to foster a new generation of UHI conscious citizens.
Business Engagement and Support	Create a support system for businesses to adopt green practices. This could involve providing consultancy, resources, and potential tax incentives for businesses that actively reduce their heat footprint and invest in sustainable practices.

3. Implementation Plan

A detailed implementation plan is necessary to ensure the success of the project. Stakeholders' perceptions must be carefully monitored throughout the project to ensure that these are in line with the project's objectives, and that sources of funding and expertise are being utilised.

3.1 Pilot Program

A pilot program in a district in Bangkok provides an opportunity to measure and highlight the short-term benefits of the project to raise private sector interest and community awareness. The BangCool initiative's pilot phase aims to cover 3,000 residential roofs in one of Bangkok's hotspot districts such as Udom Suk, Khlong Toei, and Huai Khwang. Based off past successful examples of similar initiatives, the implementation strategy includes forming partnerships with local universities, NGOs, and the private sector, recruiting volunteers from local colleges and communities, and involving real estate developers for innovative UHI measures.

Community awareness and engagement will involve information campaigns and practical demonstrations in community centres. Monitoring and evaluation will include installing temperature sensors and energy measuring devices in selected homes and collecting feedback from residents. For funding, the initiative will seek local government funding, private sector contributions, and international aid.

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	Very Successful	Successful	Unsuccessful					
Temperature Monitoring (Decrease in average indoor temp)	>2.0°	>1.0°	<1.0°					
Feedback (Resident Satisfaction)	>70%	>50%	<50%					
Impact Assessment (Energy Savings)	>20%	>10%	<4%					
Cost-Benefit Assessment (Benefits/Cost)	>1.5	>1.0	<1.0					

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Flaure	5.	Success	Criteria	for the	Pilot	Proi	ect
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3.2 Funding

The BangCool initiative, emphasizing simplicity and cost-effectiveness through approaches like government reorganization and subsidizing white roofs, aims to circumvent the shortcomings of previous projects. However, despite the affordability of these strategies, external funding remains essential due to the limited government interest in Urban Heat Island (UHI) effects and budgetary constraints. Potential financial support could come from major climate funds such as the Green Climate Fund (GCF), the Asian Development Bank's Urban Climate Change Resilience Trust Fund, and the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR), all of which have previously backed similar UHI-focused initiatives, including projects like "Strengthening Women's Resilience to Heat Stress in Asia and the Pacific." ²⁴ Given

²⁴ "Strengthening Women's Resilience to Heat Stress in Asia and the Pacific." 2023. Asian Development Bank. August 10, 2023. https://www.adb.org/projects/57051-001/main.

Bangkok's high vulnerability to UHI and the relatively low cost of implementing these solutions, securing funding for the initiative is expected to be manageable.

3.2 Stakeholder Analysis and Engagement

This project strategically leverages existing regulatory frameworks and government structures, intending to make targeted adjustments. This method allows the project to stay cost-effective while utilizing market forces to promote heat-resilient infrastructure. A robust engagement plan should ensure that the project can be implemented, as can be seen in Figures 6 and 7.

	Perception	Response
Government/ Political Interest	The BMA has previously stated a prioritization of economic development over sustainability issues. In addition, failed efforts to implement green spaces in Bangkok may make BMA hesitant in adopting this project.	This project provides a low-cost solution by reorganizing the government structure and procurement policy. With the potential long-term economic benefits of this project, in addition to reductions in public expenditure in the medium-term, convincing BMA should be viable.
Private Interest	Potential resistance from developers who have exploited loopholes in land use regulations, a practice that the project seeks to curtail. However, market demand in Bangkok is shifting to prioritize 'quality' over 'quantity', which this project utilizes. ²⁵	An inclusive approach to private sector will prove more persuasive in guiding private developers towards heat-resilient infrastructure. This will encourage private-public cooperation, which will be crucial for this project.
Community Interest	There may be criticism regarding the subsidization of the private sector, with concerns that it primarily benefits large corporations and the affluent.	Community engagement should ensure that the positive impact of UHI mitigation to city residents will be prioritised. In addition, the engagement of civil society groups during the planning process will ensure that community interests are protected and improve transparency.

- Figure 6: Potential Opposition to Project

²⁵ "PARK Origin Thonglor Housing Sales for Approximately 1,200 Units to Launch in November." 2018. Nomura Real Estate Development Co., Ltd. <u>https://www.nomura-re.co.jp/cfiles/engnews/n2018100500183.pdf</u>.

	Stakeholders	Description	Influence Level	Interest Level	Engagement Plan
	National Thai Government: - Ministry of Interior - Ministry of Natural Resources and Environment - Ministry of Public Health	Due to an incomplete level of decentralisation in Bangkok, national ministries possess a varying degree of decision-making power across the policy environment for urban heat island mitigation.	High	Low	Officials in relevant national ministries will be made aware of the project, its objectives and implementation timetable. They will be given the opportunity to highlight where the project may conflict with existing government policies, and efforts will be made to de-conflict where possible.
Public	Department of Public Works and Town & Country Planning (DPT)	Agency in charge of national-level land use planning, an agency of the Ministry of Interior. Although not heavily involved in land use planning in Bangkok, they can be a useful ally in discussions with national ministries.	Low	High	Contact agency officials and try to recruit them as supportive allies. Ask if they have access to land use planning expertise that would support the project.
Public Sector	Bangkok Metropolitan Administration (BMA): - The Governor of Bangkok Secretariat - City Planning Department - Land Department - Environment Department - Health Department - Strategy and Evaluation Department	Sub-national government administering Bangkok and Thonburi. At present, the BMA is perceived to be fragmented and to have limited authority and capacity due to the political structure of Thailand. ²⁶ However, if properly empowered, it could succeed in engaging developers with credibility and authority.	Medium	High	Involve the Governor of Bangkok Secretariat in the UHI Task Force's steering committee to gain senior buy-in. Also involve the Strategy and Evaluation Department who have experience in novel urban planning policy development. ²⁷ Reach out to individual departments to discern current level of understanding and data held.
	Bangkok District Offices	Bangkok is divided into 50 local districts, with each having a council and office for local governance.	Low	Medium	While not all district offices will be directly involved, they can be a valuable source of local knowledge and an intermediary between the BMA and local communities.
Private Sector	Domestic and International developers, construction companies etc.	Private sector actors involved in developing new buildings across Bangkok. A key element of the project is to ensure that they are persuaded to	High	High	Identify which developers have CSR and ESG policies in place and target them as first collaborators. Develop a track record

- Figure 7: Stakeholder Mapping and Engagement Plan

 ²⁶ Rhoden, T. F. 2015. "Oligarchy in Thailand?" Journal of Current Southeast Asian Affairs 34 (1): 3-25. https://doi.org/10.1177/186810341503400101.
²⁷ Amanda Alderton et al., 'Measuring and Monitoring Liveability in a Low-to-Middle Income Country: A Proof-of-Concept for Bangkok, Thailand and Lessons from an International Partnership', *Cities & Health* 5, no. 3 (2 September 2021): 320-28, https://doi.org/10.1080/23748834.2020.1813537.

		enter into collaboration with others to incorporate effective UHI mitigation strategies into their development projects.			with these companies that can then be used to persuade more challenging developers.
	Local Communities	Residents of communities in Bangkok. This could also include non-permanent groups such as travelling workers and informal settlements.	Low	Medium	Highlight their position as potential beneficiaries of the project and invite them to be involved in project consultation. They can act as a useful means of persuasion towards developers that are uncooperative.
Civil Society	NGOs	NGOs advocating for sustainability can be utilized for community engagement and grassroots initiatives.	Low	Low	Depending on gauged interest in projects, seek support in engaging communities and international stakeholders.
	Think-tanks and Universities	Can provide useful skills and knowledge. Project leaders can capitalise on their preexisting expertise on infrastructure development and business incubation.	Low	Medium	Engage with key departments in Universities (Engineering, Architecture, and Urban Planning) and relevant think-tanks, e.g. Thailand Development Research Institute (TDRI).
International and Other Organizations	International Organisations: - UNEP - UN-Habitat - World Bank - Asian Development Bank (ADB) National Development Organisations: - Japan International Cooperation Agency - USAID Non-Profit Organisations: - ClimateWorks Foundation - Clean Cooling Collaborative	Intergovernmental organisations can provide funding, technical expertise and oversight for the project. One potential area of difficulty is attracting attention and funding if there is strong competition from other projects.	High	Low	Review similar projects run by the World Bank, ADB and national development agencies to learn about successes and failures. Identify contacts associated with these projects and develop linkages. Identify potential sources of funding for pilot projects and, later in the implementation phase, for larger green infrastructure projects. Can also approach centres of excellence for technical expertise, such as the UN Global Compact's Cities Programme for urban enterprise sustainability.

3.3 Project Timeline

The BangCool initiative can be broken down into several key stages as can be seen in the GANTT chart in *Figure 8*. Stretching across four years and structured into the two main phases, the initial phase kicks off with project planning and reorganization of government structure, both accomplished within the first year. A significant portion of this phase is dedicated to the pilot project which encompasses preparation, implementation, and evaluation until the end of the second year. The results from the pilot project can be used to improve awareness and interest from the government, private sector, and the community. The second phase consists of the establishment of a Green Building Rating System, revising of the procurement criteria, and the subsidization of white roofs and tree planting across all of Bangkok. The project concludes with a substantial period of results monitoring, ensuring a thorough analysis over the final two quarters of the timeline to refine and scale the project.

	PROCESS		YEAR 1			YEAR 2			YEAR 3				YEAR 4				
	PROCESS	QI	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Project Planning		1														
	Reorganization of Government Structure																
se 1	Pilot Project - Preparation																
Phas	Pilot Project - Implementation																
	Pilot Project - Evaluation																
	Establishment of Green Building Rating System																
se 2	Revising Purchasing Criteria												1				
Pha	Subsidization of White Rooves and Planting Trees																
	Results Monitering																

- Figure 8: GANTT Chart depicting Project Timeline

3.4 Monitoring and Evaluation

A robust monitoring and evaluation methodology will be developed, setting specific targets. Regular data collection will allow for adjustments based on feedback and performance indicators. Figure 9 shows the project's Results Chain which guides the selection of performance indicators.

Additionally, the establishment of feedback and adaptation mechanisms will allow input from stakeholders. Maintaining communication with stakeholders to receive feedback particularly in-between project stages will be crucial. With concerns of an unequal and unjust political ecology, engaging with civil society groups and international organizations should ensure

transparency, community needs are represented, and the legitimacy of the BMA is strengthened.²⁸

- Figure 9: Results Chain



Performance Indicators:

- Consolidation and reorganization of government responsibilities (Qualitative, Short-term)

- Community satisfaction (Qualitative, Long-term)
- Number of heat-resilient buildings (Long-term)
- Number of heat-related illnesses/ deaths (Long-term)
- Number and intensity of UHI areas (Long-term)

²⁸ Marks, Danny, and John Connell. 2023. "Unequal and Unjust: The Political Ecology of Bangkok's Increasing Urban Heat Island." Urban Studies, January, 004209802211409. <u>https://doi.org/10.1177/00420980221140999</u>.

3.4 Contingency Planning

As the Bangkok Cooling Initiative relies on the development of productive collaboration between multiple actors, there are inevitably risks and challenges. During the implementation phase, several contingency options have been identified, as shown in Figure 10 below:

- Figure 10: Risk Assessment and Contingency Options

Issue	Potential Causes	Mitigation Options
The private sector and developers do not participate in the pilot study, nor engage meaningfully with local government.	Commercial interests remain a priority; Non-compliance perceived as still economically beneficial.	Apply persuasion through alternative groupings such as professional associations and industry groups; Highlight positive case studies in other areas.
The local government (BMA) remains fragmented, causing further gaps in governance.	Lack of engagement with UHI Task Force; Conflicting priorities with National Thai Government	Assess where institutional barriers are found; Highlight alignment in objectives; Use momentum of initial successes to overcome setbacks elsewhere.
Local communities are not involved with consultation, or are not persuaded to take part; Specific vulnerable groups, such as low-income migrant workers, are unable to be involved.	Lack of awareness; Lack of trust.	Establish more comprehensive consultation forums; Demonstrate benefits from other cases.
Technical expertise and knowledge is not shared and made accessible to relevant stakeholders.	Lack of communication with local experts and international organisations; Political or financial incentives to withhold knowledge are not addressed.	Ensure reporting from studies and pilots are publicly shared; Facilitate sharing of IO's technical expertise; Ensure that positive outcomes from collaboration are identified as greater than those of non-cooperation.

3.5 Approach to Refinement and Scaling

To ensure that we can self-correct and improve the project over time, we made the decision to focus on pilot activities and foundation-setting in the first phase. This is in recognition of the fact that while there are many measures that can be taken to mitigate UHI, one of the key tasks is to determine which policy options are best suited to an urban environment such as Bangkok. The city is characterised by the more challenging features of an emerging economy, including strained public finances and more pressing infrastructure needs that can conflict with transparent governance.

Through our stakeholder engagement approach, we aim to build capacity to learn over time. A focus on dialogue and partnership will provide our project with a valuable feedback loop and the ability to work through any issues that may arise with key stakeholders. We will combine this with more formal consultation methods throughout the implementation period.

There is moderate potential for the project to be scaled up. Within Bangkok, the results of the initial pilot can easily be replicated in many of the other 50 districts of Bangkok. The BMA's Strategy and Evaluation Department will be well placed to advise on which districts should be prioritised according to levels of UHI heat gain and population risk.

While one of the overarching aims of the Bangkok Cooling Initiative is to be tailored to the specific policy context of the city, the principles of the project could be applied to other cities internationally. Cities in South and Southeast Asia with similar geographical, demographic and socio-economic characteristics would be the most likely candidates for expansion. However, the concept of designing a sustainable policy solution through the use of inclusive collaboration and iterative standard-setting is one that could be applied to a range of policy problems.

4. Conclusion

Effectively tackling Bangkok's UHI problem is not simply about funding green infrastructure development in the city. A sustainable, long-term solution requires a process that ensures buyin from government, developers and local communities, and reduces misalignment between stakeholders. Our solution, BangCool, is well placed to do this. BangCool positively influences the design of infrastructure projects through data-driven and community-led prioritisation. It will not only mitigate the effects of UHI but also has the potential to transforms cities for a more sustainable future.

The identified problem of rising temperatures, exacerbated by the UHI effect, poses significant threats to public health, labour productivity, and overall urban resilience. The proposal acknowledges the specific vulnerabilities of Bangkok, a city experiencing extreme heat during the dry season, with the aim of creating conditions for effective public-private partnerships and enhancing community awareness.

The policy background analysis reveals the passive stance of the national government towards UHI mitigation and the limitations of existing city policies. This proposal also recognises the need for a shift in governmental priorities and outlines a two-phase approach to initiate change. The first phase focuses on raising awareness through a pilot program, involving stakeholders from the government, private sector, and local communities. The second phase builds on the pilot's success, implementing targeted incentives to drive behavioural change and sustainable practices.

The proposed solution, with its clear objectives and goals, addresses key aspects such as partnership development, institutional awareness, bureaucratic fragmentation, and community well-being. The BangCool initiative leverages existing momentum in public construction, emphasises governance innovation, and prioritises community engagement to create a sustainable and scalable model for UHI mitigation. Stakeholder analysis and engagement are also very central to the success of the initiative. This proposal highlights the need for cohesive governmental efforts, active participation from private developers, and the crucial role of community involvement. By aligning the interests of these key stakeholders, the BangCool initiative aims to overcome previous challenges and achieve long-term success.

Next, a comprehensive and clear implementation plan provides a detailed roadmap, encompassing a pilot program, funding strategies, stakeholder engagement, and a robust monitoring and evaluation framework. Our contingency planning also acknowledges potential risks and pitfalls which may occur as well as suggesting measures to address unforeseen challenges.

Overall, the Bangkok Cooling Initiative offers a tailored and innovative approach to UHI mitigation and acknowledges the specificities of Bangkok's problem. By encouraging collaboration, raising awareness, and implementing targeted incentives, the proposal aims to create a resilient, sustainable, and heat-resilient urban environment, setting an example for other cities facing similar challenges worldwide.

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