(DE)CARBONIZING ASIA

HISTORIES AND FUTURES OF ENERGY, SPACE, AND INFRASTRUCTURE

21-22 November 2024

ARI
ASIA RESEARCH INSTITUTE
National University of Singapore

https://ari.nus.edu.sg/events/decarbonizing-asia/

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The current energy transition toward renewable energy and sustainability is a global consensus strongly supported by Singapore's government (Tan, 2022). Still, it is an endeavor comparable in its far-reaching impacts to the tremendous changes brought about by the Age of Coal and the Industrial Revolution. For Singapore and other countries, trialing and upscaling new energy sources is a challenge that is inevitably shaped by the previous energy transitions toward fossil fuels (coal, petroleum, natural gas), which gave birth to the present situation. In Singapore's case, its history as a key coaling station and its recent past and current status as a petrochemical hub mean the transition is fraught with even more difficulties than in other countries (Ng, 2013). On top of the politico-technological path dependencies and lock-in effects, the nation's energy transition faces obstacles due to its small size, dense urban area, minimal wind speeds, and lack of geothermal resources (Ministry of Sustainability and the Environment 2019). Such environmental-geographical factors further complicate long-term investments in infrastructure, changes in the built environment to accommodate new energy sources and the transition away from fossil fuels to mitigate climate change and related problems.

As many scholars have argued, energy exists within socio-technical and technopolitical regimes (Seow, 2022; McNeill and Engelke, 2014; Hecht, 1998; Szeman and Boyer, 2017). The present energy transition, hence, is not limited to engineering and economic questions but has to be understood as historically embedded in and interacting with political (civilian and military), social, cultural, and environmental contexts that complicate any modification of the human-created carbon cycle toward emissions reduction.

Asia is central to the current energy transition due to the lock-in effects, path dependencies, and material conditions created by fossil fuel usage and the related carbon cycle. Our workshop will scrutinize these historical factors to increase our understanding of how previous energy transitions are still shaping the present one. Such energy transitions refer to highly dynamic processes of a gradual shift from a specific pattern of energy provision to a new state of an energy system, such as from biofuels (wood, charcoal) to fossil fuels (coal, oil, natural gas) or from them to renewables (Smil, 2010, vii). Recently, energy historians have compellingly argued that an energy transition is less "a discrete, punctuated shift" from one stage or system or fuel to another, but more "a layering" that leads to new and hybrid forms of energy provision and services (Gross and Needham, 2023:13; Barak, 2020). Energy transitions since the Age of Coal, in Asia beginning roughly in the mid-nineteenth century, have strongly transformed the planetary carbon cycle through human-caused carbon emissions resulting from new techno-industrial regimes of heat and energy generation. To mitigate climate change and multiple other highly undesirable environmental impacts related to carbon emissions, such as ocean acidification, sea level rise, and urban smog from fossil fuel burning, the Asia-Pacific region's importance cannot be overstated. The region's carbon emissions surpass the collective emissions of all other regions. Decarbonizing Asian economies is key to achieving the goal of net zero carbon emissions by 2050, which needs a historical understanding of the previous pathways of carbon lock-in.

The workshops will address the following questions which include:

- How have Asia's specific socio-technical and techno-political configurations historically shaped the use—including production, circulation, and consumption—of fossil fuels in Asia?
- Why did these historical patterns of energy use in Asia create certain spaces and infrastructures while excluding or marginalizing alternative configurations? How did these choices and the corresponding built environment cause path dependencies and lock-in effects that constituted barriers and opportunities for past and present energy transitions?
- How have environmental conditions and political decisions resulted in local differences in speed and intensity of energy transitions? How did such differences shape the (unequal) relationship between Asian urban centers and their hinterlands?

PROGRAM AT A GLANCE

DATE	TIME (SGT)	PANEL SESSION
21 Nov 2024 (Thu)	09:15 – 09:30	**WELCOME & INTRODUCTORY REMARKS**
	09:30 – 11:00	**PANEL 1**
	11:30 – 13:00	**PANEL 2**
	14:00 – 15:30	**PANEL 3**
	16:00 – 17:00	**PANEL 4**
	17:00 – 17:30	**SUMMARY OF DAY 1**
	18:00 – 20:00	**WORKSHOP DINNER** (For speakers and chairpersons only)
22 Nov 2024 (Fri)	10:00 – 11:30	**PANEL 5**
	13:00 – 14:30	**PANEL 6**
	15:00 – 16:00	**PANEL 7**
	16:00 – 16:30	**SUMMARY OF DAY 2**
	16:30 – 17:00	**CLOSING REMARKS**

21 NOVEMBER 2024 • THURSDAY

09:15 – 09:30	**WELCOME AND INTRODUCTORY REMARKS**
	JIAT-HWEE CHANG | *National University of Singapore*
	STEFAN HUEBNER | *National University of Singapore*
09:30 – 11:00	**PANEL 1**
Chairperson	**STEFAN HUEBNER** | *National University of Singapore*
09:30	Uneven Expansion of 'Sweet Power': Sugarcane-based Electricity Production and Circulations in Cold War 'Hydro'-'Power' Geographies of Northeast Thailand **HIROMI INAGAKI** | *Future Cities Lab, Singapore-ETH Centre*
09:50	From Hydro to Fossil Fuel: Energy Transitions, Agrarian Democracy, and Environmental Pollution in South India, c.1940-1980 **ADITYA RAMESH** | *University of Washington*
10:10	Vietnam's Energy Transition: Overcoming Historical Lock-ins for a Sustainable Future **LAN THUONG NGUYEN** | *National Chengchi University*
10:30	**QUESTIONS & ANSWERS**
11:00 – 11:30	**MORNING TEA BREAK**
11:30 – 13:00	**PANEL 2**
Chairperson	**FATHUN KARIB** | *National University of Singapore*
11:30	Historic Energy Transitions in Southeast Asia **ROGER FOUQUET** | *National University of Singapore*
11:50	Energy Hinterlands: Socio-Spatial Implications of Renewable Energy Production in Southeast Asia **NAOMI C. HANAKATA** | *National University of Singapore*
12:10	Mapping Collaborative Solar Energy Strategies through Green Regionalism in Taiwan and Southeast Asia **NATALIE W.M. WONG** | *National Chengchi University*
12:30	**QUESTIONS & ANSWERS**
13:00 – 14:00	**LUNCH**

14:00 – 15:30	**PANEL 3**
Chairperson	**WALKER DEPUY** | *National University of Singapore*
14:00	A Garden City in a Petropolis: Mapping the (In)visibility of Oil and the (Dis)connections of Carbon in Singapore **JIAT-HWEE CHANG** | *National University of Singapore* **STEFAN HUEBNER** | *National University of Singapore* **DOROTHY TANG** | *National University of Singapore*
14:20	Asia's Oceanic Great Acceleration and the Amphibious Development State: How Waters, Seabeds, Coastlines, and Subsoils Became Part of Japan and Singapore's Shared Fossil Fuel Space **STEFAN HUEBNER** | *National University of Singapore*
14:40	National Gasification: The Struggle Over Gas Distribution from Colonial to Postcolonial Indonesia **FATHUN KARIB** | *National University of Singapore*
15:00	**QUESTIONS & ANSWERS**
15:30 – 16:00	**AFTERNOON TEA BREAK**
16:00 – 17:00	**PANEL 4**
Chairperson	**DOROTHY TANG** | *National University of Singapore*
16:00 *Online*	The Making of Fossil Asia: Historical Networks of Petroleum Flows and the Energy Transition **CAROLA HEIN** | *Delft University of Technology*
16:20	Petroleum Dreamscape: How Science and Politics Fuel the Search for Oilfields within Korean Territory? **BUHM SOON PARK** | *Korea Advanced Institute of Science and Technology*
16:40	**QUESTIONS & ANSWERS**
17:00 – 17:30	**SUMMARY OF DAY 1**
	HIROSHI OHTA | *Waseda University*
17:30	**END OF DAY 1**
18:00 – 19:30	**WORKSHOP DINNER** (For speakers and chairpersons only)

22 NOVEMBER 2024 • FRIDAY

10:00 – 11:30	**PANEL 5**
Chairperson	**NAOMI C. HANAKATA** | *National University of Singapore*
10:00	Flyover Shamans, Energy Transitions, and Layered Infrastructures on Hong Kong Island **JACK GREATREX** | *Nanyang Technological University*
10:20	Japan's Green Transformation (GX): Its Inclination to Technological Fixation **HIROSHI OHTA** | *Waseda University*
10:40	The Dilemma of Data Centres: Understanding Infrastructural Lock-In from Within **YEE WIN NEO** | *King's College London & National University of Singapore*
11:00	**QUESTIONS & ANSWERS**
11:30 – 13:00	**LUNCH**
13:00 – 14:30	**PANEL 6**
Chairperson	**JAMES D. SIDAWAY** | *National University of Singapore*
13:00	Diesel Power Plant Conversion: A Critical Analysis of Indonesia's Plan to Decarbonize **ANTO MOHSIN** | *Northwestern University – Qatar*
13:20	Future Pasts: Oil Transitions in the Urban Frontier of the Persian Gulf and Arabian Peninsula **NELIDA FUCCARO** | *New York University – Abu Dhabi*
13:40	Mobility Revolution: Offshore Oilfield Service Industry in Shenzhen and its Connections to Singapore **TAOMO ZHOU** | *National University of Singapore*
14:00	**QUESTIONS & ANSWERS**
14:30 – 15:00	**AFTERNOON TEA BREAK**
15:00 – 16:00	**PANEL 7**
Chairperson	**TAOMO ZHOU** | *National University of Singapore*
15:00 *Online*	Petrocultural Obstructions to the Bruneian Energy Transition **RINNI MARLIYANA BINTI HJ AMRAN** | *University of Brunei*
15:20	Indonesian Oil and Coal during the Colonial and New Order Period **FARABI FAKIH** | *Gadjah Mada University*
15:40	**QUESTIONS & ANSWERS**
16:00 – 16:30	**SUMMARY OF DAY 2**
	BUHM SOON PARK | *Korea Advanced Institute of Science and Technology*
16:30 – 17:00	**CLOSING REMARKS**
	STEFAN HUEBNER | *National University of Singapore* **JIAT-HWEE CHANG** | *National University of Singapore*
17:00	**END OF WORKSHOP**

Uneven Expansion of 'Sweet Power': Sugarcane-based Electricity Production and Circulations in Cold War 'Hydro'-'Power' Geographies of Northeast Thailand

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Much literature on energy transitions has explored ways in which biophysical and socio-technical systems shape transitions to renewable energy, yet limited attention has been paid to the uneven expansion of renewable energy production and distribution. By employing a case of sugarcane-based electricity generation in Northeast Thailand, this paper investigates the historical and geographical processes through which socio-material-technical interactions both facilitated and constrained the spatial and scalar expansion of 'sweet power'. The study integrates material politics and technopolitics with a historical geographical materialist framework to illuminate the political reorganization of expertise and science, its effects on material accumulation, subsequent new formations of socio-techno-material networks and their effects on capitalist production and circulations of 'power'.

Through archival analysis, multi-sited interviews, and field observations, this research traces the accumulation and circulation patterns of sugarcane, water, and electricity in Northeast Thailand, while examining key actors, their motivations, and associated discourses. The findings demonstrate that the interconnected hydropower grids established during and after the Cold War continue to influence the scale of 'sweet power' expansion. While 'sweet power' production can spatially expand wherever sufficient sugarcane and water resources exist, its scale remains constrained by the necessity of integration with a particular 'power' transmission regime. This study suggests that energy transition research should expand beyond single-source analysis to examine the interactions and friction among spatially interconnected, co-constituted energy systems. Theoretically, it advances an understanding of uneven renewable energy development by shedding light on the historically and geographically specific accumulation and circulation of material and technological power, and its influence on the expansion of both social and electrical 'power' networks.

Hiromi Inagaki is a postdoctoral researcher at the Future Cities Lab. Her research investigates extended urbanization processes in which agricultural territories have been operationalized for renewable energy production. The case studies include bioenergy and solar power production in Thailand and Indonesia. Hiromi Inagaki received a doctoral degree in Political Geography from the National University of Singapore. Her thesis examined historical, geographical and material processes in which sugar and electricity productions had been expanded and interlinked within and across Northeast Thailand. By engaging material-techno-politics and political economic geography, her research traced interconnected material and discursive flows of 'power', water, sugarcane, and electric and agricultural engineering knowledge. Prior to the PhD study, Hiromi Inagaki was based in Bangkok, Thailand, for over eight years, managing multi-donor-funded projects on climate change mitigation and adaptation in Southeast Asia. She holds a MA in Development Studies from the Institute of Social Studies in the Netherlands.

From Hydro to Fossil Fuel: Energy Transitions, Agrarian Democracy, and Environmental Pollution in South India, c.1940-1980

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Beginning in the 1960s, as backwater wetlands rapidly transformed into Tamilnadu's (a large state in southern India, formerly known Madras State) petro-chemical hubs, the coastal histories of south India reveal overlapping ideas about how cities, industry, and energy infrastructure were imagined and materialized. The aqueous terrain of the backwaters, its creek, canals, marshes, and the sea were germane to the negotiation of land rights, national energy regimes, urban infrastructures, and multilevel environmental governance. The Madras State, in the 1950s, was *unique* in newly independent India, producing over 70% of its electricity needs through hydropower. Through the colonial era from the 1930s, successive governments had put in place an extensive network of hydropower plants, created an electricity grid, nationalized power production and distribution, and marketed electricity to successfully to the agriculturalists. From 1947, the year of Indian independence, electricity usage rapidly grew in South India. However, as the paper argues, through a combination of Dravidian social justice and agrarian politics, the state identified hydropower plants as having 'irrigation primacy', or to be used primarily for irrigation rather than the production of electricity. In the face of failing monsoons in the 1960s and politically unstable hydropower plants, the Madras State turned to fossil fuel.

In tracing the history of the first coastal power plants in Madras State, fired by oil and coal, this paper relies on multiple archival sources (visual, material, textual, and oral) to show how the uneasy cohabitation of the aqueous backwaters and fossil fuel led industrialization unravelled from the 1960s. As newly released archives reveal, the science of uncertainty backed the creation of fly-ash dump pipes into the sea and sand dredgers that affected fish and prawns in the backwaters. Meanwhile, fisher petitions reveal the limited solutionism to environmental pollution through fly-ash dumping, namely 'compensation' and permanent employment. I argue that the origins of the coastal wetlands as an environmentally polluted and fragile region lie in the rapidly changing agrarian democratic framework of the state, production of scientific uncertainty on environmental harms, and transforming energy regimes in South Asia and beyond.

Aditya Ramesh is Assistant Professor of South Asian and environmental history at the University of Washington, Seattle. He is currently completing a book manuscript on the history of rivers, energy, technocracy, and agrarian politics in South India. Drawing on research across three continents and numerous local archives, libraries, and oral histories the book manuscript, focusing on Southern India, asks what links agrarian politics, technocratic systems, and rivers. Parts of this research have been published in journals such as *Historical Journal, History Compass, and Capitalism: a Journal of History and Economics*. He works closely with researchers at the French Institute of Pondicherry, Puducherry, and together, have built a collective of researchers working on deltas and rivers in south India. We draw on numerous methods, including life-history interviews, archives, quantitative data, and geographic information system. Her next project turns to urban history and geography, thinking about environmental health through worker rights, the household, and hazards in the city.

Vietnam's Energy Transition: Overcoming Historical Lock-ins for a Sustainable Future

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Since the Vietnamese government committed at COP26 to reducing net GHG emissions to zero by 2050, a transformation of the energy industry towards using renewable energy sources is rapidly increasing. This paper explores the historical and contemporary dynamics, providing a comprehensive analysis of the factors influencing energy transitions in Vietnam and their implications for regional development and social equity. By qualitative approach, findings show that Vietnam's energy transition is shifting from a socio-technical-political (STP) configuration to an environmental-political-economic (EPE) configuration, in which the former is driven by internal factors (such as investment and infrastructure priorities, economic interests, policy inertia, technological lock-in, and social acceptance and behavior), favoring the use of fossil energy. Meanwhile, the latter model is driven by both domestic and international factors. Although the historical choices have fostered dependencies on traditional energy sources, creating lock-in effects that act as barriers to energy transitions, there are significant opportunities for energy transitions. Growing awareness of environmental issues, technological advancements in renewable energy, and international pressure to reduce greenhouse gas emissions create momentum for change. Additionally, investments in alternative energy sources can stimulate economic growth and job creation. Furthermore, the research uncovers that regional disparities in the speed and intensity of energy transitions significantly shape inter- and intra-regional relationships during the energy transition process. Regions with advanced energy infrastructures and favorable environments, particularly in southern urban areas, experience economic growth and improved living standards. In contrast, less favored regions, such as their rural hinterlands, face slower development, reinforcing existing socio-economic divides. Addressing these disparities through targeted policies and investments is crucial for fostering more balanced regional development and social equity in Vietnam's energy transition.

Lan Thuong Nguyen is a PhD candidate in the International Doctoral Program in Asia-Pacific Studies at National Chengchi University in Taiwan, where she also achieved a Master's degree (2017) in Asia-Pacific studies. Her Bachelor's degree is in international relations (2013) from Ho Chi Minh City University of Foreign Language and Information Technology (HUFLIT), Vietnam. Her research interests span various facets of Asia-Pacific international relations, primarily focusing on political and economic dynamics concerning the United States, China, and Southeast Asia, alongside an interest in water security and innovative solutions for sustainable energy development. Currently, she is Research Assistant at the Center for Asia-Pacific Resilience and Innovation (CAPRI) and Teaching Assistant at the Master's program in Asia-Pacific studies at NCCU. She also served as Research Assistant at the Institute of Political Science of Academia Sinica and the Taiwan Centre of Security Studies in Taipei.

Historic Energy Transitions in Southeast Asia

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This paper explores the history of energy transitions in Southeast Asia – focusing on Indonesia, Malaysia, Thailand, Vietnam and Singapore. The history of energy transitions in Southeast Asia is marked by shifts from traditional biomass to modern energy sources, driven by economic growth and development, technological advancements, and policy initiatives. Pre-colonial societies primarily relied on biomass, such as wood and agricultural residues, for cooking. While traditional fuels remained an important source of energy, the colonial period introduced coal and oil, spurred by industrialisation and the establishment of transport networks. Post-independence, nations like Indonesia and Malaysia capitalised on abundant oil and gas reserves, becoming key exporters. From the late twentieth century, rapid urbanisation and industrialisation increased energy demands, leading to diversification. Countries invested in hydroelectric power, notably Vietnam and Thailand, leveraging the region's abundant water resources. The twenty-first century has seen a significant push towards renewable energy, driven by environmental concerns and international climate commitments.

Roger Fouquet is Senior Research Fellow at the Energy Studies Institute at the National University of Singapore. He investigates the changing relationships between economic development, energy use and its environmental impacts, in order to provide a long-run perspective on energy and climate change issues. In 2006, his joint article was chosen for the Campbell Watkins Award for Best Paper in *The Energy Journal*. In 2010, his book, *Heat, Power and Light*, was selected by Choice Magazine as one of three Outstanding Academic Titles in Business and Economics that year. He is the editor of *Handbook on Energy and Climate Change; Handbook on Green Growth;* and *The Economics of Renewable Energy in the International Library of Critical Writings in Economic series*.

Energy Hinterlands:
Socio-Spatial Implications of Renewable Energy Production in Southeast Asia

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This paper explores the manifold implications of rapidly expanding renewable energy production in Southeast Asia. It takes Singapore as a vantage point to investigate different modes in which concentrated and extended urban territories are entangled in the production of renewables, including flows of electricity, capital, expertise, technology, commodities, and labour. It examines these modes of entanglement to better understand the interdependencies between centralities and their hinterland and takes them as an instance that requires to transgress conceptual binaries of cities/non-cities, urban/rural, Global North/Global South, and producers/consumers.

Creating the narrative of an 'alternative-energy-disadvantaged' country, Singapore is externalizing many of the measures that are required to meet carbon neutrality by 2050 to other territories in the region. This is leading to an intensification and rationalisation of extractivism and the re-evaluation of extended urban territories as a resource, which describes much of Southeast Asia's condition.

The research draws from quantitative data with regard to electricity generation, national projects and ambitions as well as qualitative data gathered through interviews. The paper presents the preliminary results of this research as well as an explorative mapping approach that is deployed as a heuristic tool in the process.

Naomi C. Hanakata is Assistant Professor for Urban Planning at the College for Design and Engineering at the National University of Singapore. She is also Co-Founder and consultant of HANAKATA, a research and planning practice based in Singapore. Her work focuses on the research and development of adaptive planning strategies to deal with uncertainties and dynamic urban futures in urban development and planning. Addressing challenges of planetary urbanisation, decarbonisation, decentralisation of resources, and digitalisation in planning practice are central to her work towards sustainable and equitable urban futures. She has practiced in Zurich, Tokyo, New York and Singapore as a planner and consultant. She has taught at Rice University and ETH Zurich and was educated at ETH, Tokyo University and London School of Economics, and holds a PhD from ETH Zurich.

Mapping Collaborative Solar Energy Strategies through Green Regionalism in Taiwan and Southeast Asia

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This study examines the potential of green regionalism, underpinned by Ecological Modernization Theory (EMT), to drive policy measures in East and Southeast Asia, aiming to achieve a renewable energy target of 23% by 2025. The research emphasizes collaboration, particularly among Singapore, Taiwan, the Philippines, and Indonesia, to foster renewable energy initiatives. Solar energy is identified as a highly feasible option due to the region's high solar radiation levels, with recent studies indicating that large-scale solar photovoltaic (PV) deployment can significantly contribute to sustainable energy goals in the region (Wang et al., 2021) and Taiwan (Kung & McCarl, 2020). By exploring the synergy between national policies and regional goals, the study evaluates the feasibility of collective actions and shared strategies in achieving renewable energy targets.

The methodology involves seeking policy options through policy analysis and incorporating quantitative data from various regional energy projects, renewable energy adoption rates and investment flows. This approach allows for a comprehensive understanding of the framework and impact of regional energy policies and evaluates the feasibility of regional cooperation among Singapore, Taiwan, the Philippines, and Indonesia.

The significance of this study lies in its comprehensive evaluation of regional collaboration in promoting renewable energy through green regionalism, offering valuable policy recommendations for enhancing regional cooperation and coordination. By highlighting the feasibility and benefits of solar energy, the research provides critical insights into practical strategies for sustainable development in Taiwan and Southeast Asia. The study addresses the urgent need for effective regional collaboration to meet ambitious renewable energy targets, contributing both practical and academic implications. It proposes frameworks for improved regional cooperation in renewable energy, advancing the discourse on green regionalism and its feasibility in regional policymaking, particularly in the solar energy sector.

Natalie W.M. Wong is Assistant Professor of the Department of Public Administration at National Cheng-chi University, Taiwan. Her research interest focuses on environmental governance and state-society relations in Asia. Her research has been published in China Information, the *Journal of Environmental Planning and Management,* and *Voluntas*. Recent publications include a book, *The Politics of Waste Management in Greater China Environmental Governance and Public Participation in Transition*, at Routledge. She is also the editorial board member for *Social Sciences & Humanities Open and Humanities and Social Sciences Communications*.

A Garden City in a Petropolis: Mapping the (In)visibility of Oil and the (Dis)connections of Carbon in Singapore

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In the 1970s, Singapore was called the "Houston of Asia" as it had the world's third largest petroleum refining capacity in the world after Houston and Rotterdam. This petropolis at the heart of the Pacific Basin's oil economy was, however, largely imperceptible within the main island of Singapore as its oil infrastructure was primarily consigned to the southern coastal zones and offshore islands. The rapid rise of Singapore as a petropolis in the 1960s and 1970s was closely connected to the radical territorial transformations of its southern coastal region as people were resettled, large tracts of land were reclaimed, and massive industrial and port infrastructure was constructed to strengthen the city-state's oceanic connections to the world. These connections included the flows of hydrocarbons to and from its oil refinery complexes, the city's importance as a provider of ship and airplane fuel, and the newly emerging offshore oil industry of platform construction and maintenance. It was Singapore's bid to forge new economic links to become what its Minster of Culture S Rajaratnam described in 1972 as a "global city" after it became independent in 1965 and was severed from its traditional hinterland of Malaysia.

But this radical coastal territorial reconfiguration and infrastructural construction surrounding oil did not seem to register in the larger spatial and environmental imaginary of Singapore as a city state. Instead, the dominant imaginary of Singapore of the 1960s and 1970s, which continues till today, is one of Singapore as a Garden City. Why does such a terracentric imaginary, one seemingly divorced from Singapore's oceanic connectivity and dependence, predominate? This paper argues there were at least two simultaneous forms of energy and thus carbon intensive forms of infrastructure building in the 1960s and 1970s Singapore. They were the industrial infrastructure in the coastal and offshore region directly linked to the oil economy and the green infrastructure in the inland area indirectly connected to the oil economy. And the latter prevailed over the former in public spatial and environmental imaginary of Singapore. Supported by mapping and a study of different modalities of spatio-environmental representations of Singapore in the 1960s and 1970s, this paper seeks to show how and why the imaginative geography of a green metropolis rather than a black petropolis of Singapore was constructed. Despite the apparent differences between the two infrastructures and imaginaries, this paper also seeks to show how they were inextricably connected if we follow the carbon metabolism between the hydrocarbons and bio-carbons.

Jiat-Hwee Chang is Associate Professor of Architecture and Research Leader of the Science, Technology and Society Cluster at the Asia Research Institute, National University of Singapore. He is an interdisciplinary researcher working at the intersections of architecture, environment, and STS (Science, Technology and Society). He is the author of *A Genealogy of Tropical Architecture: Colonial Networks, Nature and Technoscience* (2016), which was awarded an International Planning History Society Book Prize 2018, and the co-author of *Everyday Modernism: Architecture and Society in Singapore* (2022), which was awarded the Society of Architectural Historians of Great Britain's Colvin Prize 2023. Jiat-Hwee is currently working on a book manuscript on the socio-cultural histories and techno-politics of air-conditioning and climate change in urban Asia.

Stefan Huebner is a historian interested in environmental and oceanic topics whose work centers on modern Japan and its connections to Asia and the West. He is also Senior Research Fellow at the Asia Research Institute, National University of Singapore, and the President of the Society of Floating Solutions (Singapore). His monograph on the history of the industrialization and urbanization of the ocean in the Anthropocene is under review. He is the lead editor of *Oceanic Japan: The Archipelago in Pacific and Global History* and his recent articles focused on the history and present situation of floating structures for coastal climate adaptation (forthcoming in *Ocean and Coastal Management*, "Asia's Oceanic Anthropocene" (*Journal of Global History*), "Earth's Amphibious Transformation" (*Modern Asian Studies*), and "Tackling Climate Change, Air Pollution, and Ecosystem Destruction" (*Environmental History*).

Dorothy Tang is a landscape architect and Assistant Professor in the Department of Architecture at the National University of Singapore. Her work concerns the intersections of infrastructure and everyday life, especially in communities confronting large-scale environmental change. Her current research explores the histories of water, infrastructure, and urbanization in East Asia, the infrastructural landscapes of foreign investments in Southeast Asia and Africa, and the geopolitics of transnational watershed management.

Asia's Oceanic Great Acceleration and the Amphibious Development State: How Waters, Seabeds, Coastlines, and Subsoils Became Part of Japan and Singapore's Shared Fossil Fuel Space

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During the latter half of the twentieth century, the Japanese and Singaporean developmental states created a shared fossil fuel space, stretching horizontally from the Persian Gulf to the West Pacific and vertically from offshore and terrestrial oil and gas reservoirs to the atmosphere. The term "Great Acceleration" refers to the period since the mid-twentieth century marked by rapid, exponential change in large parts of the globe, indicated by both socioeconomic and earth system parameters, such as GDP and population growth, as well as carbon emissions and global warming. This presentation zooms in on a part of the globe and investigates how the shared fossil fuel space of the Japanese and Singaporean developmental states contributed to the Great Acceleration. It argues that the mutually beneficial high-growth economies in both countries were the result of socio-economic development-oriented governmental policies guiding the private sector toward oil-centered industrialization. The resulting shared fossil fuel space "accelerated" socio-economic development in both countries. Beginning in the 1960s, Singaporean oil-fueled industrialization domestically profited from the facilities set up by Japanese companies. In Southeast Asia, this industrialization assisted other countries in developing their fossil fuel reserves and supplying the Japanese economy with oil and gas products. Beyond these economic impacts, oil-fueled industrialization reshaped coastlines through evolving production chains and new industrial clusters, which involved built environments, including oil ports, refineries, fuel oil-fired power plants, and petrochemical complexes. Later accompanied by natural gas utilization, this industrialization also transformed Asian geological strata and waters through oil or gas extraction, submerged pipelines, and the growing seaborne fossil fuel trade.

Stefan Huebner is a historian interested in environmental and oceanic topics whose work centers on modern Japan and its connections to Asia and the West. He is also Senior Research Fellow at the Asia Research Institute, National University of Singapore, and the President of the Society of Floating Solutions (Singapore). His monograph on the history of the industrialization and urbanization of the ocean in the Anthropocene is under review. He is the lead editor of *Oceanic Japan: The Archipelago in Pacific and Global History* and his recent articles focused on the history and present situation of floating structures for coastal climate adaptation (forthcoming in *Ocean and Coastal Management*, "Asia's Oceanic Anthropocene" (*Journal of Global History*), "Earth's Amphibious Transformation" (*Modern Asian Studies*), and "Tackling Climate Change, Air Pollution, and Ecosystem Destruction" (*Environmental History*).

National Gasification:
The Struggle Over Gas Distribution from Colonial to Postcolonial Indonesia

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This paper delves into the history of the Indonesian State Gas Company, also known as Perusahaan Gas Negara (PGN), and its role in distributing gas across Indonesia. Established in the nineteenth century, PGN has undergone significant changes from the colonial era to the period of Indonesian independence. The downstream gas distribution began in 1863 when the first gas company, Nerlandsch-Indische Gas-Maatschappij (NIGM), was established in Batavia. After independence, NIGM transformed into PGN and started distributing gas nationwide. The paper focuses on transitioning from the colonial era to the independence era. It raises a fundamental question: How is the company's transition process linked to the global structural changes and political dynamics that shaped the Indonesian national gas industry? Through a comprehensive search of archives in Indonesia, this paper argues that the company's transition was part of a global critical conjuncture driven by a strong push for nationalisation and the prevailing national political sentiment against foreign interests in Indonesia.

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The Making of Fossil Asia: Historical Networks of Petroleum Flows and the Energy Transition

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Singapore thrives on oil. It has been embedded in multiple (colonial and post-colonial) energy systems that have shaped the urban development of the city state and its relationship with other Asian countries. The form and function of the port, the number of institutional headquarters, the presence of expatriates are all connected to global energy flows. A change in these systems will impact the position of Singapore. Understanding the extent of the petroleumscape and the role of the port in this transformation can facilitate the decision making for the much-needed energy transition. This contribution presents the methodology of the Port City Atlas as a model for the exploration of Asian port city networks.

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Petroleum Dreamscape: How Science and Politics Fuel the Search for Oilfields within Korean Territory?

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On June 3, 2024, President Yoon Suk Yeol of South Korea made a rare appearance in the press room to announce his approval of exploratory drilling of potentially massive gas and oil reserves off the southeastern coast. With this unexpected announcement, he rekindled Korea's long-standing dream of becoming an oil-producing nation – a dream that dates back as early as 1959. The stock market reacted swiftly, with a surge in oil company shares, but critics quickly began to question why President Yoon chose to personally brief the public on this risky and costly project, and what political motivations might lie behind his decision. Even more surprising is the issue that has received less media attention: the implications for energy transition. Why pursue fossil fuel sources in an age of decarbonization? By tracing Korea's decades-long search for oilfields, this paper explores what I call "petroleum dreamscape." This term refers to an imaginary of power, control, and security, layered on top of a physical and social landscape already transformed by fossil fuels, as described by Carola Hein in her book *Oil Spaces* (2022). My goal is to uncover the epistemic infrastructure of energy policy, shaped by global scientific organizations and national political interests.

Buhm Soon Park is Professor at the Graduate School of Science and Technology Policy at the Korea Advanced Institute of Science and Technology and Director of the Center for Anthropocene Studies. Trained as a historian of science, he has studied disciplinary dynamics and institutional formation in the US and East Asia. He has numerous publications on quantum chemistry and biomedical sciences, as well as the US National Institutes of Health and the Institute for Basic Science in Korea. His current research explores the Anthropocene concept as a tool to understand the geohistorical transformation of East Asia in the twentieth century. He is also interested in exploring the intersection between sciences, humanities, and arts.

Flyover Shamans, Energy Transitions, and Layered Infrastructures on Hong Kong Island

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The heavy slapping sounds of shamans beating paper effigies of villains (打小人) echo underneath the Canal Road Flyover on Hong Kong Island. A familiar presence, the villain-hitters have well-established stalls under the Flyover, profuse with images of Guanyin, other gods and goddesses, and incense sticks stood upright in vertical parallels with the concrete pillars supporting the flyover road.

Alongside hosting villain-hitting, the Canal Road Flyover plays a key role in the automobile infrastructure of modern Hong Kong, linking to a tunnel passing underneath Victoria Harbour to Kowloon. Developed in the 1960s and 1970s, the modern road is however only the latest installation in a long-standing infrastructural clustering in this corner of Hong Kong Island. The canal which gives the modern road its name and contours was constructed in the mid-nineteenth century here, crossed by the tramway and close by a coal-powered generating station.

This paper takes the Canal Road Flyover as an emblematic site to analyse the layerings left vestigial in the urban landscape across shifting energy regimes, from the early nineteenth century to the modern day. It explores both the shaping of current-day infrastructures by those of a preceding energy regime and so too the multifarious repurposings possible in the interstices of transitions: from coal to cars and from the vehicles overhead to the villains beaten below.

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Japan's Green Transformation (GX): Its Inclination to Technological Fixation

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Japan has seemingly caught up with European countries and other frontrunner countries in a climate change mitigation and decarbonization race by setting an ambitious greenhouse gas reduction target and carbon-neutrality policy and launching the Green Transformation (GX) policy. However, when we scrutinize the GX policy, we find discrepancies between it and the decarbonization objective. The author demonstrates this inconsistency by comparing GX core policy items and desirable policies to pursue decarbonization, especially shedding light on Japan's renewable energy policy. Japan is abundant in renewable energy sources, such as solar, wind, and geothermal, and among them, wind power is a relatively undeveloped natural energy. At the same time, it inclines to technocratic solutions by relying on developing new technologies involving the Asia-Pacific neighbors. The author briefly analyzes why Japan is still a laggard in renewable energy development even though it can simultaneously mitigate climate change and energy insecurity and reduce energy costs.

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The Dilemma of Data Centres: Understanding Infrastructural Lock-In from Within

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Data centres are critical to digital services, but they are both a boon and bane to Singapore. In this paper, I attempt to understand how data centres in Singapore have been "locked-in" into their current dilemma as energy-guzzlers. Drawing upon ongoing ethnography with data centre people based in Singapore, I perform what Bowker (1994) calls an "infrastructural inversion" to foreground the different levels at which data centres have been thrust into unsustainability.

First, from a chip level, data centres require an immense amount of energy because the more powerful computer chips are, the higher their heat production. Current data centre cooling solutions predominantly rely on air cooling, which is sufficient for existing loads but insufficient for upcoming AI workloads. Second, from a facility level, data centres can now look forward to more energy-efficient cooling solutions that use liquid cooling, but its rate of adoption is hindered by the uncertainties that accompany any emerging technology. Third, from the energy infrastructure level, Singapore data centres are constrained by the limited supply of renewable energy available; 95 per cent of Singapore's electricity is still generated from natural gas from Malaysia and Indonesia (Ng, 2023). Elsewhere in Asia, coal still makes up more than half of the region's electricity generation (Oğuz, 2023). So long as fossil fuels remain the main fuel source of existing infrastructures, the growth of the data centre industry in Singapore and Asia will always outpace its ability to make amends. Finally, Singapore's move towards AI is not only set to exacerbate the workload of data centres here, but also entrench their existences. The interlocking of these layers makes it difficult to envision a different lifepath for data centres in Singapore, juxtaposing the industry's impending sense of doom with the techno-optimism towards AI.

Yee Win Neo is a second-year joint PhD student at King's College London and the National University of Singapore. Her doctoral research looks at the materialities of heat in Singapore data centres, in particular focusing on the adoption of liquid cooling technologies and standards.

Diesel Power Plant Conversion: A Critical Analysis Of Indonesia's Plan To Decarbonize

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In order to facilitate the electrification of rural areas, particularly in the remote and isolated regions of the Indonesian archipelago, the state-owned power company, Perusahaan Listrik Negara (PLN), has been deploying small to medium-sized diesel-powered plants (DPPs) since the early 1970s. As reported by PLN, there are currently 5,200 DPPs distributed across 2,130 locations throughout Indonesia. While most of these plants operate as standalone units, they collectively form a "power grid," as they are managed and maintained by PLN personnel. The rationale behind the establishment of these diesel-powered plants, which are characterized by their emissions of noxious odors, noise, and carbon dioxide, is multi-faceted, encompassing technical, financial, and political considerations. A significant consequence of the proliferation of DPPs has been Indonesia's dependency on oil for the electrification of numerous rural areas. Additionally, unpredictable weather conditions and the inadequate transportation infrastructure on many islands often hinder the timely delivery of oil and spare parts necessary for the consistent operation of these diesel generators, leading to an unreliable electricity supply. Furthermore, the high carbon footprint associated with DPPs cannot be overlooked. In late 2020, PLN introduced a strategic document outlining a plan to transition the fuel sources for select DPPs. Termed the "DPP Conversion Program Towards 2 GW Renewable Energy," this initiative aims to convert 201 diesel-powered plants across 24 provinces to use locally sourced renewable energy. This paper offers a historical context of PLN's technological lock-in and critically analyzes the company's strategy for decarbonization.

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Future Pasts:
Oil Transitions in the Urban Frontier of the Persian Gulf and Arabian Peninsula

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This paper deals with the urban pasts of the Arabian Peninsula and Persian Gulf in relation to the expectations generated by the prospect of futures replete with oil. It concentrates on a region which to date is the largest oil producer in the world but has not yet come to terms with what has been dubbed the 'delirious' petroleum-driven development of its glitzy metropolises in the last 70 years or so: in the 1950s and 1960s Manama (Bahrain), Baghdad and Kuwait City; since the 1970s Dubai and Abu Dhabi; and more recently Doha in Qatar. The premise of the argument I put forward in this paper is that thinking of energy transitions in the past tense helps us to historicize oil development and to get rid of much of the abstraction that has characterized 'oil talk' on this region. This talk has been generated by academic studies on the rentier state, by local governments that have presented themselves as 'natural' owners and custodians of oil wealth, and by public narratives of the oil age (zaman al-bitrul) as a sudden leap into the modern world, embodying a 'rag to riches' story.

Taking the period after WWII as a point of departure, I concentrate on particular types of politics and practices of energy transition as they created imaginaries of oil futures – usually confident and upbeat - in a region that throughout history had been economically marginal and politically fragmented, a frontier society that by the early 20th century was also little urbanized. The paper discusses how, by whom and through what means and media the crude oil lying underground started to be thought, popularized and identified as the key ingredient of urban and national futures across the region, highlighting different understanding of energy transition. In other words, by focusing on selected oil/company towns and developing coastal cities I show how anticipated and ongoing oil booms defined the region's new urban horizons of expectation. In parallel, I delve into the flipside of these horizons to illustrate how hinterlands - rural and desert regions and their peoples, particularly in the Arabian Peninsula and Iraq - were reshaped as an appendix of future landscapes of urban and national development, but at the same time construed as custodians of national heritage, and loci of a new technical age of oil extraction.

Nelida Fuccaro is Professor of Middle Eastern History at New York University Abu Dhabi, and was formerly based at the School of Oriental and African Studies (SOAS), University of London. In the last fifteen years, Professor Fuccaro has developed a keen interest in cross-regional and inter-disciplinary approaches to the study of oil societies and energy cultures, urban history, public violence, and historical borderlands. Her work on oil is located at the intersection of History, Social and Visual Anthropology, the Energy Humanities, and Science and Technology Studies. Among her publications, she is the author of *Histories of City and State in the Persian Gulf: Manama since 1800* (Cambridge University Press, 2009, paperback 2011), the guest editor of the thematic contribution 'Histories of Oil and Urban Modernity in the Middle East' in *Comparative Studies in South Asia, Africa and the Middle East* (2013), and the editor of V*iolence and the City in the Modern Middle East* (Stanford University Press, 2016). She has recently edited with *Mandana Limbert a Life Worlds of Middle Eastern Oil: Histories and Ethnographies of Black Gold* (Edinburgh University Press, 2023).

Mobility Revolution: Offshore Oilfield Service Industry in Shenzhen and its Connections to Singapore

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Shenzhen is China's first and most successful special economic zone located immediately north of Hong Kong. Commonly known as the "social laboratory" of reform and opening, Shenzhen was the frontier for the People's Republic of China (PRC)'s experimentation with market principles in the late 1970s. This paper discusses Shenzhen's history as an offshore oil exploration center in the early reform period. Offshore oil not only served as an important source of energy in Shenzhen's development, but also a medium for knowledge transfer and capital circulation—both critical to China's transition from planned to market economy. Particularly, the paper focuses on one of the first China-foreign joint enterprises in the People's Republic, the Chiwan Petroleum Supply Base (CPSB). CPSB was started by Offshore Joint Services Company of Singapore in 1984, and its birth preceded the official establishment of the China-Singapore diplomatic relationship. Through this joint enterprise, Singapore brought to Shenzhen foreign capital, managerial expertise and new technologies in logistics. The development of offshore oilfield service also expedited the internationalization of Shenzhen's financial and accounting practices, forging a mobility revolution through which the Chinese economy reconnected with the world.

Taomo Zhou is a historian specializing in modern China and Southeast Asia. Her research focuses on borders, frontiers, and liminal spaces, including communities of ethnic minorities, free ports, and special economic zones. She studies the movement and mobility of people, ideologies, commodities, and capital in the twentieth century. Currently, she holds the position of associate professor in the Department of Chinese Studies and Dean's Chair in the Faculty of Arts and Social Sciences at the National University of Singapore. Her latest book, *Migration in the Time of Revolution: China, Indonesia, and the Cold War* (Cornell University Press, 2019), explores Chinese diasporic identities and Sino-Southeast Asian geopolitics. Her research has been published in various publications, such as *Journal of Asian Studies*, *Diplomatic History*, *The China Quarterly*, *Critical Asian Studies*, *Inter-Asia Cultural Studies*, *Journal Indonesia*, and *Made in China Journal*.

Petrocultural Obstructions to the Bruneian Energy Transition

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In the past decade, Brunei has been undergoing a green awakening that can be observed across various public and private sectors. While the environmental initiatives and programmes conducted by these organizations undoubtedly play an important role in growing national awareness of environmental issues, they also demonstrate a particularly technoscientific and Euro-American approach that risks being counteractive when uncritically adopted in the Bruneian context. As this paper will argue, this bias is fortified by the pervasive local petroculture and petro-aesthetics that value techno-optimism and Euro-American values in their privileging of the extraction, circulation and consumption of oil. Furthermore, such values are continually cultivated by the dominating presence of multinational oil companies in the nation's economic, political, social and cultural landscapes. Given that the most prominent environmental initiatives and energy transition efforts currently come from or are deeply involved with the oil companies themselves, it is unsurprising that such petrocultural values inform the environmental narratives and approaches.

This paper casts a critical eye on current dominant environmental narratives and energy transition initiatives in Brunei, particularly those found in Brunei Shell Petroleum's (BSP) energy transition and decarbonization initiatives, the government authority Brunei Climate Change Office (BCCO) national policy and environmental non-government organizations (ENGO) activities. By identifying the petrocultural assumptions and values found in these narratives, this paper makes a case for localizing and diversifying environmental approaches as a necessary component to the energy transition. Drawing on insight from recent studies on green imperialism, decolonizing environmentalism and imaginary lock-ins, I identify the ways in which the Bruneian petroculture, its petro-narratives and petro-aesthetics are continually emphasized and strengthened, thus contradicting, obscuring or even erasing potentially effective approaches to sustainable ways of living and minimizing future climate disasters. In order to decarbonize Brunei's economy then, it is necessary to dismantle the inherited petrocultural assumptions and values that currently obstruct the much-needed energy transition.

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Indonesian Oil and Coal during the Colonial and New Order Period

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This paper compares the two periods of the emergence of the Indonesian oil sector. The first period during the early 20th century with the consolidation of Royal Dutch Shell and the question of American involvement in the sector up to the early 1920s. The second period was during the late 1960s and the 1970s with the expanding investment into oil under Pertamina and Ibnu Sutowo. We will look into the techno-political and socio-technical changes within the context of the early 20th century Dutch East Indies and later 20th century New Order political economy and petroleum sector. The petroleum sector shaped Indonesia's technopolitics and the political economy of its elites in both periods, providing path-dependent structures that endure to this day. Both these periods also created significant technological and financial investments that propelled the country's oil sector as a global operation. We will look at why in both periods, the kind of investments into the oil sector were absent in alternative energy sources, particularly coal. What were the relations between institutions, socio-political structures and the flow of technologies/knowledge and finance that determined these preferences and that emerged and continued between these two periods.

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