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Political Economy of Cooling: National Conditions References

	China	Brazil	Mexico	Indonesia	Thailand
National Conditions					
Climate Risk	China will experience the full array of climate induced extreme weather[1], varying across different regions[2]. Given the severe impact of temperature increases on health[3] & energy consumption[4], climate risk in relation to cooling needs to be addressed. Regional imbalances[5] in food production[6] will likely mean cold chains become increasingly important.	Brazil is highly vulnerable to climate change[7]. The country's coastline is exposed to sea-level rise, putting coastal communities & heavily populated cities at risk[8]. Agriculture is likely to be one sector that will face high economic losses[9] & could stand to benefit from a sustainable cooling transition.	Large regional climate variation[10] in Mexico creates a wide array of climate risks with water availability[11] a defining feature. Agriculture will likely be one of the hardest hit sectors[12]. Heat stress & heatwaves are geographically uneven[13]. In the hottest regions, cooling can account for half of peak electricity demand[14].	Indonesia's vulnerability to climate change poses risks to key sectors of the economy[15], livelihoods & food security[16]. Significant climate-induced temperature increases are expected[17], with clear implications for cooling demand. [18]	Thailand is particularly susceptible to increased risk of flooding in low-lying urban areas[19], causing significant economic losses. Agriculture is also threatened[20]. Climate change induced heatwaves are already impacting health[21] & electricity consumption in Thailand[22], the latter linked to increased AC use.

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Energy Transition	Structural & technological change[23] is driving rapid energy intensity gains[24] & lowering carbon intensity[25] while energy demand growth slows[26]. However, China continues to construct coal power plants, home to over half of the world's operating coal capacity.[27] Coal plays a central part in China's energy mix, accounting for over 60% of electricity generation.[28] Cooling's share of energy demand is increasing.[29] Steady, incremental progress is being made on efficient, clean conventional cooling, with	Whilst fossil fuels dominate many sectors such as transport & industry, the power sector has historically been dominated by hydropower.[31] AC will be a major driver of energy use in buildings, particularly in the residential sector.[32] Rising Cooling Degree Days mean space cooling will become a major demand on the power system.[33]	Despite vast potential, low costs & rapid renewables growth[34], renewable energy has not so far reduced carbon intensity[35]. Mexico's current energy policy focuses on revitalizing the national oil & gas industry.[36] Whilst cooling represents a small percentage of the total power use, demand for it is set to rise dramatically in the coming decades with implications for the power sector.[37]	Indonesia is actively pursuing high carbon development, leading to increased dependence on coal & oil. [38] Indonesia is behind ASEAN peers in terms of AC penetration & equipment efficiency. The adoption rate is high, rising & set to become a much larger driver of electricity demand in Indonesia.[39]	Fossil fuels dominate electricity generation in Thailand, led by gas & coal power, with renewable energy capacity increasing - half from bioenergy sources - but holding a significantly smaller share.[40] Energy demand is highest & rising rapidly in the industrial & transport sectors.[41] Cooling demand is rising with AC and refrigeration already accounting for an estimated 50% of electricity consumption.[42]

	fundamental policy elements in place.[30]				
Energy Security	As the largest producer & consumer of energy globally, China's top energy security priority is diversifying its energy supply.[43] However, China emphasizes the role of fossil fuel in its definition of energy security, a view that is reiterated in its most recent 14th 5 Year Plan.[44] Cooling demand growth will double its contribution to annual peak energy demand with seasonal peaks already high[45] & poses challenges to power system stability.[46]	Brazil is becoming less reliant on fossil fuel imports[47], with a focus on domestic offshore oil & gas production[48], & large renewable energy potential, although this is constrained by high costs of transmission.[49] Water shortages have made hydropower less reliable[50], driving growth in gas power[51]. Cooling demand is set to increase, up to 1/3 of peak power by 2050, with consequences for grid, price stability & peak load curves.[52]	The potential for efficiency, including in cooling, to enhance energy security & tackle energy poverty in Mexico is strong, with AC power demand set to rise rapidly in coming decades, but challenged by the priority to revitalise domestic energy production & maintain large household power subsidies.[53] Cooling energy costs are a major cause of energy poverty.[54]	Energy exports are being redirected for domestic use & a focus on achieving universal electrification has driven coal power development in Indonesia.[55] Renewables are largely untapped though domestic biofuel production is increasing to reduce dependence on imported oil.[56] Despite low AC penetration, cooling is already a major contributor to peak demand.[57]	High import dependence means energy security is Thailand's energy policy priority driving, in particular, domestic bioenergy development.[58] Thailand seeks to leverage its geography in Southeast Asia & attractiveness to investors to establish itself as a regional energy trading hub, marking a shift to energy interdependence.[59]

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Technology & Innovation	According to the Global Innovation Index, China has joined the leading high technology countries[60], a trajectory determined by its heavily state-led & financed industrial policy[61]. China's cooling manufacturers dominate global supply[62]. Efficiency of AC exports abroad tend to match destination country standards[63].	Brazil has a strong agribusiness[64] & biofuels sector[65] but its history of protectionist industrial policy has limited innovation capacity[66]. Brazil imposes high tariffs on imported goods including AC & associated components[67], to promote domestic production. To avoid high tariffs, multi-national manufacturers establish plants inside Brazil[68] and largely rely on one manufacturer of less than highly efficient compressors.[69]	Mexico is characterized by a dual economy whose strength lies in its larger, export-orientated businesses[70] while productivity growth is much slower among SMEs & smaller 'informal' companies[71]. Mexico is a large cooling appliance exporter[72], mostly to the USA[73]. Strong trade ties to the USA[74] encourages multinational manufacturers to operate in Mexico[75].	Indonesia is a major producer & exporter of high carbon energy, commodities & minerals[76]. Indonesia's technology & innovation capabilities are ranked lower than ASEAN peers[77]. Indonesia has no significant manufacturing base for cooling appliances[78] & is heavily reliant on cooling appliance imports (especially AC)[79].	Thailand has a strong manufacturing base[80] but is susceptible to global economic cycles due to a reliance on exports[81] & tourism[82]. Thailand is a leading manufacturer of cooling equipment globally[83]. The manufacture of cooling products mirrors the trends seen in larger export sectors such as automobiles[84] [85], with continued reliance on multinationals[86].
Finance & Investment	Financial stability is considered vital to China's	Brazil has a large, financial system which is	Mexico's trading[96] & investment profile is	In Indonesia, state-owned & regional development	Banks account for a sizable share of the

	national security[87]. While domestic green finance policies have shifted investment towards renewables[88], finance continues to flow to fossil fuel projects abroad[89]. China has the world's largest ESCO market with a 52% global share in 2019[90].	dominated by banks & investment funds[91]. Public banks provide 55% of bank credit[92]. Brazil has the largest green bond market in in South America[93]. Foreign investment into Brazil is the largest in South America[94] but is heavily directed towards fossil fuels[95].	highly dependent on other countries mainly the USA &, to a lesser extent, the EU[97]. Public[98] & private[99] financial sectors are interested in pursuing a green agenda, but this is undermined by ongoing mixed policy signals & uncertainty[100].	banks have a sizeable presence[101]. Indonesia has begun promoting sustainable finance[102] [103]. Foreign investment as a % of GDP has fallen in recent years[104]. Mining, transport, energy, & chemicals have been key targets of this investment. [105]	financial sector but assets of government-owned financial institutions have grown quickly[106]. Foreign investment is key for the development of Thailand's economy[107] and there is fierce competition for foreign investment in other South East Asian countries[108]. Interest in sustainable finance is beginning to emerge[109] [110].
Land Use	Economic expansion has significantly harmed China's rich biodiversity.[111] Consumption behaviours are encouraging further land use change & pose threats to aquaculture.[112]	Large-scale commodity production is a major driver of land use change in Brazil.[114] Inadequate cold chain exacerbates food loss, adding pressure to land use change.[115] The potential to enhance the	Mexico is one of the most biodiverse countries in the world, contributing to its highly productive agribusiness sector & negatively impacted by land use change for agriculture.[117] The	Cold chain infrastructure is closely linked to Indonesia's rich marine resources. Growth in local fisheries is a major factor in cold chain demand growth & decentralised cold chain development is	Thailand has significant biodiversity; however, this faces pressure from deforestation, unsustainable fishing & tourism.[121] Fisheries is considered a strategic sector with seafood a key

	The connection between sustainable cooling & reduced emissions from land use & land use change has yet to emerge as a significant opportunity, though there is opportunity to reduce food loss through cold chain links.[113]	efficiency of cold chains for agricultural goods could be leveraged to attract the support of agribusiness interests & build a broader coalition of actors behind the sustainable cooling agenda.[116]	connection between sustainable cooling & reduced emissions from land use & land use change has yet to emerge as a significant opportunity.	a major challenge given Indonesia's geography.[118] Food loss is high & partly a reflection of the state of cold chain development.[119] Cold chain improvements could reduce food loss as well as protect & enhance livelihoods.[120]	source of nutrition, exports, & employment.[122] Food loss is a significant problem in Thailand, but data availability constrains efforts to establish a national baseline along the food supply chain.[123]
Public Goods	Whilst Chinese public awareness of climate change is high, people are especially concerned about health, education & livelihoods.[124] Poor air quality is a particular health concern & there is growing demand for air purification systems & AC units.[125] The centrality of this public concern can be	Brazil's population is highly concerned with socio-economic inequalities, human health & protection of forests & indigenous rights in the Amazon. However, the social welfare system – a point of national pride - is largely perceived as tied to fossil fuel rents.[127]	Mexicans' primary concerns are reducing crime, corruption, & poverty.[130] The public are concerned that climate change poses a threat, in particular, to water resources & national security, though other environmental issues overshadow this concern.[131] Renewable	Preferred routes for development are contested & differ across regions & social groups In Indonesia.[133] For example, traditional Indonesian architecture, characterised by shaded interiors & natural ventilation is ideal for passive cooling but runs counter to a trend	Environmental concerns are tied to coal & air quality.[135] Awareness of climate change impacts is growing largely due to floods, agricultural impacts, & growing youth protest movements.[136] Access to and affordability of cooling in Thailand is higher than several regional peers but there is

	a positive driver of energy & sustainable cooling transition.[126]	Environmental concerns are dominated by deforestation in the Amazon[128] & air pollution[129].	energy has faced resistance from local communities due to concerns & conflicts over land rights.[132]	towards construction of 'modern' buildings - enclosed & air-conditioned – with implications for cooling demand.[134]	still significant potential for needs to be better met.[137]

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