BACKGROUND PAPER

Behavioral Changes during Asia's Net Zero Transition: Evidence from Middle-Class Household Consumption

Babette Never

BEHAVIORAL CHANGES DURING ASIA'S NET ZERO TRANSITION

Evidence from Middle-Class Household Consumption

Babette Never
Senior Researcher
IDOS German Institute of Development and Sustainability (formerly named DIE)

Abstract

A net zero transition to climate-neutral development in Asia needs to systematically include the consumer perspective. Net-zero transition policies including consumers will need to differentiate both between and within Asian countries, reflecting inequality in emissions, consumption patterns, and capabilities. The growing and aspiring middle classes present the key consumer group that will shape the next decade in Asia. Key opportunities include changing consumer norms and aspirations before lock-in, while reaping co-benefits on local problems, and new job and market opportunities from rising consumer incomes, e.g., in (a) low-carbon technologies, (b) new services/sharing economy, (c) refurbed and remanufactured products/circular economy, and (d) low-carbon buildings and construction. Future policies could integrate and expand sustainable consumption and production policies more systematically to unleash a virtuous cycle, combining regulations, financial incentives and behavioural insights tools. Regulations and financial incentives are particularly useful for costly investments, complex decision-making situations, infrastructure support and steering unpopular choices. Behavioural insights tools are helpful for concrete, individual-level programs, the adoption of low-carbon technologies and addressing individuals with high environmental concern and intrinsic motivation. Sequencing and targeting measures in policy packages to ensure a timely and just transition is required.

Note

In this report, "$" refers to United States dollars.

EXECUTIVE SUMMARY

A net zero transition to climate-neutral development in Asia needs to systematically include the consumer perspective. Focusing on greening the supply side will not be sufficient; consumer pressure and demand shifts are essential to push the producer side. The mitigation potential of consumer-oriented measures is large: 40%–70% reduction of greenhouse gases in the end-use of technology and use of infrastructure is possible, according to the latest report of the Intergovernmental Panel on Climate Change (IPCC 2022). Net-zero transition policies including consumers will need to differentiate both between and within Asian countries, reflecting inequality in emissions, consumption patterns, and capabilities. The growing and aspiring middle classes present the key consumer group that will shape the next decade in Asia. Their role is central for a net zero transition for two reasons: First, lock-in effects of consumption habits and lifestyles happen as people move up the income ladder. Second, the projected middle class consumption growth has a sheer impact in the coming decades. Already 17%–20% change in consumer choices can be a tipping point for market structures and a committed group of 25% can be enough to change social convention (Newell et al. 2021; Otto et al. 2020; Centola et al. 2018). Windows of opportunity to engage in win-win situations for low-carbon transitions are open now.

Key opportunities include:

(i) changing consumer norms and aspirations before lock-in, while reaping co-benefits on local problems, such as air pollution, health, gross domestic product losses because of traffic jams, and energy security; and

(ii) new job and market opportunities from rising consumer incomes, e.g., in (a) low-carbon technologies, (b) new services/sharing economy, (c) refurbed and remanufactured products/circular economy, and (d) low-carbon buildings and construction.

Key challenges include:

(i) how to guide consumers towards low-carbon consumption without depriving anyone of opportunities (boosting sustainable, low-carbon demand);

(ii) how to manage consumption and emission inequality across and within Asian countries;

(iii) status consumption and aspiration/social norms of consuming carbon-intensive goods;
(iv) lack of environmental awareness;
(v) knowledge/value action gap; and
(vi) complex decision-making situations with many stakeholders, expensive low-carbon alternatives, and rebound effects.

Future policies could integrate and expand sustainable consumption and production policies more systematically to unleash a virtuous cycle. Sequencing and targeting measures in policy packages to ensure a timely and just transition is required.

Regulation and financial incentives/support (standard toolbox) are particularly useful for:

(i) larger and/or very costly investment decisions at individual or collective level;
(ii) complex decision-making setups with many influencing factors and stakeholders;
(iii) set up of sustainable alternatives (e.g., product design, infrastructure); and
(iv) steering unpopular choices.

Behavioral insights are particularly useful for:

(i) improving existing individual-level programs (e.g., recycling);
(ii) increasing the adoption and smart use of low-carbon technologies (e.g., air conditioners);
(iii) expanding support for environmental policy and projects; and
(iv) addressing individuals with high environmental concern/intrinsic motivation, especially when using "nudging" techniques

I. INTRODUCTION: CONSUMER WELL-BEING IN ASIA'S NET ZERO TRANSITION

A net zero transition to climate-neutral development in Asia needs to systematically include the consumer perspective. The mitigation potential of consumer-oriented measures is large: 40%–70% reduction of greenhouse gases in the end-use of technology and use of infrastructure is possible, according to the latest report of the Intergovernmental Panel on Climate Change (IPCC 2022). Population growth, urbanization, and the growth of middle classes with more consumption capabilities put the spotlight on the demand side.

Global middle class growth has started to increase substantially, with 50% of the global population belonging to the middle classes in 2018 (Kharas and Hamel 2018). This trend will skyrocket in the coming decades in spite of slower economic development because of global crises, adding 1 billion new middle-class consumers in Asia alone until 2030. Beyond the People's Republic of China (PRC) and India, the strongest growth in middle-class consumers is expected in Indonesia, Pakistan, Bangladesh, and the Philippines, in descending order (World Data Lab 2021).

Net-zero transition policies including consumers will need to differentiate both between and within Asian countries, reflecting consumption patterns and capabilities: (i) Asia's high-income countries with large, stable middle classes and elites (e.g., the Republic of Korea, Japan); (ii) middle-income countries with rising middle classes and strong economic production hubs (e.g., the PRC, India, Viet Nam); and (iii) low-income countries with small and instable, but possibly aspiring middle classes (e.g., Cambodia and the Lao People's Democratic Republic [Lao PDR]). In Asia's high-income countries, such as Japan or the Republic of Korea, more stringent low-carbon policies for consumption and production systems are possible across all population sections than in low-income countries, such as the Lao PDR or Cambodia.

Inequalities of consumption patterns and capabilities within countries need to be taken into account. A just transition to net zero needs to target demand-side measures carefully while managing synergies and trade-offs for different sections of the population, e.g., building attractive modern bus systems for urban middle-class commuters, while offering staggered and integrated fare systems to not crowd out the poor.

Windows of opportunity to engage in win-win situations for low-carbon transitions are open now: (i) investing in low carbon infrastructure and low carbon technology that benefits future markets and economic development and (ii) influencing evolving norms of consumption towards well-being. In 2022, the Stockholm plus 50 conferences organized by the United Nations Environment Programme called for a new compass of welfare and well-being.[1] A norm of well-being as the 'new cool' in Asia has a large potential to transform markets and enable a net zero transition. For now, Europe and the United States are still mostly setting global consumption trends. However, Asian countries have a range of opportunities to set a new norm of well-being without compromising on development needs.

Environmental externalities are often more visible in Asian developing countries than in industrialized countries of the Global North (e.g., flooding), making them harder to hide (Bhar and Anantharaman 2022). For middle-income and high-income households in Asia, the cause-and-effect chain of own consumption patterns and resource use therefore may be easier to grasp than for largely unaffected middle-income households in Europe. Consumption and behavior norms may also not be as fixed yet, especially among the socially mobile middle classes. Finally, depending on the sector, sunk costs of existing high carbon infrastructure and technologies may not be as substantial yet as in industrialized countries, or may need to be expanded or adapted in any case because of urbanization and population growth (e.g., energy production infrastructure, transport systems).

This background study will focus on three key sectors for a net zero transition in Asia that offer particular opportunities by integrating a consumer perspective into systemic sustainable consumption and production policies. Changes in mobility have the highest greenhouse gas reduction potential and offer clear local co-benefits in terms of individual health and reduction of overall air pollution (IPCC 2022). The energy sector also has a high climate change impact, both in production and end-consumption, and presents a political priority across governments in Asia. The shift to a circular economy and, specifically, recycling and reuse of materials rather has a low to medium direct mitigation impact but counts as an easy entry to sustainable consumption for many consumers across the world.

Across sectors, policies to support the net zero transition towards well-being need to make use of the full range of the toolbox available: Technology and infrastructure investments, financial

[1] https://wedocs.unep.org/bitstream/handle/20.500.11822/38911/Stockholm50_CN.pdf.

incentives and support, regulation, and informational and behavioral insights tools. For a successful net zero transition in Asia, a systematic and targeted linking of consumer (demand) and producer (products, infrastructure) measures that combine these tools is required.

II. CURRENT CONSUMPTION TRENDS

A. Key Mitigation Sectors

The key sectors for mitigation at the household level are transport, energy, and food (IPCC 2022). Across Asia, changing mobility and energy behaviors are likely easier to shift towards low-carbon opportunities than deeply cultural and emotionally charged food traditions. As zooming into circular economy and recycling may be promising, it is therefore discussed here rather than the food sector.[2]

Transport. The transition to low-carbon transport systems offers co-benefits for convenient, efficient mobility for all income groups, health and air pollution. Across Asia, three major trends in private mobility can be witnessed: First, online ride-hailing services, such as Didi, Grab, or Ola, are estimated to have served more than 800 million users across Asia in 2020 (McKinsey 2021). These ride-hailing services also increasingly include motorcycles in congested cities. Second, car subscription services by major automotive firms such as Toyota and Hyundai are becoming more popular as an alternative to buying a private car; for instance, in the PRC (McKinsey 2021). Finally, the shift to electric vehicles is ongoing, with a clear boom in the PRC already and the market in India developing fast as well, given government incentives (refer to other background note on electric vehicle markets). Depending on the energy source producing electricity for the cars, the effects for a net zero transition are mixed. Finally, consumer interest in combustion engine and diesel cars is unbroken. Asian consumers shifted somewhat to acquiring used rather than new cars during the coronavirus disease (COVID-19) years, but compound annual growth rate forecasts for Southeast Asia, for example, expect a steady 6% increase in all private vehicles from 2022 to 2027 again.[3]

These trends all tend to private motorized mobility, possibly both reacting to and fuelling individual consumer preferences. As the transition to low-carbon public transport infrastructure

[2] To the author's knowledge, another *Asian Development Outlook* background note on agricultural practices discusses options for limiting food waste in Asia.

[3] https://www.mordorintelligence.com/industry-reports/south-east-asia-used-car-market (accessed October 2002).

and mobility systems requires both large financial investments and time, it is imperative to understand consumer motivations, beliefs, and decision contexts and to develop policy packages to support, especially the emerging middle classes, to remain in public transport.

Energy. Given the current global crises, energy security, energy efficiency, and the transition to renewables are now more linked than ever. Demand-side management of energy systems and energy saving by consumers have been part of energy policies in many Asian countries for years now. Total energy consumption per capita is still low in Asia compared to Europe (Figure A1). From a climate mitigation perspective, increasing energy consumption is only problematic if energy is derived from fossil fuels. This will remain the case in many Asian countries for years to come, both in terms of covering current baseloads and planned additional power capacities.

Further, sub-nationally, energy consumption trends start to differ substantially (Figures A2–A4), Table 1), calling for a shift to more differentiated consumption policies. Middle class growth means increasing pressure on energy supply and a higher carbon impact of the energy sector as more people can afford energy-using assets. Increasing temperatures in Asia because of global warming fosters dynamic air conditioning markets, both of new and used air-conditioners (ACs), for example.

The demand for global space cooling and, correspondingly, the sales numbers of room ACs are soaring, especially in tropical middle-income countries in Asia. Energy demand for space cooling is expected to triple globally until 2050 (IEA 2018). The room AC market in the Philippines, for example, was already sizeable with about 700,000 new units sold annually in 2016; it increased to about 900,000 units in 2018 (GIZ 2019; Statista 2020). Growth trends in the room AC market are expected to continue strongly on the back of more home staying activities and a very limited online market, in spite of overall economic impacts of the COVID-19 pandemic.

These market dynamics present a challenge from an energy security perspective, but also from a climate change perspective. Global warming effects deriving from both electricity use of ACs (if non-renewable electricity source) and climate-harmful refrigerants in the AC are tremendous. Globally, energy-efficient, climate-friendly cooling could save up to 8 years of global emissions at 2018 levels (IEA 2020). For the Philippines, cooling sector emissions are

expected to rise from 24.7 metric tons of carbon dioxide equivalent ($MtCO_2e$) in 2017 to 44.6 $MtCO_2e$ in 2050 in a business-as-usual scenario (GIZ 2019).

ACs make up a substantial amount of a household's carbon footprint and electricity bill because of the energy intensity in the use stage and possible refrigerant leakage. The cooling transition needs to be addressed much more proactively to enable a net zero transition in Asia; for example, by supporting the transition to green ACs, passive cooling, green architecture, and influencing consumer norms on cooling comfort. Lower middle class and poorer households may rather buy a used AC; here, more interventions are required to strike a balance between affordability and access to cooling, carbon footprint, energy intensity, and reuse of materials (Never 2022).

Circular economy and recycling. The transition to circular economy and the progress of recycling as a part of waste management offer neglected opportunities to achieve a net zero transition. Waste incineration and landfill emissions are substantial: 20% of all methane emissions emanating from human activity come from waste (UNEP 2021). In parallel, the sheer amount of waste produced because of population growth and middle class growth, who have more capacities to buy and replace items than low-income groups, needs proper management, offering co-benefits. Similar to the transport and energy sectors, investments into the supply side (waste management plants and recycling, mechanical and chemical recycling options rather than incineration, and integration of informal waste collectors) need to go hand in hand with the demand or consumer side (waste separation and recycling, consumer awareness, and waste avoidance) to achieve deeper change in line with a net zero transition. For consumers, avoiding waste, reusing materials, or recycling often constitute a low-cost, easy entry to pro-environmental, low-carbon behavior. To achieve behavioral changes in households, it is therefore useful to analyse this sector and to identify possible synergies and trade-offs to other, high impact, high cost sector such as transport and energy.

B. Key Consumer Groups for the Future

Once households move out of poverty, consumption capacities and consumption patterns change. This is desirable from a development perspective but may have implications for the environment. Increasing consumption, in turn, has socio-environmental consequences, shaping natural resource and space availability, air pollution, and carbon emissions. The emerging

middle classes make lifestyle choices that ultimately impact the environment positively or negatively.

Inequality in per capita consumption trends and associated carbon footprints necessitates differentiated strategies within Asian countries. The inequalities in income and livelihood conditions across and within countries both fuel and are affected by ecological resource depletion and climate change. Whereas middle-income and higher-income households contribute more to climate change and are more capable to deal with resource scarcity and climate change, lower-income households contribute less to global ecological crises and are disproportionally affected by adverse impacts of climate change. In India, for example, the top 20% of households emitted seven times the emissions of poor households (those who spend less than $1.9 per day) in 2021 (Lee et al. 2021a). In the PRC, the urban and rural middle classes contributed nearly 40% and 15% of total household consumption emissions in 2016, respectively (Wei et al. 2020). In this study, middle-class households are understood here as those with an income of $11–$110 purchasing power parity per capita per day, following the definition by Kharas (2017).

The aspiring middle classes in Asia may not yet belong to the highly emission-intensive groups in their respective countries. Still, their role is crucial for guiding future trends towards a net zero transition for two reasons:

First, lock-in effects of consumption habits and lifestyles happen as people move up the income ladder. The more used to a certain way of living and consuming a person is, the less likely he or she is to change their ways easily. Once formed, consumption habits and related social norms become deeply entrenched and are difficult to change (Seto et al. 2016). Among the growing middle classes, these habits and social norms are not as deeply fixed yet, but rather driven by aspirations, status considerations, or a mix of specific values and thrift that result in various different preferences. Thus, turning low carbon consumption and sustainable lifestyles into an aspiration for the middle classes is still a viable option now.

Second, the sheer impact of projected middle class consumption growth in the coming decades is key for the success of a net zero transition, as already 17%–20% change in consumer choices can be a tipping point for market structures and a committed group of 25% can be enough to change social convention (Newell et al. 2021; Otto et al. 2020; Centola et al. 2018). If a vast number of middle-class consumers in, say, Bangladesh decided to only use jute bags and avoid goods in plastic packaging as much as possible, this would incite companies to cater to the local market instead of exporting jute bags. As spending capacities and demand for products and services increase, the consumption patterns and lifestyles of the middle classes have the potential to drive global and local economies (Kharas 2017). In the PRC, for example, the consumption pattern changes of the middle and rich classes already drove 131% and 83% of the growth of emissions from 2010 to 2016, respectively (Wei et al. 2020). Therefore, a shift to sustainable consumption may shift markets.

Box 1: What is sustainable consumption?

Sustainable consumption can be understood as individual contributions to decouple development pathways from resource use without compromising development needs; for example, by increasing energy efficiency and recycling, while reducing carbon emissions. It is not meant as a normative concept that compares "good" and "bad" lifestyles or imposes a topic of discussion among industrialized countries on low-income and middle-income countries. Definitions of sustainable consumption tend to stress either the production of more sustainable products or the behavior and lifestyles of end consumers (Jackson 2007). This report focuses on the latter.

Source: Jackson (2007).

Asia differs from other world regions because of the higher shares of middle classes now and in the future as well as its unique link between global production and consumption hubs. The middle classes in Asia are growing at unprecedented scale, though their growth has varied considerably across countries (Chun et al. 2017). As key hubs for global production and consumption are increasingly located in Asia, especially the PRC and India, the window of opportunity to shape consumption and production patterns is open for Asia now. The transition to electric vehicles is much more advanced in the PRC than in the United States, for example, and ride-sharing is much common in many Asian than in European countries, even though the

positive environmental effect of ride-sharing depends on which previous mobility behavior was replaced (Chalermpong et al. 2022). Thus, Asian consumers have the option to define own norms and goals of well-being and influence producers, which can be positive and negative for the environment. The aspirations and preferred lifestyles of the middle classes will be particularly relevant in this regard.

Even though Asia's middle classes do not present a homogeneous group, trends in key sectors for a net zero transition are likely to be similar among the global middle classes across the world. In general, the share of energy use, mobility, and communication in household expenditure increases with income, whereas the share of food decreases, but usually becomes more carbon-intensive. A higher intake of meat and processed food that has been transported for longer distances are responsible (Tschirley et al. 2015).

Energy- and carbon-intensive goods such as cars, freezers, or ACs are more likely to be acquired as households move up the socioeconomic ladder. Indeed, analyses based on household surveys among middle-class households in Ghana, Peru, and the Philippines have uncovered that carbon-intensive asset acquisition and mobility behavior (e.g., air travel) start to increase significantly among the two upper middle class quintiles (Never et al. 2020; Figures A5–A6). Income or wealth levels and household demographics present the predominant drivers of car and household appliance uptake, for example in India and the Philippines (Ramakrishnan et al. 2020; Never et al. 2020). Household carbon footprint studies on the PRC and India (Lee et al. 2021a; Wiedenhofer 2016) and an analysis of energy-intensive asset acquisition in Mexico confirm this general picture (Gertler et al 2016).

Current efforts to invest in energy efficiency and practice energy saving behaviors in households do not necessarily lower electricity bills and total household electricity consumption (Table 1). The example of the Philippines shows that consumers with more environmental concern are more likely to adopt curtailment behaviors, but that concern does not relate to energy efficiency investments. In turn, higher levels of environmental knowledge make households' energy efficiency investments more likely, but do not predict curtailment. Neither energy efficiency investments nor curtailment behaviors significantly predict households' electricity expenditures, but sociodemographic factors such as assets, household size, and income do (Never et al. 2022).

Overall, consumption trends among low-income groups require a different political strategy than consumption trends and projections among middle-income and upper-income groups. For a timely and just net zero transition with a smart mitigation approach for Asian consumers, developing measures for middle-income and upper-income classes is urgent. For low-income groups, policy tools to advance energy access, increase mobility, and foster consumption-based development are more established already and need to be continued.

Table 1: Regression Results (Log of) Electricity expenditure in Purchasing Power Parity: Philippines

	Model 1	Model 2	Model 3	Model 4
(Intercept)	4.26***	4.25***	4.37***	4.28***
	[4.19, 4.33]	[4.12, 4.37]	[4.31, 4.43]	[4.18, 4.38]
Independent variables				
Curtailment	-0.01	-0.03	-0.02	-0.02
	[-0.06, 0.03]	[-0.07, 0.02]	[-0.06, 0.02]	[-0.06, 0.02]
Efficiency investment	0.36***	0.35***	0.15***	0.15***
	[0.27, 0.46]	[0.25, 0.44]	[0.07, 0.24]	[0.06, 0.23]
Individual control variables				
Education		0.07**		0.01
		[0.02, 0.11]		[-0.04, 0.05]
Gender		0.03		0.11*
		[-0.10, 0.16]		[0.01, 0.22]
Age		0.10***		0.05*
		[0.05, 0.14]		[0.01, 0.09]
Household control variables				
Asset			0.21***	0.21***
			[0.17, 0.26]	[0.16, 0.26]
Income decile			0.08***	0.09***
			[0.03, 0.13]	[0.04, 0.14]
Rooms			0.16***	0.16***
			[0.12, 0.20]	[0.11, 0.20]
Household members			0.12***	0.12***
			[0.08, 0.17]	[0.08, 0.16]
N	785	785	756	756
AIC	1598.87	1584.02	1246.97	1242.88
BIC	1617.53	1616.68	1284.00	1293.79
adj. R^2	0.07	0.09	0.38	0.38

Note: All continuous predictors are mean-centered and scaled by 1 standard deviation. Confidence intervals are shown in squared brackets and are calculated based on heteroskedasticity robust standard errors.

*** p<0.001; ** p<0.01; * <0.05

Sources: Never et al. (2022); and household survey with 900 middle-class members in Metro Manila.

III. KEY CHALLENGES FOR THE CONSUMER SIDE IN A NET-ZERO TRANSITION

Two overarching challenges exist when it comes to integrating consumer-oriented measures in Asia's net zero transition. First, **how to guide consumers towards low-carbon consumption without depriving anyone of development opportunities.** Essentially, this means boosting demand towards low carbon, sustainable choices and influencing social norms and aspirations towards new low carbon, sustainability as "standard behavior". Second, **how to manage both consumption patterns and consumption-based emission inequalities across and within Asian countries.** This means developing differentiated sub-national strategies for each sector that do not take the national per capita average as starting point anymore. For instance, increasing energy access and consumption by low-income groups, while also decisively shifting energy demand by middle-income and upper-income groups to low-carbon, energy-efficient alternatives. In addition, enforcing energy saving among middle-income and upper-income groups is likely to be necessary beyond current promotion campaigns to save energy. Meeting both challenges is required to ensure a timely and just transition.

Zooming into **middle-class consumer behaviors**, five main challenges concerning motivations and implementation of consumer motivations exist. Some of these also apply to other consumer segments as they reflect general human nature and present a similar challenge in other societies across the world.

First**, status consumption** as well as consumers' **aspirations** and **social norms** of consuming carbon-intensive goods as services present interlinked challenges that need attention now before the window of opportunity closes and lifestyles of the aspiring middle classes are locked in. Here, a differentiated perspective on necessary goods for development and conspicuous goods of luxury consumption may be useful.

Status consumption means that consumers associate a certain social status with a product or the use of a good or service, i.e., signalling their position in society in comparison to other households or individuals. For the middle classes, these often present various signals to others that "they have made it" in life, as qualitative research in the Philippines has shown (Never and Albert 2021). Status-oriented consumption does not necessarily have to be conspicuous luxury

consumption only, but can also include day-to-day mobility and lifestyle products at moderate price.

In the transport sector, aspirations and status consumptions primarily concerns car ownership. Empirical evidence in Asia is somewhat mixed, possibly because of measurement differences. For many middle-class members, car ownership presents both a signal of having achieved respectability and a symbol of distinction from the working classes (Never and Albert 2021; Anantharaman 2017). Among the Indian middle classes, social status perceptions of car ownership are strong and clearly discernible in mobility behaviors (Ramakrishnan et al. 2020; Table A1). However, as Anantharaman argues, the consumption patterns of India's middle classes cannot only be explained by conspicuous consumption or status consumption, but are also driven by changes in living arrangements, gender, and family roles (Anantharaman 2014). Pockets of pro-environmental exist among the emerging middle-class consumers as well—some out of environmental concern and a pro-environmental identity, some rather for lifestyle reasons and to signal a new status or position (Figure A3). Middle-class cyclists in Bangalore, for example, explicitly "go green" with high end bicycles and expensive gear as this allows them to maintain the distinction to lower-income classes, even if it is a rather defensive distinction (Anantharaman 2017).

Among the Asian middle classes, mobility norms are as much influenced by available infrastructure and objective travel times as by subjective convenience, comfort, safety concerns, and possible status perceptions. A combination of these factors is responsible for the success of ride-hailing services like Grab Car or Angkas motorcycle across Southeast Asia in recent years (Chalermpong et al. 2022). As Javaid, Creutzig, and Bamberg (2020) find in their meta review on the adoption of low carbon transport modes globally, individuals are most motivated to shift transport modes if they are well informed, if personal norms match low-carbon mode use, and, most importantly, if they perceive to have personal control over decisions. Perceptions about common travel behavior (descriptive social norms), especially if supported by perceived normative beliefs of others (injunctive norms), are highly influential to support mode shift. However, the overall margin of shift as induced by individual and social settings remains limited. Instead, the infrastructure factors explain large differences in mode choice.

Concerning energy use, Ramakrishnan and Creutzig (2021) found that 20% of energy consumption and willingness to pay for low carbon consumption can be ascribed to status effects. They analysed 53 studies in a systematic review. In the Philippines, social status considerations are not as clearly associated with rising carbon emissions from travel and energy use (Never et al. 2020; Table 3). The difference to India, however, may also be because of measurement of social status in each study. Sociological qualitative studies found that ACs present a status good for some families in the Philippines; people may rarely switch them on, but have them mounted in a way that they are visible to neighbors and passersby (Sahakian 2014).

Aspirational consumption and corresponding lifestyles may already start ahead of income changes, among the lower-income classes or "floating classes" (Birdsall et al. 2015) that still undergo periods of poverty. The empirical evidence for this type of consumer behavior is not entirely clear though. Floating or struggling middle-class members may buy specific status goods early, attracted by aspirations and easier payment models (e.g., by instalment for a car or larger asset). Possible backfiring effects on living standards and poverty are not yet fully understood. Social mobility goals are strong among certain sections of the middle classes, with education and socioeconomic upward mobility as primary goals (Never and Albert 2021; Neubert and Stoll 2018).

For recycling, status and aspirations play less of a role than social norms and habits. The under- or overestimation of recycling norms and habits of others leads to consumer behavior that is only allegedly in line with "what everyone else does". In a field experiment with 1,709 middle-class households in a municipality of Lima (Peru), Fuhrman-Riebel et al (2022) found that randomly correcting people's beliefs causally raised the willingness to sign up to the recycling program, but reminder messages were then necessary to increase the actual recycling rate. Therefore, individual level belief updating can explain heterogeneous responses to social norm information (Fuhrmann-Riebel et al. 2022): social norm information treatments effectively motivated people to sign up to the recycling program when people initially underestimated the actual norm (i.e., more people already recycle than they thought), while there is no effect for those who overestimate or are correct about it. The authors find that this holds irrespective of whether the norm is high or low, or whether it is presented in a static or dynamic way. Analyzing beliefs may help to understand why the effect sizes of social norm interventions vary considerably between studies and why they may work in some, but not in other contexts.

Second, **a lack of environmental awareness** presents a challenge for some consumer segments only. Among the rising middle classes, environmental concern and knowledge, as stated in household surveys, are at mid to high levels, comparable to other middle-income countries. The example of the Philippines shows this (Figures A7–A8). Further, in the most recent round of the World Values Survey, a majority of respondents in the PRC, Indonesia, Malaysia, Myanmar, the Philippines, Singapore, and Thailand[4] prioritized the environment, even if it means slowing of economic growth and job losses (Table A2). Finally, an increasing body of research is revealing that **awareness-raising campaigns alone often only do not lead to behavior change** (e.g., Whitmarsh et al. 2021; Newell et al. 2021; Seimetz et al. 2016; Kollmuss and Agyeman 2002).

Further, there may also be a difference between general environmental concern and knowledge, and specific knowledge and understanding of opportunities for action or consequences of own actions, e.g., of savings on the electricity bill. Social science research differentiates between financial energy literacy; device energy literacy (energy consumption of the device); and action energy literacy, i.e., the ability to judge the impact of one's own actions on energy saving in the home (Van den Broek 2019). In a discrete choice experiment on energy labeling in the PRC and the Netherlands, He et al. (2022) found that only energy literacy (knowledge) on daily energy use had a significant and positive effect on cost-minimizing decision, whereas broader knowledge and attitudes were not significant. Among the Philippine middle class, appliances with an energy efficiency are particularly valued by people with environmental concern and knowledge. A concrete explanation and understanding of energy labels and of the impact of the product on the environment increase the probability of consumer choice for a device with a higher energy efficiency (Kuhn et al. 2022).

Third, the so called **knowledge/value–action gap** exists among Asian consumers as well. This phenomenon is globally well-documented in a range of environmental psychology studies (e.g., Kollmuss and Agyeman 2002); it is a very human feature to be inconsistent to some extent. Some researchers call it the intention-action gap to be more precise in terms of psychological concept. In addition to our household survey among the middle classes in Ghana, Peru, and the

[4] Here are two statements that people sometimes make when discussing the environment and economic growth. Which of them comes closer to your own point of view?
1. Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs.
2. Economic growth and creating jobs should be the top priority, even if the environment suffers to some extent.

Philippines, where the knowledge/value-action gap became apparent (Never et al. 2020), a survey among the urban middle classes in Viet Nam also confirmed its existence (de Koning 2015). In the PRC, a high degree of variability exists across sociodemographic groups; and surveys found both a knowledge-action gap and a value-action gap (e.g., Andrews-Speed and Ma 2016).

Thus, on the one hand, consumers with insufficient specific knowledge on the impact of their behaviors and opportunities to change require support. On the other hand, consumers who already have sufficient environmental knowledge and hold pro-environmental values need guidance, incentives, and regulation to overcome the gap to action. Section IV elaborates on opportunities for this.

Fourth, **complex decision-making situations with many stakeholders** make individual behavior change difficult. In households with many household members or firms with many employees, the targeting of specific measures may be challenging; inconsistencies of behaviors and rebound effects occur. In our survey on energy saving behaviors among the middle classes in Ghana, Peru, and the Philippines, stated curtailment behavior and energy efficiency investments by the respondents (household head or purchase decision-maker) are likely to not have correlated with a lower electricity bill because of the behavior of other household members and rebound effects (Never et al. 2022). Similarly, Charlier and Martinez-Cruz (2020) found in their household survey in France that energy saving habits of household heads do not compensate for energy-intensive behaviors of other household members.

Fifth, the **availability and affordability of alternative low-carbon products and services** presents a challenge, especially in smaller towns and rural areas. This challenge clearly links to the production and supply side. Even successful energy efficiency programs such as the minimum energy performance standards (MEPS) and labeling program in India still struggle with a full market penetration of labelled products in rural areas and smaller towns (Never and Kemp 2017). In the study by de Koning et al. (2015), the surveyed urban middle classes in Viet Nam found it challenging to put sustainable consumption intentions into practice because of a lack of knowledge and money (availability challenge) and a lack of support structures (e.g., opportunities such as recycling system, trustworthy ecolabels). These challenges are likely to be similar in other Asian countries.

For policy planning, these various challenges imply that a more systematic linking of demand and supply-side policies to unleash a virtuous cycle of sustainable consumption and production is required. The challenge lies in identifying suitable policy packages and getting the sequence of measures right for each sector, while managing subnational inequalities of consumption and emission trends in line with the goal of a timely and just transition.

IV. KEY OPPORTUNITIES EMANATING FROM CONSUMER CHANGE IN A NET ZERO TRANSITION

Consumers are situated in an evolving norm environment. Policies, infrastructure, and market opportunities shape choices. Thus, changing the decision context and evolving social norms means changing consumer behavior. This presents a tremendous opportunity, especially as both global production and consumption hubs will be located in Asia in the coming decade. The appropriate sequence of measures to support the reaping of opportunities depends on the sector.

Generally, several co-benefits of low-carbon, sustainable consumption on current local problems can be identified (IPCC 2022; Creutzig et al. 2018): health, air pollution, gross domestic product (GDP), and time losses because of traffic jams, energy security (less demand during peak times secures overall grid stability, for example), and freed capital for consumers because of energy savings.

Additionally, the following sectoral opportunities for economic development from a consumer shift to low carbon, sustainable consumption could arise (refer also to Box 2 on job and economic growth opportunities; IPCC [2022]; Malerba, Never, and Altenburg [2020] adapted to Asia; Altenburg and Rodrik [2017]):

(i) **Low-carbon technologies:** green air-conditioners, electric vehicles (if electricity sourced from renewable energy), solar photovoltaic for homes, and light emitting-diodes (LEDs).

(ii) **New services/sharing econo.my:** cooling as a service, repair and reuse services for various goods, sharing platforms (for ride-sharing, positive effect depends on what kind of behavior is replaced).

(iii) **Refurbed and remanufactured products/circular economy,** e.g., electronics, plastic bricks, lightweight machinery parts, and automotive parts.

(iv) **Low-carbon buildings and construction:** reusable materials, solar panel installation, natural ventilation and cooling, but split incentive challenge (landlord-tenant), development of often voluntary green building codes as such unlikely to be sufficient as value chains in the whole construction sector need to change.

Box 2: **Possible Growth and Job Opportunities Emanating from Rising Consumer Income**

In Asia's low-income countries like the Lao People's Democratic Republic or Cambodia, positive local economic development effects of middle class consumption can be mainly expected for (i) non-tradeables; (ii) goods that are costly to trade (bulky, perishable); and (iii) tradeables with low entry barriers and limited economies of scale. The table below gives some sectoral examples. For Asia's middle-income and high-income countries that are highly competitive in trade (e.g., the People's Republic of China and the Republic of Korea), new markets and economic development opportunities from rising middle class demand could develop across both tradeable and non-tradeable goods. Many of these can be green or low-carbon products.

	Tradeable	**Non-tradeable or Costly to Trade**
Transport	Cars, electric buses, trains, bicycles	Repair services, driving services/staff
Housing/construction	(Green) steel, aluminium, glass, tiles, furniture	Urban planning, architecture and maintenance, cement, pre-fabricated low-cost houses, bricks, clay, cobble stones
Diversified food and beverages	Highly processed/frozen	Unprocessed and simple processed, e.g., local beer brands
Financial services	Offers by global insurance companies	Changes of local banks, local insurances, tax and investment counsellors

Substantial new market opportunities in specific tradeable products with economies of scale could also arise because of the global production hubs situated in Asian countries, fostered by changed middle class consumption patterns. These could develop in the cooling sector; for example, especially for air conditioners with natural refrigerants as the majority of air conditioner producers are located in Asia. Here, a policy push and awareness raising among consumers is required to support demand and make the case for economies of scale for companies. Additionally, opportunities for local innovative sustainable products, such as reused, refurbed, or remanufactured products (e.g., electronics, plastic bricks, and lightweight machinery parts) exist. Because of the vast number of influential factors in market development and dynamics, scientifically valid, exact figures projecting potential employment are unavailable.

Sources: Malerba, Never, and Altenburg (2020), adapted to Asia; Altenburg and Rodrik (2017).

The market trends in these fields are discussed in more detail in other background studies to the *Asian Development Outlook Thematic Report 2023*. Two examples will be discussed in more detail here that show how future middle-class consumer preferences and demand will create and impact low carbon market development.

To use the opportunities in the **green cooling market**, a shift in consumer preferences is required which, in turn, put pressure on manufacturers to make green ACs available in all Asian countries. Currently, this is not happening as manufacturers deem demand for green ACs too low, e.g., in the Philippines, preferring to offer cheaper, less energy-efficient and less climate-friendly models.

The positive impacts of AC ownership and use on human development are fairly clear. Studies have found better health (sleep, disease control) and higher productivity in cooled environments (Khosla et al. 2021; Barecca et al. 2016; Kjellstrom 2016). A growing AC market is likely to have positive employment effects on local technician and service enterprises. Moreover, many livelihoods depend on formal and informal scrap dealing and recycling of e-waste, including ACs (Alam 2021). Therefore, an emphasis to forego the purchase of ACs should not be the primary political strategy in tropical middle-income countries, but rather a market transition to green ACs. Green ACs can be energy efficient and contain natural, climate-friendly refrigerants such as R290.

Thailand is a frontrunner in the transition to green cooling in Asia, both for room ACs and refrigeration. This includes the production of green cooling technologies that use natural refrigerants and promote energy efficiency, which are expected to dominate the domestic refrigeration market in 2025. Currently, the use of refrigeration and air conditioning still accounts for about 50% of Thailand's electricity consumption. Therefore, the cooling transition is vital to achieve the Nationally Determined Contributions under the United Nations Framework Convention on Climate Change and to phase out hydrochlorofluorocarbons (HCFCs) partially until 2030 and completely by 2040, as agreed under the Kigali Amendment to the Montreal Protocol. Thailand has also piloted financing mechanisms targeted at the cooling sector and enhanced the capacity development infrastructure for technicians in the sector.

Middle-class consumers will likely be responsible for a substantial share of the room AC market in the coming decades, along with companies and hospitality businesses. Middle-class members purchase either new or used ACs, as particularly aspiring and lower-middle income class members may be looking for a lower priced unit (Never 2022). With the progress of global warming, thermal comfort norms and needs are likely to become a major concern of middle-class consumers. Cooling needs and preferences can be as much culturally and even industry-driven as a physical necessity because of heat waves (Mazzone and Khosla 2021). People can choose 'thermally uncomfortable' clothing because of social norms or status. For some households in the Philippines, for example, owning an AC has become a status good, even if is rarely switched on (Sahakian 2014). A locally embedded social construction of comfort and cooling habits exists that demand-side interventions in the cooling sector would need to take into account.

From a carbon footprint perspective, both purchase decisions of ACs and the use of cooling technologies or passive cooling option are crucial. Available lifecycle assessments for the PRC, Indonesia, and India have found that energy and climate impacts are highest during the use stage of the AC, not during manufacturing, transport, or sales (Gupta 2021; Karkour et al. 2020; Zhao 2015). This is primarily because of the share of fossil fuels in the electricity mix, confirming the findings of lifecycle assessments in the United States (Li 2015; Shah et al. 2008). Importantly, not only the user behavior itself (e.g., active use duration, leaving the AC on when not in the room), but also the electricity required to keep the refrigerant cool while the unit is idle contribute up to a third of the lifecycle emissions in hot countries (Ross and Cheah 2016). Passive cooling options include building design features (either preventing heat from entering indoors or removing heat from the building with natural cooling), smart space use by occupants, and adjusting clothing or using shades. Interestingly, traditional and ancient building design in Asia often offer substantial passive cooling.

Policymakers and technical cooperation agencies around the world tend to focus either on the active phase-in of new green technologies or on the end-of-life (e-waste) stage, neglecting the stage in between. The decisions if, when, and how to speed up the phase-out of old appliances deserves more attention. In many low-income and middle-income countries, large second hand markets for used appliances such as ACs exist. Apart from health and safety requirements and guidelines on e-waste that generally encourage reuse of technologies, more concrete regulations on used appliances such as ACs are missing in many low-income and middle-

income countries this far. From an energy and climate perspective, taking old ACs off the market as quickly as possible seems desirable (De Kleine et al. 2011). However, a material resource and lifecycle lens may change the picture. Further, social questions of affordability in low-income and middle-income countries rather call for prolonged use of cheaper, repaired ACs. Managing this complexity requires political attention.

The opportunities in the **circular economy,** especially concerning **reuse** and **recycling to close resource loops**, depend a lot on consumer behavior. Consumer behavior may not be consistent across policy fields. If positive behavioral spillover happens, then rather in low-cost domains such as recycling (Lanzini and Thogersen 2014). While several surveys and experimental studies confirm this inconsistency of behavioral spillover to other domains (Geiger et al. 2021; Maki et al. 2019), a lot of co-benefits from reuse and recycling exist for a net zero transition. From a net zero perspective, reusing materials and recycling present a low-cost, easy entry to pro-environmental behavior for the consumer and may help to foster a broader transition to a circular economy. The majority of the climate change mitigation effect comes about at waste management plants and landfills. Emission reductions by avoiding or reducing the amount of waste incineration can be substantial, even if many waste plants now concert the incinerated waste to electricity. The efficiency of these mechanical recycling plants presents another challenge. In Germany, for example, of the 5.35 million tons of post-consumer plastic packaging waste produced in 2019, only 19% were mechanically recycled as post-consumer recyclates for plastic production. The majority (i.e., 61%) of post-consumer plastic packaging waste are combusted for electricity and district heating, turning chemical recycling into a viable option for speeding up a net zero transition, also for Asia (Lee et al. 2021b).

In the absence of fully functioning waste collection and recycling systems, middle-class consumers can be sensitized to reuse products, to avoid unsustainable products with unnecessary packaging, for example, and to use take-back options that supermarkets and producers are beginning to offer voluntarily. Supermarkets and small corner shops (“bodegas”) can play a key role in partly functioning waste and recycling governance systems, as research on Peru has shown (Borasino and Fuhrmann-Riebel 2021). Small corner shops have close customer relations and may help to raise awareness and influence new recycling norms, whereas supermarkets have the possibility to step in as a powerful actor between producers in consumers, providing some recycling infrastructure as well.

Regarding sharing economy options, these practices have the opportunity to support the shift of aspirations from owning to using goods or services. Rebound effects may occur, however, as freed income from sharing may be used to invest in other carbon-intensive goods (IPCC 2022, Chapter 5).

Finally, a midterm to long-term opportunity that already needs to start now concerns **changing consumer norms and aspirations for low-carbon, sustainable consumption and production to become the "new cool"**. As mentioned above, already 17%–20% change in consumer choices can be a tipping point for market structures and a committed group of 25% can be enough to change social convention (Newell et al. 2021; Otto et al. 2020; Centola et al. 2018). The expert survey by Otto et al. (2020) identifies norms and values as one area in which social tipping points are possible to occur in the near to mid future, along with energy production systems, human settlements, the financial system, and education systems.

To reach a sustainable consumption tipping point, consumers have the power to choose (e.g., buy) and behave (e.g., travel) differently by themselves, but suppliers and policy also need to make a minimum of sustainable options available as well. To generally change status consumption and social norms prevalent among Asia's middle classes, belief updating and behavioral interventions to foster climate-friendly aspirations of well-being as a new norm presents one of several options. Other options include actively using education, especially of children, and influencers in social media to start transporting new green trends.

Intergenerational influence means the transmission of information, beliefs, attitudes, and skills from one generation to the next within a family (Moore et al. 2001). The majority of studies finds this influence flowing from parents to children or adolescents, namely by observable actions by the parents and by children's perception of parental expectations (Gronhoj and Thogersen 2012). Reverse or reciprocal family influence (from children to parents) has been found for the use of new technologies and environmental issues discussed at school (Moore et al. 2001; Ballantyne et al. 2001), but there is hardly any research on energy saving. It appears that adolescents acquire energy use behavior to a significant degree by observing what their parents do in the home sphere, adapting to the family norms and recreating their parents' use patterns. These correlations are stronger in shared spaces of the home than in private contexts (Wallis and Klöckner 2020). A difference between verbal rules and actions performed by parents seem to exist (Gronhoj and Thogersen 2012). The identification of

intergenerational influence connected to family communication and norms can be relevant in several environmental domains, for instance the duration of AC use and the temperature setting by different household members.

A combination of guidance by policy, regulations of the producer side that shift market supplies, as well as investments in infrastructure and awareness raising will be required. Changing social norms and associated consumer habits is a midterm to long-term process (Newell et al. 2021).

V. CONCEPTUAL FRAMEWORK: HOW TO LINK BEHAVIOR CHANGE, CONSUMPTION, AND SUPPLY-SIDE INVESTMENTS IN A NET ZERO TRANSITION

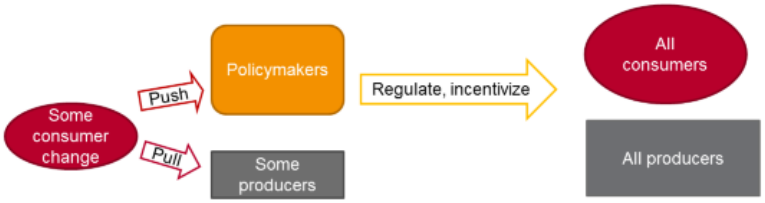
Greening only the supply side will not be sufficient to reach a net zero transition. The appropriate sequence of supply or demand focus and respective measures depends on the sector. Changing consumer demand and using the positive impact of consumer choice for low carbon products and services may be required in some sectors to push a net zero transition (e.g., cooling), whereas in others, the infrastructure (e.g., for public transport) and market may need to be available first. In many cases, policy measures require a preparatory phase that prepares the ground by lowering the costs of measures, communicating the costs and benefits to citizens, and building coalitions for policies, thus reducing political resistance (Meckling et al. 2017).

Unleashing a virtuous cycle of middle class consumption change, production, and infrastructure change to advance a net zero transition requires the systematic targeting, linking, and sequencing of policy measures aimed at sustainable consumption and production. Middle class behavior change presents both a starting point and a policy goal in this respect. The middle classes can exert considerable pressure on policymakers and businesses to provide sustainable products and infrastructure, already with small but consistent changes in consumption choices (starting point consumer pressure). In parallel, policy needs to provide the context conditions for middle-class consumers to overcome well-known knowledge/value–action gaps in pro-environmental behavior and drive deeper, costlier transformations in lifestyles (goal-changed

consumer behavior). Arguably, both the starting point and the goal related to consumer behavior are necessary elements for a successful net zero transition (Figure 1).

Current consumer-oriented demand side policies are fragmented, piecemeal, and too weak to

Figure 1: Relevance of Consumer Pressure for Change to a Net Zero Transition



Source: Author's illustration.

drive a demand-side net zero transition (IPCC 2022 Chapter 5, high evidence, high agreement). Current production and supply-side policies in low-income and middle-income countries usually focus on environmental and economic goals on the producer side only, starting with low hanging fruit and neglecting consumers and the demand-side beyond awareness-raising programs. A systematic extension and linking of the two can be conducive to both a net zero transition and broader development goals.

In general, the specific goals of each political measure that aim at sustainable consumption or production need to be complementary, pulling or pushing consumers and producers in the same direction without offsetting positive effects of other measures. Depending on the sector, the sequence of measures may need to be reviewed and adjusted. Hard-to-change behaviors will likely require more time and a combination of different types of measures, whereas easy-to-change, low-cost behaviors may be sufficient to achieve with well-targeted few instruments or investments. In terms of the combination of policies and measures, both regulatory and financial instruments as well as behavioral insights tools can be useful. For policy planning, evaluating, and reflecting (i) specific policy goals; (ii) the type of impact on the net zero transition; (iii) the type of consumer targeted (household, within household, employees, whole enterprises); (iv) type of target behavior (degree of complexity and cost for consumer to change); (v) type of conducive context required to achieve deeper behavior change (e.g., market structure, infrastructure); and (vi) possible safeguards, e.g., to avoid rebound effect could be useful.

As Asia is heterogeneous in terms of climate change impacts, economic capabilities, and development pathways, developing a one-size-fits-all approach is not possible. The next section gives some examples of potential policy packages and section VI provides an in-depth case study.

A. Policy Package Examples

As this report focuses on the emerging middle classes, policy packages for expanding energy access and ensuring decent living standards for the poor are important, but will not be discussed in detail. The IPCC suggests clustering demand-side policies according to an "Avoid–Shift–Improve" framework. Arguably, for developing Asia, this may need to be complemented by a "Remain"-option, for instance concerning public transport of the aspiring middle classes. Rebound effects need to be anticipated as well. Table 3 presents some examples for the energy and transport sectors.

Table 3: Examples for Avoid-Shift-Improve-Remain Policy Packages

Sector	Avoid	Shift	Improve	Remain
Transport	Integrate transport and land-use planning Tele-working Compact cities	Modal shift from car to walking, cycling, public transit	Lightweight vehicles Electric vehicles Fuel/emission standards	Attractive, efficient public transport system with integrated fare system
Energy (cooling)	Foster passive cooling (e.g., in building construction, individual norms) Longer lifetime of devices and repair standards (balanced phase-out) Smaller dwelling size	Higher standard temperatures of air conditioners Architectural design (e.g., ventilation, building materials/traditional designs that support cool environment)	Green air conditioners	Use natural ventilation, light clothing also in offices
Energy (lighting)	Occupancy sensors, lighting controls	Architectural designs with maximal daylight use	Light-emitting diodes (LEDs)	

Sources: IPCC (2022) (Chapter 5), slightly adapted; Never (2022) for cooling.

Concerning energy saving in households and energy efficiency more broadly, MEPS combined with energy efficiency labels present the key policy in most Asian countries. Japan has deviated from the MEPS with its "top runner" program. Even those countries that have lagged with

introducing standards and labels (e.g., Cambodia and the Lao PDR) are now in concrete planning and implementation phase. For the European Union, Schleich et al. (2021) estimated that the European Union MEPS and labels program increased the share of cold appliances (fridges, freezers) with the highest energy efficiency grade by 15%–38% between 2007 and 2017. For Asia, to the authors' knowledge, no such evaluations are available. In India, the widespread diffusion of MEPS and labels in rural areas and small towns remains challenging, in spite of the overall successful program (Never and Kemp 2017). Simplified labels that explain environmental impacts to consumers more clearly have been shown to increase consumer choice for higher rated devices (Kuhn et al 2022).

To increase the effectiveness of labels in terms of purchasing decisions and use of devices, programs would need to be complemented by awareness-raising and behavioral-insights programs that include all household members (e.g., real-time and comparative feedback on energy use), children's education in school. Information and awareness on maintenance and options for performance contracts (e.g., via energy service companies), effects of user behavior, alternative options, and repair and reuse standards (for second hand devices) would be useful. On the producer side, a ratcheting of MEPS over time, an increase in control and compliance (including fees), (illicit) trade controls, the development and harmonization of repair and reuse standards, as well as public procurement to support potentially slow energy service company markets or lower initial cost barriers for new, efficient devices could complement policy packages.

For the transport sector, low-carbon infrastructure and public transport development would need to be prioritized (sequenced), but awareness-raising campaigns and behavioral interventions to change norms and aspirations to remain in public transport or accept renewable-energy based electric vehicle car sharing could start now. Subsidies for purchasing electric vehicles require careful targeting as they may have inframarginal effects, i.e., supporting high-income households who had the intention to buy an electric vehicle also without subsidy (e.g., Gillingham and Stock 2018).[5] Here, local policymakers would need to evaluate the energy sources for the local electric vehicle market, the size and type of targeted consumer segment, and the design of green manufacturing policies (to avoid canceling out of

[5] To the authors' knowledge, the electric vehicle market and the role of subsidies to stimulate demand are the topics of another *Asian Development Outlook* 2023 background paper. Therefore, this paper refrains from an in-depth analysis.

emissions/mitigation in production and consumption). For instance, in a fossil fuel-based country with small middle and upper classes and highly congested urban areas, subsidies for electric vehicles may have lesser effects for a net zero transition than in a country with a higher share of renewable energies, manageable urban congestion, and a sizeable growing middle classes with strong car purchase intentions. A more in-depth discussion of the transport sector is in section VI.

B. Behavioral Insights as a Complementary Tool in Policy Packages

Behavioral insights present a collection of knowledge about the functioning of human decision-making as well as a set of choice architecture tools. In energy policy, for example, instrumental applications of choice architecture (nudges) have prevailed this far, for example as salient framing, defaults, and feedback on energy use (Dosmukhambetova 2020; Andor and Fels 2018). Behavioral insights can uncover explanations why single instruments, but also why combinations (packages, layering or patching over time) work or fail in a specific context (Capano and Howlett 2020). This can be helpful both by way of conducting randomized controlled trials and broader, mixed methods policy evaluations that take both behavioral and non-behavioral aspects into account.

Understanding why a target behavior is not performed, e.g., the uptake of efficient cookstoves, may have social, cultural-historical, or technical reasons. The ineffectiveness of a particular instrument, e.g., incentives for energy management systems in firms, may also be because of distortive effects by another instrument, e.g., fossil fuel subsidies. Behavioral insights studies can provide a value-added in uncovering how and why recipients deal with several regulations and incentives targeting them simultaneously, especially when insights beyond economics and psychology are taken into account. This could improve the coherence and effectiveness of policy mixes.

In energy policy, behavioral tools have been primarily applied to foster energy efficiency and energy saving (Andor and Fels 2018). Far fewer interventions have sought to increase residential uptake of renewable energy by changing the default electricity provider. The most widely used behavioral insights are social norm interventions to increase residential energy saving, commitment/goal setting, reminders, and real-time feedback on electricity use.

Effects of these nudges in energy policy vary. Defaults have the biggest effect (Hummel and Mädche 2019; Andor and Fels 2018), but are technically more difficult to implement in energy systems than other interventions. Social norm interventions reduce residential energy consumption between 1.2% and 30% compared to the control group (Andor and Fels 2018). In their meta-review of randomised, controlled trials on climate mitigation in households, Nis et al. (2020) find only small effects: 6.6% probability of benefit[6] for energy interventions generally and only 2.5% for the purchase of energy-efficient appliances. Similarly, Buckley (2020) only finds an average treatment effect of <2% on residential electricity consumption in her meta-review. An increasing number of studies now replicates the "Opower" study (Allcott 2011) on social norm comparison and feedback on electricity consumption in low-income and middle-income countries, also with varying effect sized (e.g., Mi et al. 2019).

For an effective, comprehensive, and long-lasting application of behavioral interventions as single energy policy instruments, two challenges remain: first, the high variation in significant effect sizes coupled with a potential publication bias of only successful interventions (Hummel and Mädche 2019). This makes blueprinting across countries and micro contexts difficult. Across policy fields, only 62% of nudge interventions have a significant effect (Hummel and Mädche 2019). Second, the persistence of behavioral intervention effects over time are still largely unclear. The effects of the social norm comparison in the "Opower" home energy reports in the United States are relatively persistent, declining at a rate of 10%–20% per year (Allcott and Rogers 2014). In contrast, interventions on climate mitigation in households are hardly persistent beyond the intervention period at all (Nis et al. 2020).

The following factors increase the likelihood for effective behavioral interventions (Box 3). A higher effectiveness of behavioral insights can be expected when using them in the design of a policy package that consists also of regulations, financial incentives, and investments in infrastructure and the choice context for the consumer. Behavioral insights tools tend to be more effective in contexts when behaviors can be traced back clearly to an individual (or key responsible person in the household), when the number of barriers to behavior change is limited, and also if individual costs are low and/or pro-environmental motivation is generally existing already.

[6] Probability that the intervention will promote climate mitigation behavior in the experimental group compared to the control group.

Waste separation and recycling, for example, usually comes down to one or two key individuals in the home. If the consumer is actually a larger entity such as enterprises or a hospital, targeting individuals within these entities via behavioral insights may remove some barriers, but a change of the overall company likely requires additional other measures (e.g., financial, regulatory) because of the high complexity and multitude of barriers to change. Finally, pro-environmental behavior change interventions tend to be most successful among consumers who already have some environmental concern, but may struggle with the knowledge/value-action gap, or more specific, intention-action gap. As discussed above, this is a common human phenomenon across the world with environmental concern and good intentions not translating to action in the end.

Box 3: How to Apply Behavioral Insights to Change Consumer Behavior "Hands On"

Behavioral insights are no silver bullet; every solution needs to be adapted to the circumstances and needs of the given context. Four steps make a successful intervention more likely.

First, an understanding of the status quo by asking the questions what, who, how, and why:

(i) What exactly is the issue? For example, a household consumes a lot of energy or a waste separation plant receives mixed waste, and only a fraction can be recycled. But this is not detailed enough. Which materials exactly are an issue in that waste, food waste, garden waste, or hospital waste?

(ii) Whose behavior causes the issue? Again, e.g., "households" is not enough! A specific group of households? Who in the household? Who takes the relevant decision (e.g., that a household starts to separate waste or save energy), and who implements it? Is it a female or male member, children, or household employees?

(iii) This leads us to the how: How do they currently behave (e.g., treat their waste or use/save energy), and how do we need them to do it?

(iv) And last but not least: why do they do what they do? And why would they do what we want them to? If we cannot force them (and we rarely can, or should), we need to offer a better option. Convenience, societal or personal values, cost, availability of options, and knowledge are all factors that play a key role here.

(v) In each of the above questions we need to prioritize. What is our most pressing issue? Which group is it mainly caused by? Which is their main barrier or motivation for change? Who/which barrier is easiest to address?

Second, based on the above answers, targeted interventions need to be developed. These can be changes in the infrastructure, institutions or communication measures, for example. Behavioral sciences give us some general guidelines of how to develop such interventions. For example, a new behavior should be made:

(i) Simple, that is, easy to understand, with short communication, simple rules, minimize additional hassle, maximize convenience (with an eye on costs).
(ii) Attractive, in terms of money, but also nonmonetary (e.g., generating a "warm glow" for doing something good; creating trust that waste, once separated, will actually be recycled; make it fun through gamification, etc.)
(iii) Social. Humans tend to follow the behavior of others, especially their peers, and want to look good in front of them. Further, if given the choice, most of us actually want to cooperate.

Third, piloting the intervention and adapting it according to the results of the pilot is crucial. Sometimes this brings surprising results, when things we were sure to work suddenly do not, or others we just tried because they would be so cost-effective, but did not have much hopes for, turn out to be quite impactful. Only in the fourth step, the up-scaling of successful solutions happens.

Sources: German Institute of Development and Sustainability (IDOS) experience in various projects; and Pegels (2022).

VI. CASE STUDY: LINKING CONSUMER BEHAVIOR CHANGE AND INFRASTRUCTURE INVESTMENTS IN THE TRANSPORT SECTOR IN THE PHILIPPINES

Urbanization and rural-urban migration rates are high in Asia, straining transport systems. Many urban centers across Asia are at the limits of congestion and air pollution already. With soaring mobility demand of the middle classes, future sustainable transport system development requires attractive infrastructure developments that motivate the middle classes to forego car purchase and frequent use. Therefore, transport policymakers need to address both supply and demand: (i) multimodal infrastructure systems that addresses middle class needs, and (ii) managing middle-class consumer behavior. This section discusses these issues

by way of the Philippine example, summarizing insights from a middle-class household survey, focus group discussions, and expert interviews.

Box 4: Key Points for Transforming Mobility in the Philippines

The transport sector has the highest mitigation potential and offers clear co-benefits for health and air pollution, especially in urban centers.

Both sustainable mass transit options for the poor and attractive options for the middle classes are required.

Public transport is used, especially by the lower middle classes, but convenient, modern options still appeal to upper middle class as well.

Carbon intensity of transport patterns increases, especially among upper middle classes.

Behavior change interventions for middle classes need to complement demand-side management (e.g., change of social norms, status symbols).

Performance-based contracts for private operators can support the physical integration of transport modes, while an integrated informational and fare system with staggered tariffs could appeal to both middle class and poorer parts of the populations.

Source: Author.

In many Asian countries, urbanization and rural–urban migration cannot be matched by current infrastructure capacities. From 1970 to 2017, the number of urban inhabitants in the region increased from 375 million to 1.84 billion. The urbanization rate is projected to rise from 46% in 2017 to 64% in 2050 (ADB 2019). With every new migrant in a city, there is also one more person on the roads in the need of travelling to the workplace, find a job or attend to grocery and leisure purposes. Because of the current extension and configuration of cities with clearly separated uses (residential, work places, commercial and leisure), these trips can often only be achieved using motorised travel modes.

Congestion and air pollution present a tremendous cost to Asian economies and to individual health and well-being already. According to the *Asian Development Outlook* 2019, Metro Manila, Kuala Lumpur, and Yangon City rank as the most congested cities in the 25 developing countries in Asia surveyed. Lost time and higher transport costs because of road congestion amount to annual costs between 2% and 5% of GDP. Metro Manila alone loses ₱3.5 billion per day to congestion, for example. Each year, the registration rate for new vehicles in Metro Manila increases by about 7%, according to the Land Transportation Office. From 2016 to

2018, this meant an addition of another 387,814 vehicles to the roads—many of them likely to belong to the growing middle classes.

The mobility demand of the growing middle classes, including car ownership, puts additional pressure on transport systems. For many middle-class families, buying a car presents a matter of social status, security, and convenience. Further, travel and mobility have become a part of newly acquired lifestyles. The automotive market in Asia counts as the fastest-growing market globally, led by the PRC, but also showing stable growth rates across the other Association of Southeast Asian Nations (ASEAN) countries until the COVID-19 pandemic (ASEAN Automotive Federation). Car purchase has become much more affordable because of low tax policies on car importation that are part of free trade agreements for vehicles within ASEAN. These allow for easy payment systems offered to customers, i.e., payment by instalments at low rates and low down-payments. Our analysis for the Philippines shows that this is an important factor for many middle-class families who are considering car purchase.

Mobility trends emanating especially from the middle classes are currently not matched by investments in public infrastructure, apart from major investments in road infrastructure for private vehicles. Overall, Asian transport sectors require $8.4 trillion in investments up to 2030 for countries to continue economic growth, eradicate poverty, and respond to climate change (ADB 2017, Meeting Asia' Infrastructure Needs). Subregional differences exist according to the respective infrastructure stock, level of economic development, and growth projections.

Now, the Government of the Philippines has the opportunity to embark on multimodal infrastructure planning and policy that includes demand-side management of the middle classes. On the one hand, economic effects of the COVID-19 pandemic hampers political leeway in the coming years. On the other hand, economic recovery can be boosted by public works programs in sustainable infrastructure. A more permanent shift to flexible work solutions with remote work may incentivize especially middle and upper classes to carry out long motorized trips less frequently.

A. Infrastructure Planning in the Philippines

The Philippines still rank below its neighbors in terms of the quality of roads, railroads, port, and air transport infrastructure (IMF 2019). The Duterte Administration has started to increase expenditures on infrastructure projects from 3% of GDP in 2016 to 5% of GDP in 2020, aiming

for 7.3% by 2022. The "Build, Build, Build" Program is supposed to become President Rodrigo R. Duterte's political legacy. The program lists 100 large infrastructure projects that shall bridge the investment gap and secure the country's economic growth path, especially by allowing a swifter economy recovery post-COVID-19. Its implementation can only partly be called successful this far. Only two projects were completed half-time into the presidential term and 56% of the projects are scheduled for completion by the end of 2022.[7] Mixed funding models, operational and political economy challenges in infrastructure planning limit the type and effectiveness of mobility options available to the middle classes. Demand-side management is not a political priority yet.

The shift from purchasing power parity to mainly public and Official Development Assistance (ODA) funding is a double-edged sword. The government chose this option in an attempt to expand the lagging infrastructure projects of previous administrations under more favorable financial conditions. ODA loans are offered at concessional rates and with longer repayment periods, but project implementation is often slower than with private sector participation. The Asian Development Bank (ADB) tends to advise against public funding for large infrastructure projects because of budget variability and weak governance in many countries. New, long-term loans in an economic recession are also unlikely to ease the financial burden. As the operational costs for maintenance of the existing rail and road systems are high and are not currently recovered by fares (except for toll roads), a full privatization of the transport system would not solve financial challenges quickly either. Performance-based contracts for private transport operators and a multimodal approach with an integrated fare system across transport modes could support cost recovery.

Various political economy challenges hamper sustainable transport policy in the Philippines. Political preference has been given to rail solutions rather than a full-fledged multimodal approach that prioritizes comparatively cheaper bus rapid transit (BRT) systems in major roads, for example. High staff turnover and cases of corruption in the various governmental agencies engaged in transport undermine the reliability and progress of infrastructure projects. Further, the fragmented transport governance system makes swift decision-making and implementation challenging. The World Bank project on a BRT system in Metro Manila, for instance, has been slowed down because of these political economy challenges.

[7] https://www.rappler.com/newsbreak/in-depth/where-are-we-on-build-build-build-program.

Currently, middle-class consumers have the following public transport options within Metro Manila: three light rail (metro) lines (extensions for all lines are planned; one more under construction; subway-line and a north-south commuter line with a common station planned), buses, specific point-to-point buses, mini-vans called UV-Express, taxis, ride-hailing services by car (Grab, formerly also Uber) or by motorcycle (Angkas, Joyride) and motorized tricycles. A large number of jeepneys (converted US Army vehicles that can seat about 12 passengers) run on fixed routes painted on the side of the vehicle. Intervals depend on the route and can vary from a few minutes only to half an hour waiting time. Jeepneys are often highly polluting, but are also a national cultural symbol. The current jeepney modernisation program by the Department of Transportation to curb air pollution was therefore met by a lot of protests, including jeepney drivers who fear for their livelihoods. Separate bicycle lanes are available in very few neighborhoods only (e.g., Marikina, Quezon City, and Makati) and around university campuses. The density and frequency of coverage of these various options depends on the area within Metro Manila and available services often overlap rather than feed each other optimally. Public transport suspension during the COVID-19 lockdown in 2020 presented both a burden for commuters and an opportunity for new initiatives such as pop-up bike lanes. The Metropolitan Manila Development Authority and the Department of Public Works and Highways are now planning to set up separate motorcycle and bike lanes on the main circumferential road Epifanio delos Santos Avenue (EDSA) permanently. A permanent, clearly separate bus lane on EDSA is also being discussed. Only the bike lane shall have a permanent lane separation to augment cyclist security; a bike-sharing program is also being discussed. However, the funds set aside for the separate bicycle lanes in the "Bayanihan 2" law, passed in September 2020, will expire as of June 2021.[8] As some political reluctance seems to remain within executing agencies, the implementation of these bicycle projects is questionable.

B. Managing Middle Class Mobility Behavior

Middle classes in the Philippines are mostly located in Metro Manila. While private vehicle ownership in the metropolitan region is still behind many other Asian cities, demand-side management has to start early to motivate the growing middle classes to remain in public transport. The analysis of travel patterns and carbon intensity shows that the middle classes still use all public transport options, but buy and use own vehicles as soon as their financial capacities allow. Current lifestyle trends point towards an environmentally unsustainable

[8] https://www.philstar.com/nation/2021/02/11/2076998/group-warns-budget-may-expire-while-mmda-studies-edsa-bike-lanes.

pathway in the future (Never and Albert 2021; Never et al. 2020). The following outlines the main results.

1. Methods

As part of a project on carbon consumption patterns of the growing middle classes,[9] we conducted three focus group discussions and a household survey with 900 middle-class households in Metro Manila in 2018. The survey has a slight bias towards the lower middle classes. Both the focus groups and the survey targeted modes and frequency of travel (but not concrete distance covered), social status considerations, environmental knowledge, and environmental concern. Based on survey answers, we also constructed a wealth index. The focus groups additionally discussed the reasons for transport mode choice, purchase considerations of a car, and perceptions about the transport system in Manila.

The household survey was conducted in all 17 cities of Metro Manila, approximating a representative sample of the middle classes. The sampling followed two steps, one geographical and one household-based step. In the first step, slum areas and very rich districts were excluded. In the second step, probability sampling proportional to estimated population size for neighborhoods was applied. Then, every fifth house from a random starting point was approached. Households were asked screening questions to determine whether they qualify to belong to a broad bracket of middle class or not. Screening questions targeted assets, expenditures, and education level of the household head. After excluding outliers, the final sample size was N = 802 (for more details, refer to Never et al. 2020).

Based on the survey data, we constructed a score on carbon intensity of travel patterns. The carbon dioxide (CO_2) score for transport is a proxy, not an accurate measurement of the carbon intensity of all travel trajectories by actual kilometers (km) and time travelled. As a starting point, we used our survey question "On a normal day, how often do you use your own car". We asked this question for 12 available transport modes in Metro Manila, using a five-point Likert scale. Answers for a normal day were extrapolated to annual frequencies in order to match them with annual average CO_2 emissions by vehicle types.

[9] https://www.idos-research.de/en/research/description//sustainable-middle-classes-in-middle-income-countries-transforming-carbon-consumption-patterns-smmicc/.

We multiplied average vehicle emissions factors per km travelled in Metro Manila for each of the 12 transport modes (NEDA 2014; Fabian and Gota 2009) by the inverse average occupancy rates for each vehicle type, using the most recent data available (JICA 2012). The average occupancy rate captures the vehicle km per person km travelled; the inverse (person km per vehicle km) is necessary to arrive at per capita CO_2 emissions.

CO_2 emission estimate per capita = daily frequency of travel mode[10] * Inverse occupancy rate * emission factor (g of CO_2/km travelled) * 365

Walk, bike, and pedicab are human-powered and, therefore, have no emissions. Data on the occupancy rate and the emission factors of the Manila light rail systems (MRT, LRT) are missing. Yet light rail systems such as metro lines typically have very high occupancy rates in Manila, and therefore low per capita emissions. Thus, the travel mode "metro (MRT, LRT)" is assigned the value "0" as well. Annual flight emissions are computed as follows: (i) we utilize information on individuals' flight destinations and approximate the average distance (in km) travelled per air journey; and (ii) we multiply the average travel distance by a proxy for average CO_2 per air km and the number of times the person travelled by plane last year.[11]

For each land travel mode, we multiply the daily travel mode frequencies by CO_2 emissions per transport mode times 365 to arrive at a proxy for individuals' annual transport CO_2 score (refer to equation/calculation above). Given the limited data availability, this approximation is the most accurate measure we could calculate.

2. Travel Patterns of the Middle Classes

The middle classes tend to be flexible in transport mode choice. On a normal day, walking, using a jeepney or motorized tricycle (motortaxi) are the most frequent modes of road travel across wealth groups within the middle class (Table 2). Aside from these three road travel modes, the use of bus, metro and bicycle are fairly equal across wealth groups. Yet, only the wealthier middle-class members (have and) use a car, share a car with a friend or family member. Motorcycles, Grab, and utility vehicle express are used more frequently with

[10] Weights: nearly never = 0 km, a few times = 5 km, sometimes = 10 km, often = 20 km, and very Often = 25 km.

[11] Our proxy is 115 grams of CO_2 per air km travelled (source: https://www.carbonindependent.org/sources_aviation.html). We acknowledge the fact that a typical air journey involves a round trip and, thus, consider the average distance covered per journey twice.

increasing wealth. Further, air plane travel correlates with wealth among the middle class. The focus group discussions confirmed these flexible travel patterns. However, middle-class members who own cars do not always use their cars because of discomforts in traffic, parking, and costs. Grab and jeepneys are popular for shorter distances. Jeepneys and non-air-conditioned buses are used less frequently because of a lack of comfort. Walking is also perceived as uncomfortable by many, mainly because of heat and humidity, and possibly because of habits as other means of transport are often readily available.

Table 2: Frequency of Preferred Transport Modes by Middle Class Wealth Quintile

On a normal day, proportion (in %) that sometimes, often or always	Middle Class Wealth Quintile					Total
	Poorest	**Second**	**Middle**	**Fourth**	**Richest**	
Use your own car	0.0	0.0	0.0	0.6	10.1	2.1
Share a car with a friend or family member	0.6	0.0	0.0	2.5	9.4	2.5
Use a bus	11.2	10.1	15.6	13.8	15.7	13.3
Use a jeepney	52.2	58.5	55.0	58.5	57.9	56.4
Use a tricycle	52.2	58.5	49.4	47.2	54.7	52.4
Use a motorcycle	14.3	22.6	26.9	26.4	31.4	24.3
Use Grab	1.2	1.9	3.8	10.1	10.7	5.5
Use a taxi	1.2	2.5	4.4	11.3	5.7	5.0
Use UV Express	2.5	3.8	4.4	8.8	9.4	5.8
Use the metro (MRT, LRT)	9.9	13.2	10.0	17.0	15.7	13.2
Use a bike	7.5	13.8	5.0	10.7	7.5	8.9
Walk	95.7	91.2	93.8	93.1	84.9	91.7

LRT = light railway transit, MRT = metro railway transit
Source: Authors' calculations from IDOS German Institue of Development and Sustainability microdata (2018); previously published in Never and Albert (2021).

Mobility needs and abilities increase with upward social mobility. Transport makes up 6% of total middle-class household expenditures, compared to 4.7% among the low-income class and 7.1% among the upper-income class (Government of the Philippines 2015). The middle-income and upper-income classes spend nearly the same amount on road transport services, and both spend more than twice that spent by the lower-income class (Never and Albert 2021; Government of the Philippines 2015). However, the upper-income class far outspends the middle-income class in air transport services.

Car purchase behavior is influenced by the quality and convenience of public transport. Focus group participants argued that the middle class prefer to buy new cars because of the poor public transport system, comfort reasons, and the ease in buying new, safer vehicles because of payment schemes (low down payments and monthly payments). Prices for a new, small car (e.g., Toyota Wigo, Honda Brio) are about ₱500,000–₱600,000 with typical monthly instalments costs starting at ₱10,000–₱15,000. Used car prices start at ₱50,000/$200 already. Bigger, new cars with some extra features that rich families would prefer (e.g., Honda Civic, Toyota Fortuner) start at prices of ₱1 million–₱1.5 million.

High effort required and a lack of choices between modern, efficient transport modes frustrate the middle classes. Focus groups agreed that traffic and congestion greatly affect work life and family life. Real choices between transport modes do not always exist because every option is crowded and takes a lot of time. Participants also criticized a lack of rule enforcement, especially for the number coding rule that cars are only allowed on Metro Manila streets 6 days a week. Moreover, rich families own several cars to circumvent the rule on purpose.

Apart from the number coding scheme, the Metropolitan Manila Development Authority experiments with various other schemes to reduce vehicle volume in Metro Manila (e.g., higher excise tax on fuel, more road space allocation to buses in yellow lanes, U-turns, no stopping). Thus far, these demand-side interventions hardly affect the mobility behavior of the middle classes.

3. Carbon Intensity and Drivers of Sustainable Transport Mode Choice

As the middle classes in Manila move up the wealth ladder, carbon emissions from their mobility behavior increase (Figure 1). But not only wealthier, but also more educated middle-class members emit more carbon. Social status considerations, environmental concern, environmental knowledge, and the age of the individual do not impact the carbon intensity of transport behaviors directly, but play at least a secondary role in the choice of an unsustainable or sustainable mode of transport.

Wealthier, more educated Filipinos tend to be happy to pay a higher price of using a UV Express, Grab, taxi, or other shared car services because they can afford the extra comfort. Using buses, the metro, or jeepneys is cheaper but involves standing in queues for a long time,

especially during rush hour. An air conditioned car in a traffic jam may be the more comfortable option for some. For whom status plays a role as well is unclear.

The role of social status considerations in transport mode choice is difficult to pin down. A study in India has shown that car ownership presents a powerful status symbol, for example (Verma 2015). We also find a small positive correlation between status and our transport CO_2 score, which only appears when education is controlled for. Given the very small number of car owners in our survey sample, we cannot infer that cars are a status symbol for wealthier, educated middle-class households, even though our focus group discussions and background interviews suggested this. The focus groups more clearly evoked that status signalling to others plays a role for some in the middle class, especially those who seek to climb socially, trying to keep up with upper class lifestyles. Decades ago, owning a car was already a status symbol of the upper middle class, with parents proudly saying: “may sariling kotse na yan” (translation: they have their own car).

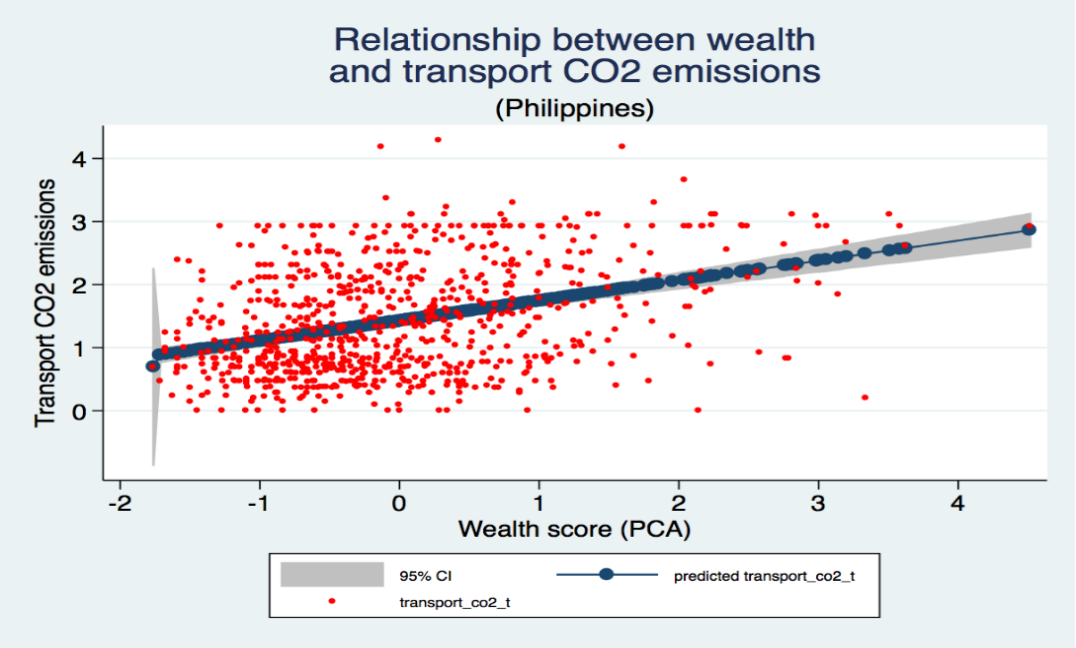
In many countries, transport mode choice is driven by a combination of individual (material and psychological), social, and infrastructure level factors. While personal control over decisions and perceptions about common behavior of others motivate some shifts in mode choice, infrastructure factors explain large differences in mode choice (Javaid et al. 2020). For a deeper analysis of the drivers of (un)sustainable transport mode choice in Manila, we group the frequency of using various transport modes on a normal day into sustainable (walk, bike, bus, metro) and motorized (here: labelled as unsustainable) modes of transport (car, shared private car, jeepney, Grab, UV Express, taxi, motorcycle, tricycle), building indices.

While younger, female, and slightly more environmentally concerned middle-class consumers tend to choose more sustainable modes of transport, the correlations are not very strong and coefficients are small. Similarly, younger but wealthier middle-class consumers choose unsustainable modes of transport more frequently. The result is also only weakly significant. In both regressions, the constant has a strong influence, indicating that other factors have been more important. The availability, time efficiency, price, and comfort of transport infrastructure play a larger role, as the focus group discussions have indicated.

Overall, the transport consumption patterns of the lower middle classes in Metro Manila consist of a more sustainable mix than of the wealthier middle class. However, even for the wealthier

middle classes, public transport is still an option, as both our focus group and choice patterns of travel modes revealed. Once households reach upper middle-class status and may further move into upper income brackets, carbon footprints from air travel and car acquisition is very likely to increase. Future demand-side management policy needs to take these different consumer segments and their motivations into account.

Figure 2: Middle Class Wealth Levels and Carbon Emissions in the Philippines



PCA = Principal Component Analysis. CI = Confidence Interval.
Source: Author's calculations.

Table 3: Transport Score Regressions: Manila

Transport Score	Model 1	Model 2	Model 3	Model 4	Model 5
Wealth	0.087***	0.088***	0.087***	0.087***	0.072**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Status		-0.028	-0.030	-0.031	-0.016
		(0.06)	(0.06)	(0.06)	(0.06)
Knowledge			0.007	0.006	0.001
			(0.02)	(0.02)	(0.02)
Concern				0.014	0.020
				(0.08)	(0.08)
Education					0.166**
					(0.06)
Age					0.001
					(0.00)
Gender					0.036
					(0.09)
Household members					0.004
					(0.01)
Constant	0.002	0.077	0.039	-0.005	-0.289
	(0.04)	(0.16)	(0.20)	(0.33)	(0.38)
R-sqr	0.018	0.018	0.018	0.018	0.027
dfres	792	791	790	789	785
BIC	2257.2	2263.7	2270.2	2276.9	2296.3

* p<0.05, **<0.01, ***p<0.001

Note: Standard errors are in brackets.
Source: Author's calculations.

Table 4: Influence of Environmental Concern, Knowledge, and Overseas Experience on the Use of Sustainable Transport Modes on a Normal Day

	(1) sust_trans~t	(2) sust_trans~t	(3) sust_trans~t	(4) sust_trans~t
concern_in~x	0.157**	0.153*	0.145*	0.143*
	(2.64)	(2.58)	(2.45)	(2.41)
knowledge_~x	-0.0201	-0.0172	-0.0152	-0.0161
	(-0.89)	(-0.76)	(-0.68)	(-0.71)
worked_ove~s	-0.0508	-0.0263	-0.0423	-0.0459
	(-0.53)	(-0.27)	(-0.44)	(-0.47)
relatives~as	-0.00150	-0.00145	-0.00137	-0.00136
	(-0.96)	(-0.93)	(-0.88)	(-0.87)
age		-0.00539*	-0.00562**	-0.00568**
		(-2.57)	(-2.69)	(-2.70)
gender_dum			0.183**	0.180**
			(2.79)	(2.72)
wealth_score				0.00792
				(0.29)
_cons	3.205***	3.388***	3.402***	3.418***
	(13.00)	(13.25)	(13.36)	(13.11)
N	796	796	796	796

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Source: Authors‘ calculations based on IDOS German Institute of Development and Sustainability (2018) survey.

Table 5: Influence of Environmental Concern, Knowledge, and Overseas Experience on the Use of Motorized (Unsustainable) Transport Modes on a Normal Day

	(1) unsust_tra~t	(2) unsust_tra~t	(3) unsust_tra~t	(4) unsust_tra~t
concern_in~x	0.0857*	0.0834*	0.0808*	0.0406
	(2.15)	(2.10)	(2.03)	(1.10)
knowledge_~x	0.0228	0.0246	0.0252	0.00318
	(1.51)	(1.63)	(1.67)	(0.23)
worked_ove~s	0.112	0.127*	0.122	0.0331
	(1.74)	(1.97)	(1.89)	(0.55)
relatives~as	-0.00148	-0.00145	-0.00142	-0.00117
	(-1.41)	(-1.38)	(-1.36)	(-1.21)
age		-0.00328*	-0.00336*	-0.00492***
		(-2.34)	(-2.39)	(-3.78)
gender_dum			0.0581	-0.0125
			(1.32)	(-0.31)
wealth_score				0.199***
				(11.89)
_cons	1.647***	1.758***	1.763***	2.169***
	(9.98)	(10.26)	(10.29)	(13.43)
N	796	796	796	796

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Source: Authors' calculations based on IDOS German Institute of Development and Sustainability household survey (2018).

4. Multimodal Planning and Demand-Management for the Middle Classes in the Philippines

For transport planners, the window of opportunity to manage mobility trends and strong demand by the growing middle classes with an eye to the future is open now. The transition to sustainable, low-carbon transport systems is captured by the widely-known "Avoid–Shift–Improve" framework.

Avoiding unnecessary motorized trips is very relevant for Asia's middle classes. Opportunities to continue remote work solutions post-COVID-19 should be sought, if possible. Shifting to public transport and active transport modes (e.g., walking, cycling) applies to the upper middle classes who own and use an own vehicle only. In Metro Manila, the vast majority of the middle classes still use public transport. Strategically supporting a "Remain" option is therefore more appropriate for the Philippines at this moment. Improving available systems and transport modes in terms of energy efficiency and fuel efficiency is useful for all consumers. The introduction of fuel efficiency standards by the Department of Energy and the jeepney modernization program belong to this category. To advance the "Avoid" and "Remain"

dimensions of sustainable transport transitions in the Philippines, systematic demand-side management is required.

Given the infrastructure gaps and maintenance challenges in the current system in Metro Manila, demand-side management has not received much political attention yet. Three types of demand-side management that are particularly relevant for adaptive planning to the middle class needs are discussed above:

Incentives to use efficient modes. Road space allocation away from the private vehicle is partly being put in place in Metro Manila, but not systematically. Further, both private cars and motorcycles tend to swerve onto bus lanes and buses stop randomly to pick up and drop off passengers. Segregated lanes for public buses and a BRT system with concrete barriers and stopping at bus stations only would increase system efficiency and time saved will attract middle-class users. This can be enhanced by the implementation of parking restrictions in congested areas, as well as congestion tariffs in the city center. Currently, especially middle-class consumers switch to more time-effective modes of transport within districts already. The tremendous growth and success of Angkas and Joyride motorcycles especially in business areas shows that new, attractive, and convenient options will be picked up by customers immediately.

Smart growth development policies. Apart from a systematic and comprehensive transport policy, smart growth development means increasing the (physical) attractiveness of public transport itself and of the public areas around it, including transit-oriented development in mixed-use urban areas. Creating pedestrian and bicycle-friendly areas, where possible, and turning the pop-up bike lanes around Metro Manila into a continuous cycling network present useful steps. The Department of Transportation has already started investing in elevated walkways and the EDSA Greenways Project, for example, approved by ADB in 2020. These efforts could be expanded. Additionally, appealing and safe public areas near stations, which are easily reachable by foot or bicycle, and—targeting the middle classes—modern, attractively-designed, air conditioned, and comfortable options support transit-oriented development. Given the current difficulties in financing, maintenance, and planning in the Philippines, this will not happen overnight, but it is worth pushing for it now before windows of opportunity to change mobility trends close.

Multimodal planning and behavior change. The physical integration of transport modes available, the provision of information on waiting times, for instance, and the integration of fares across Metro Manila would all address the middle classes' demand for convenience, time-efficient, and modern services. The LRT and MRT have an integrated fare system, which would need to be extended to other transport modes. The high number of operators of buses and jeepneys makes this challenging, but an integrated fare system can benefit poorer parts of the population for long and multimodal trips (Nag et al. 2019). For the upper and middle classes, time-based subscription cards or higher fares for access to first class seating areas could help smoothen system cost recovery, similar to the staggered electricity tariffs in place in Metro Manila (electricity lifeline tariff for the poor is cross-subsidized by a higher tariff for intensive electricity users without any governmental subsidies). An integrated system can offer all the possible trip combinations to the user, allowing them to select the most convenient one. Current technologies can facilitate this via mobile applications. In this way, public transport use can become as comfortable and convenient as private car use.

Behavior change interventions and information campaigns could increase public acceptance of new mass transit options such as BRT systems or electric bike-sharing trials. Lessons in other countries such as the successful implementation of e-bike sharing in the PRC can be helpful here. In a situation where demand cannot be met by any supply, as in Metro Manila currently, behavior change interventions are arguably even more important to start changing social status and social norm formation among the growing middle classes in the midterm to long-term. Young adults in India with a pro-environmental mentality and good public infrastructure available close to them are less likely to own a car in the future (Verma et al. 2016). The strategic support of such environmental bubbles in the Philippines by underlining international trends in communication campaigns may be useful. Dynamic norm interventions can help to create new norms that are not in place yet. Overall, the political and public acceptance of sustainable mass transit options as the pathway to the future rather than private motorized transport could still be increased in the Philippines.

In terms of policy sequence that links transport infrastructure supply and consumer demand and behavior, infrastructure investments and the creation of attractive alternatives need to come first, while also protecting and supporting small-scale sustainable mobility initiatives such as cycling in university areas to start changing consumer norms and aspirations towards well-being. During final phases of infrastructure construction and modernization, targeted

awareness raising for different consumer groups can start already. Finally, once attractive low-carbon alternatives are in place, demand-side management programs can be rolled out for different segments of the population, for instance with integrated information and fare-systems and differential pricing schemes based on economic capabilities of consumers. Infrastructure investments need to be inclusive and cater to the needs of all population groups. For a large of part of the middle classes in the Philippines, the key is to help them remain in public transport and make options so attractive and convenient that urban commuters see no status or efficiency gain in private car travel.

VII. POLICY RECOMMENDATIONS

The explicit integration of Asian consumers in policy packages for a net zero transition has many co-benefits for social, environmental, and economic goals. The type of policy package and the sequence of measures in the package to unleash a virtuous cycle of sustainable consumption and production depend on local market structures and available infrastructure, as well as on local consumption capabilities and prevalent consumer norms and preferences.

Standard command and control and financial instruments (e.g., incentives, subsidies) are suitable for costly, complex, or unpopular behavior changes and those that require a lot of investments in a conducive context for consumer decision-making. Behavioral insights tools (choice architecture, nudges) are particularly useful for very specific situations with a limited number of stakeholders and a low to mid degree of complexity and costs, for improving individual-level programs, increasing the uptake of low-carbon technologies, expanding general support for low-carbon projects, and addressing individuals with high environmental concern and intrinsic motivation to change to low-carbon consumption. The sequence of measures within policy packages also requires careful planning (e.g., infrastructure in transport first, recycling co-development of infrastructure/employment, and consumer-oriented measures).

Regulation and financial incentives/support (standard toolbox) are particularly useful for:

(i) larger and/or very costly investment decisions at individual or collective level;
(ii) complex decision-making setups with many influencing factors and stakeholders;
(iii) set up of sustainable alternatives (e.g., product design, infrastructure); and
(iv) steering unpopular choices.

Behavioral insights are particularly useful for:

(i) improving existing individual-level programs (e.g., recycling);

(ii) increasing the adoption and smart use of low-carbon technologies (e.g., ACs);

(iii) expanding support for environmental policy and projects; and

(iv) addressing individuals with high environmental concern/intrinsic motivation, especially when using "nudging" techniques.

Information and awareness-raising programs alone will not be sufficient. Individual attitudes and norms may take longer to change and do not always translate to action (value-/intention-action gap). Once changed, however, they are likely to be more stable across decision domains such as energy saving and plastic reuse. Addressing specific behavioral barriers with very targeted, context-dependent measures is more likely to lead to immediate behavior change, but the change may not be long-lasting or stable across different decision domains.

In developing Asia, a differentiation of consumer-oriented measures according to different income groups and social mobility dynamics is appropriate. Informational measures and many behavioral measures aimed at changing consumer knowledge and motivation the development of a new norm of well-being can be addressed to all income groups. This well-being norm could shift to the quality of economic development and consumption (away from the quantity orientation) by stressing the many co-benefits on social and environmental goals. This does not mean depriving anyone of experiences or opportunities, rather adjusting to a "new cool". In consequence, perceptions and aspirations of social status connected to consumption patterns may change over time, which is particularly important for the aspiring and floating middle classes as they may be the capable consumers of the future.

High-income and upper middle-income classes may be addressed with more stringent regulation and clear contributions to a net zero and just transition within their own countries. For example, business and first class air travel could include a carbon price. Luxury goods and/or large, energy-intensive assets could be put under a clear carbon tax; incomes of these taxed could be recycled to the poorest in the population (e.g., recipients of social protection cash programs), turning the tax both progressive and beneficial to the poor.[12] In electricity

[12] This has been shown to be possible in Peru (Malerba et al. 2020).

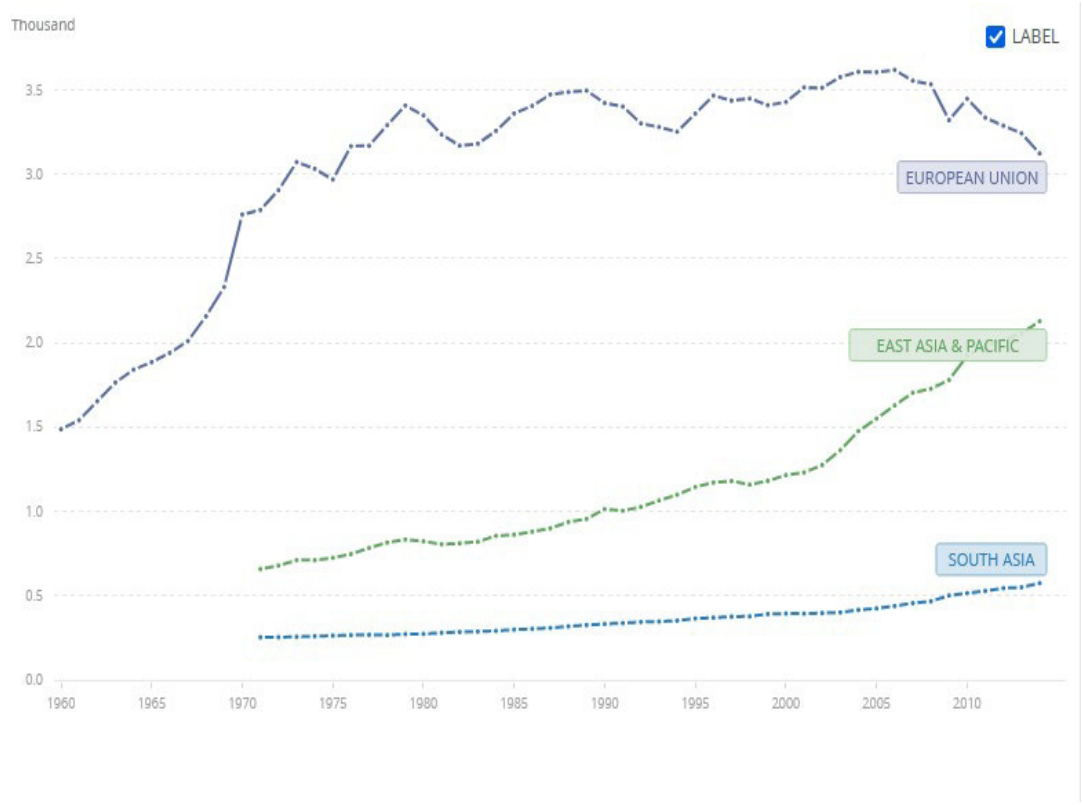
pricing, staggered tariffs according to consumption in kilowatt-hour are common in many developing countries. This approach could be transferred to modernized transport systems for example, combining attractive and efficient infrastructure, integrated informational and fare systems, and differentiated pricing schemes.

In sectors that offer opportunities to closely link consumer- and producer-oriented measures, moving from voluntary to mandatory phase-in and phase-out measures could be appropriate, e.g., energy efficiency labels and manufacturers of ACs, or organic and regional food labels and regional producers. Labelled products may be more readily available at shops or supermarkets frequented by middle-income to high-income consumers rather than in traditional markets. However, the integration of new actors (e.g., small supermarkets and corner shops) as well as a green and social regulation of used appliance markets, for example, could support the reach-out to low-income consumers as well.

Finally, sustainable, low-carbon innovations and initiatives both among local producers and among consumer groups should be more systematically identified and supported. For a net zero transition to happen successfully in time, consumer pressure on policy and producers as well as middle-income and high-income consumer behavior change are required, which in turn needs political action.

APPENDIX

Figure A1: Energy Use per Capita in Oil Equivalents per Kilogram, 1960–2014



Sources: Organisation for Economic Co-operation and Development, International Energy Agency, and World Bank.

Figure A2: Consumption Projections for Different Consumer Segments

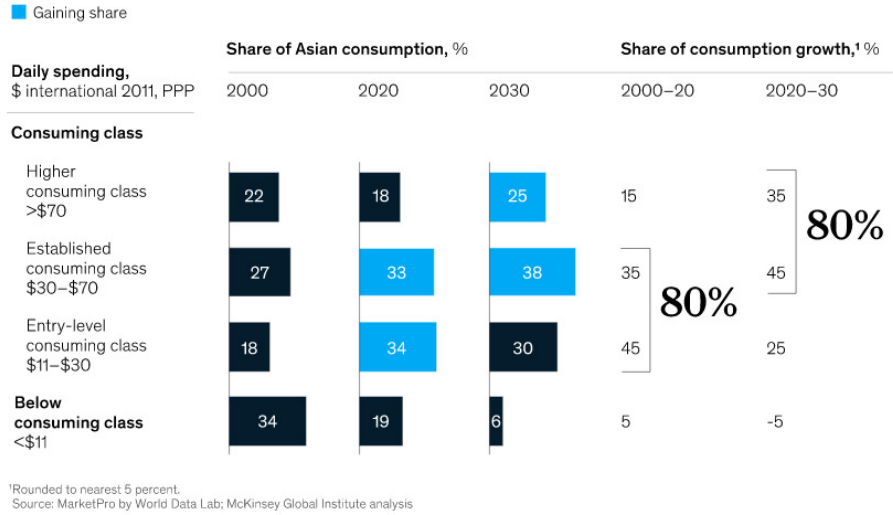
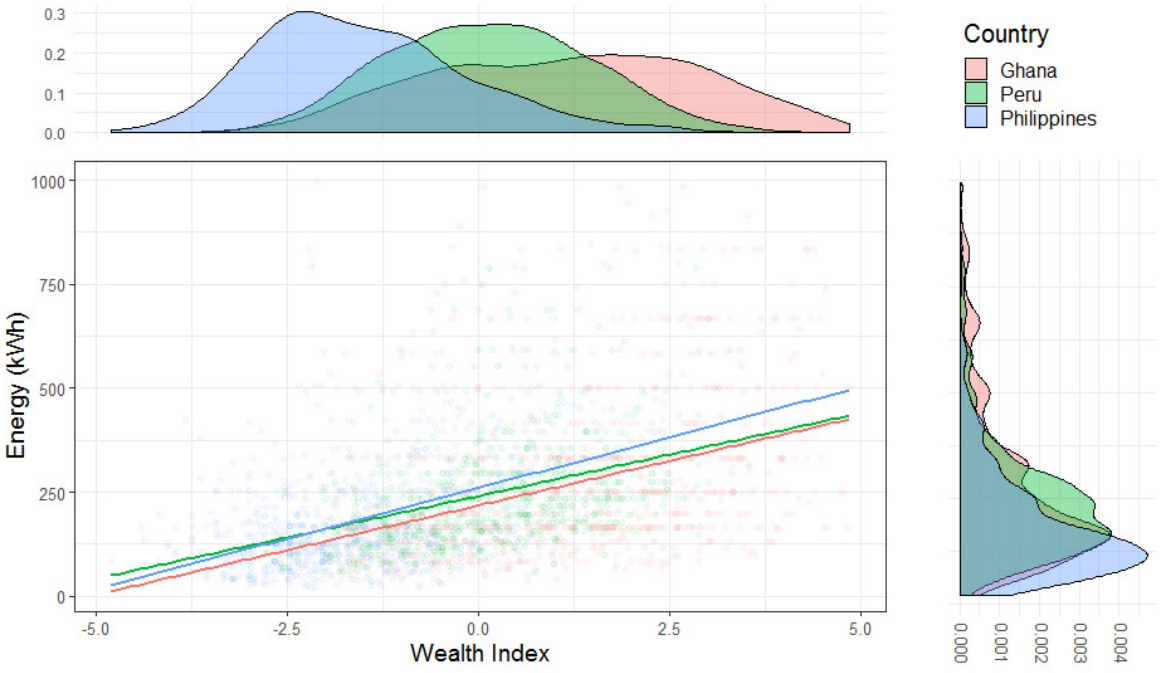


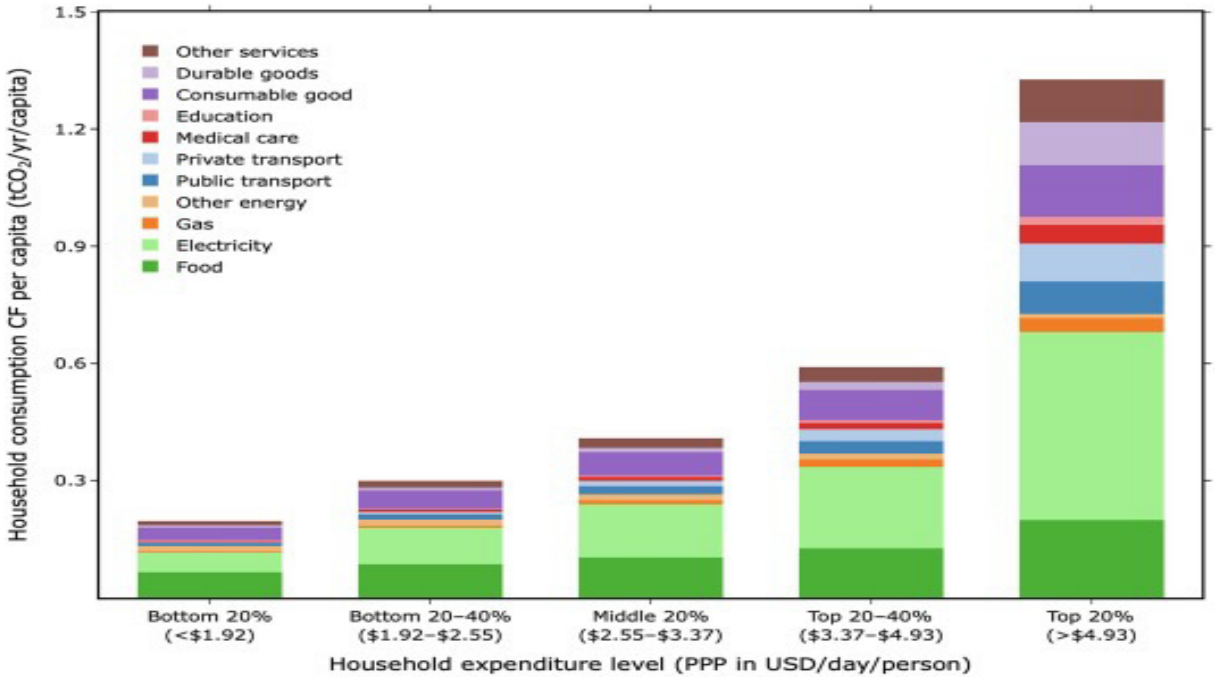
Figure A3: Middle Class Household Wealth Level and Energy Consumption

(N = 900 per country)



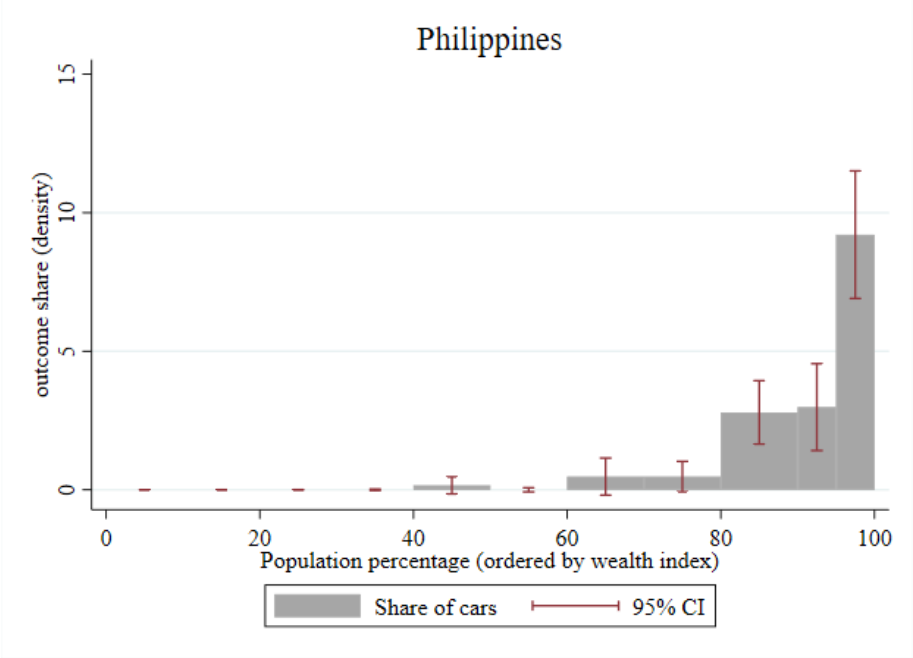
kWh = kilowatt-hour.
Sources: Household survey by German Institute of Development and Sustainability and Never et al. (2022).

Figure A4: Inequality in Household Carbon Footprints in India



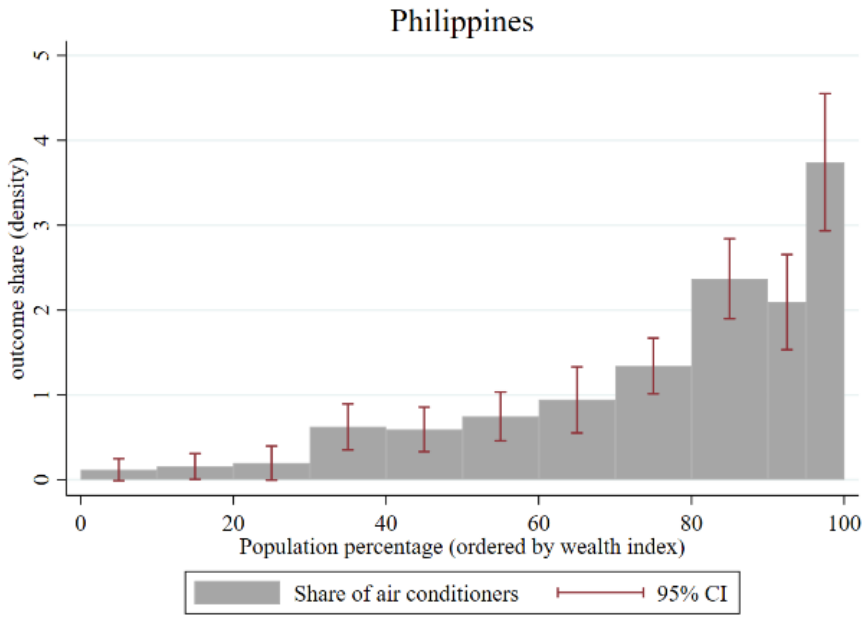
CF = Carbon Footprint, PPP = purchasing power parity, tCO_2 = total carbon dioxide.
Source: Lee et al (2021a).

Figure A5: Share of Cars Owned by Middle Class, Ordered by Wealth Quintiles



CI = Confidence Interval.
Sources: Never et al. (2020), Household surveys by German Institute of Development and Sustainability (IDOS).

Figure A6: Share of Air Conditioners Owned by Middle Class, Ordered by Wealth Quintiles



CI = Confidence Interval.

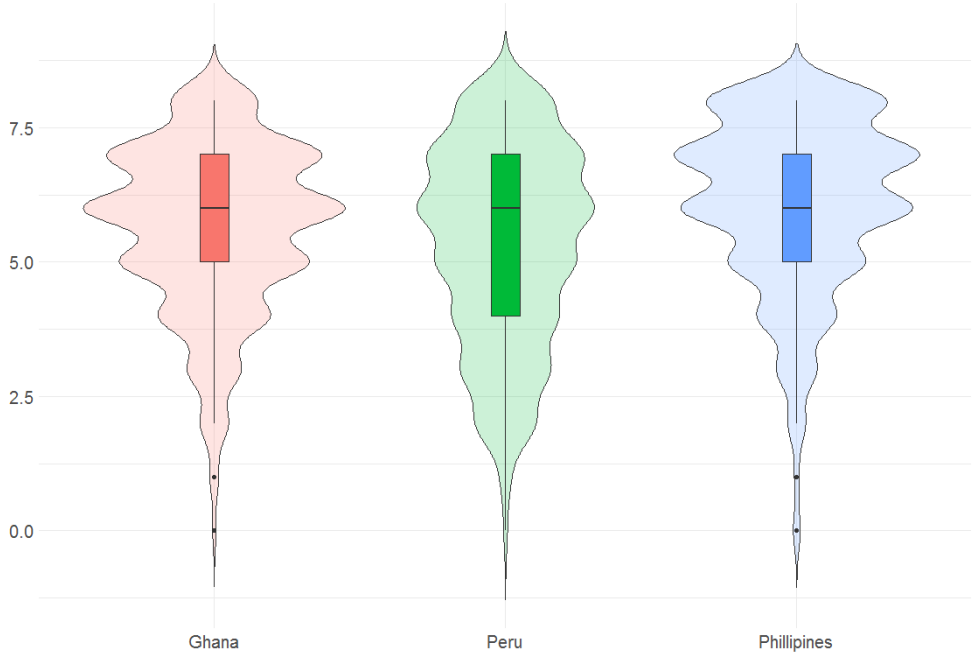
Source: Never et al. 2020, Household surveys by German Institute of Development and Sustainability (IDOS).

Table A1: Regression Estimates for the (Simultaneous) Bivariate Ordered Probit Model on Status Consumption, India

First Stage: Household Perception for Status				
Monthly Income (log) $_{05}$	0.15*** (0.01)	0.15*** (0.01)	0.15*** 0.01)	0.15*** (0.01)
Occupation$_{05}$	0.06*** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.06*** (0.01)
Education$_{05}$	0.07*** (0.01)	0.07*** (0.01)	0.07*** (0.01)	0.07*** (0.01)
Household Size	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
Religion	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.015 (0.01)
Caste	-0.05*** (0.01)	-0.05*** (0.01)	-0.05*** (0.01)	-0.05*** (0.01)
Dwelling Quality	0.27*** (0.01)	0.28*** (0.01)	0.27*** (0.01)	0.27*** (0.01)
Home - rent or own	0.27*** (0.03)	0.27*** (0.03)	0.27*** (0.03)	0.27*** (0.03)
Location (non-metro/metro city)	-0.02 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.02 (0.01)
Member of Social Group	0.09*** (0.02)	0.08*** (0.02)	0.08*** (0.02)	0.08*** (0.02)
Share of monthly expenditure on Conspicuous Consumption (IV)	9.3*** (1.06)	9.32*** (1.06)	9.28*** (1.06)	9.30*** (1.06)
Second Stage: Ownership/Consumption	**Car**	**Basic Appliances**	**Moderate Appliances**	**Luxurious Appliances**
Monthly Income (log) $_{05}$	0.06* (0.04)	-0.05** (0.02)	-0.01 (0.02)	-0.03 (0.02)
Occupation$_{05}$	0.01 (0.02)	-0.04*** (0.01)	-0.01 (0.01)	0.01 (0.01)
Education$_{05}$	0.02 (0.02)	0.01 (0.01)	0.01 (0.01)	0.02 (0.01)
Household Size	0.01 (0.01)	-0.01*** (0.01)	0.03*** (0.01)	-0.01 (0.01)
Religion	0.10*** (0.02)	0.03** (0.02)	0.07*** (0.02)	0.08*** (0.02)
Caste	-0.03 (0.02)	0.02 (0.01)	-0.08*** (0.02)	-0.04** (0.02)
Dwelling Quality	-0.02 (0.05)	0.07 (0.04)	0.11*** (0.05)	-0.03 (0.04)
Home - rent/own	-0.07 (0.06)	-0.10*** (0.04)	0.03 (0.04)	-0.07 (0.04)
Location (non-metro/metro city)	-0.03 (0.02)	0.03*** (0.01)	0.01 (0.01)	0.03** (0.01)
Member of Social Group	0.05 (0.04)	0.26*** (0.04)	-0.21*** (0.02)	-0.05* (0.03)
ρ (correlation coefficient)	-0.47*** (0.17)	-0.55*** (0.13)	-0.54*** (0.12)	-0.77*** (0.13)
Household Perception for Status (Gamma)	0.92*** (0.12)	0.87*** (0.08)	0.82*** (0.07)	1.02*** (0.05)
Likelihood Test	492.04	970.36	770.45	898.06
Observations	11,857	11,855	11,851	11,835

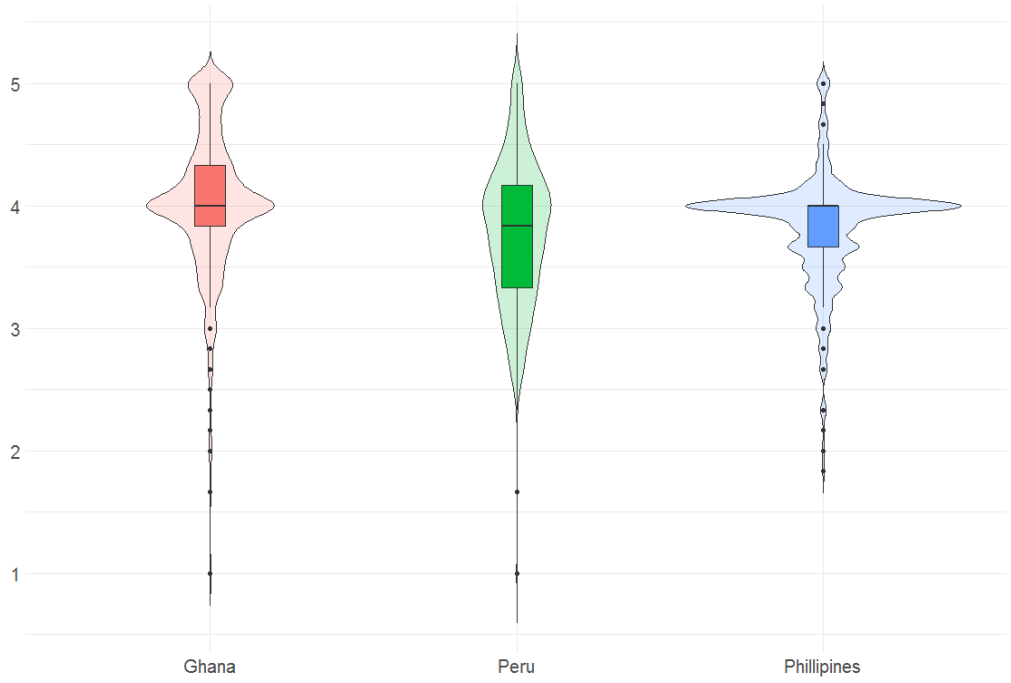
Source: Ramakrishnan et al. (2020: 9).

Figure A7: Environmental Knowledge among Middle Class Households in Ghana, Peru, and the Philippines



Source: Never et al. (2020), Household surveys by German Institute of Development and Sustainability (IDOS).

Figure A8: Environmental Concern among Middle Class Households in Ghana, Peru, and the Philippines



Source: Never et al. (2020), Household surveys by German Institute of Development and Sustainability (IDOS).

Table A2: World Values Survey Wave 7: Environment versus Economy

	Bangladesh	**Myanmar**	**PRC**	**Indonesia**	**Japan**	**Malaysia**	**Pakistan**	**Philippines**	**Singapore**	**Thailand**
Protecting environment	44.9	51.3	68.2	72.1	33.6	60.4	40.3	66.3	55.8	52.7
Economy growth and creating jobs	49.3	48.6	26.2	21.4	23.1	34.8	53.4	32.6	36	42.9
Other answer	0	0.1	4.7	5.2	9.6	4.8	0.3	0.6	3.3	3.1
Do nott know	5.7	0	0.4	0.8	32	0	5.4	0.4	3.8	0.2
No answer	0.1	0	0.5	0.2	1.7	0	0.7	0	1.1	0
Other missing; Multiple answers Mail (EVS)	0	0	0	0.3	0	0	0	0.1	0	1.2
(N)	**1,200**	**1,200**	**3,036**	**3,200**	**1,353**	**1,313**	**1,995**	**1,200**	**2,012**	**1,500**

EVS = European Values Survey PRC = People's Republic of China.
Source: World Values Survey online, https://www.worldvaluessurvey.org/WVSDocumentationWV7.jsp.

REFERENCES

ADB. 2019. *Fostering Growth and Inclusion in Asia's Cities. Theme Chapter of the Asian Development Outlook 2019 Update* (September). Asian Development Bank.

Alam, Z. 2021. *Green AC Project Report, May 2021*. Internal report. Manila: Deutsche Gesellschaft für Internationale Zusammenarbeit.

Altenburg, T. and D. Rodrik. 2017. Green industrial policy: accelerating structural change towards wealthy green economies. In Altenburg, Tilman and Claudia Assmann, eds. *Green industrial policy: concept, policies, country experiences.* Geneva and Bonn: UN Environment and German Development Institute (Deutsches Institut für Entwicklungspolitik) (DIE), pp. 1–20.

Allcott, H. 2011: Social norms and energy conservation. *Journal of Public Economics* 95, pp. 1082–1095.

Allcott, H. and T. Rogers. 2014. The short-run and long-run effects of behavioral interventions: experimental evidence from energy conservation. *American Economic Review* 104, pp. 3003–3037.

Anantharaman, M. 2014. Networked ecological citizenship, the new middle classes and the provisioning of sustainable waste management in Bangalore, India. *Journal of Cleaner Production* 63, pp. 173–183.

Anantharaman, M. 2017. Elite and ethical: The defensive distinction of middle-class bicycling in Bangalore, India. *Journal of Consumer Culture* 17 (3), pp. 864–886.

Andor, M. and K. Fels. 2018. Behavioral Economics and Energy Conservation: A Systematic Review of Non-Price Interventions and Their Causal Effects. *Ecological Economics* (148), pp. 178–210.

Andrews-Speed, P. and G. Ma. 2016: Household energy saving in (the People's Republic of) China: The challenge of changing behaviour. *(The People's Republic of) China's Energy Efficiency and Conservation*, pp. 23–39.

Ballantyne, R., Fien, J., & Packer, J. (2001). School environmental education programme impacts upon student and family learning: A case study analysis. Environmental Education Research, 7(1), 23–37

Barreca, A., K. Clay, O. Deschenes, M. Greenstone, and J. S. Shapiro. 2016. Adapting to climate change: the remarkable decline in the US temperature-mortality relationship over the twentieth century. *Journal of Political Economy* 124, pp. 105–159.

Birdsall, N., N. Lustig, and C. Meyer. 2015. The strugglers: The new poor in Latin America? *World Development* 60, pp. 132–146.

Bhar and Ananatharaman. 2022: Contradictions of sustainable consumption: externalities vs co-benefits for development. Presentation at the workshop Up-scaling co-benefits of sustainable consumption for development. Bonn, Germany/online, 13 June 2022.

Borasino, Elena and Hanna Fuhrmann-Riebel. 2021. New kids on the recycling block: the role of supermarkets and bodegas for sustainable consumer behaviour in Lima. *Circular Economy and Sustainability.* First published 1 December 2021.

Buckley, P. 2020. Prices, information and nudges for residential electricity conservation: A meta-analysis. Ecological Economics 120, 106635.

Capano, G. and M. Howlett. 2020. The Knowns and Unkowns of Policy Instrument Analysis: Policy Tools and the Current Research Agenda on Policy Mixes. *SAGE Open*, https://doi.org/10.1177/2158244019900568.

Centola, D., Becker, J., Brackbill, D. and A. Baronchelli. 2018. Experimental evidence for tipping points in social convention. *Science* 360 (6393), pp. 1116–1119.

Chalermpong, S., Kato, H., Thaithaktul, P., Ratanawahara, A., Fillone, A., Hoang-Tung, N. and P. Jittrapirom 2022. Ride-hailing applications in Southeast Asia: A literature review. *International Journal of Sustainable Transportation,* pp. 1–21.

Charlier, D. and A. Martinez-Cruz. 2020. Do habitual energy saving behaviors of household heads impact energy consumption in their own dwelling? An exploration in the French residential sector. *CERE Working Paper* 5. Center for Environmental and Resource Economics, Umea University.

Chun, N., Hasan, R., Rahman, M. and M. Ulubasoglu. 2017. The role of the middle class in economic development: What do cross-country data show? *Review of Development Economics*, 21, pp. 404–424.

Creutzig, F., Roy, J., Lamb, W., Azevedo, I., de Bruin, W., Dalkmann, H., Edelenbosch, O., Geels, F., Grubler, A., Hepburn, C., Hertwich, E., Khosla, R., Mattauch, L.Minx, J., Ramakrishnan, A. Rao, N., Steinberger, J., Tavoni, M., Ürge-Vorsatz, D. and E. Weber. 2018. Towards demand-side solutions for mitigating climate change. *Nature Climate Change* 8, pp. 260–271.

De Kleine, R., G. Keoleian, and J. Kelly. 2011. Optimal replacement of residential air conditioning equipment to minimize energy, greenhouse gas emissions, and consumer costs in the US. *Energy Policy* 39, pp. 3144–3153.

De Koning, J., Crul, M., Wever, R. and J. Brezet. 2015. Sustainable consumption in Viet Nam: an explorative study among the urban middle class. *International Journal of Consumer Studies* 39(6), pp. 608–618.

Dosmukhambetova, D. 2020. *The use of behavioural insights in promoting residential energy efficiency: an overview of available literature*. Technical Report. Auckland. https://www.knowledgeauckland.org.nz/media/1912/tr2020-015-behavioural-insights-in-promoting-residential-energy-efficiency.pdf.

Fabian, H., & Gota, S. (2009). CO2 emissions from the land transport sector in the Philippines: Estimates

and policy implications. Proceedings of the 17th Annual Conference of the Transportation Science

Society of the Philippines. Retrieved from http://tssp.tripod.com/documents/17th_tssp/fabian.pdf

Fuhrmann-Riebel, H. 2022. Motivations and incentives for pro-environmental behaviour in Peru: a behavioural and experimental economics analysis. Dissertation, University of East Anglia, https://ueaeprints.uea.ac.uk/id/eprint/91248/

Fuhrmann-Riebel, Hanna, Ben D'Exelle, and Arjan Verschoor. 2021. The role of preferences for pro-environmental behaviour among urban middle class households in Peru. *Ecological Economics* (180), article 106850.

Geiger, S., Brick, J., Nalborczyk, N., Bosshad, A. and N. Jostmann. 2021. More green than gray? Towards a sustainable overview of environmental spillover effects: a Bayesian meta-analysis. *Journal of Environmental Psychology* 78, 101694.

Gertler, P., Shelef, O., Wolfram, C. and A. Fuchs. 2016. The demand for energy-using assets among the world's rising middle classes. *American Economic Review* 106.

Gillingham, K. and K. Stock. 2018. The Cost of Reducing Greenhouse Gas Emissions. *Journal of Economic Perspectives* 32(4), pp. 53–72.

GIZ. 2019. *Refrigeration and Air Conditioning Greenhouse Gas Inventory for the Philippines*. Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH.

Government of the Philippines. 2015. *Family and Income Expenditure Survey*. Manila.

Gronhoj, A. and J. Thogersen. 2012. Action speaks louder than words: The effect of personal attitudes and family norms on adolescents' pro-environmental behaviour. *Journal of Economic Psychology* 33, pp. 292–302.

Gupta, R. 2021. Empirical assessment of sociotechnical factors that influence residential electricity use in India. Presentation at the 6th European Conference on Energy Efficiency and Behaviour, 21 April.

Hummel, D. and A. Maedche. 2019: How effective is nudging? A quantitative review on the effect sizes and limits of empirical nudging studies. *Journal of Behavioral and Experimental Economics* 80, pp. 4758.

Hu, Yansong and Christophe Van den Bulte. 2014. Nonmonotonic Status Effects in New Product Adoption. *Marketing Science* 33 (4), pp. 509–533.

IEA. 2018. *The Future of Cooling. Opportunities for energy-efficient air conditioning*. Paris: International Energy Agency.

IMF. 2019. *The Philippines: A Good Time to Expand the Infrastructure Push.* International Monetary Fund. https://www.imf.org/en/News/Articles/2020/02/06/na020620the-philippines-a-good-time-to-expand-the-infrastructure-push.

IPCC. 2022. *6th Assessment Report*. Chapter 5: Deman, services, and social aspects of mitigation. Working Group 3. Intergovernmental Panel on Climate Change.

Javaid, A., F. Creutzig, and S. Bamberg. 2020. Determinants of low-carbon transport mode adoption. *Environmental Research Letters* 15 103002.

Jackson, T. 2007. Sustainable Consumption. In: Handbook of Sustainable Development. Edward Elgar Publishing.

JICA 2012. Japan International Cooperation Agency. (2012). Appendix 2: Current transport situation in Manila. Retrieved from http://open_jicareport.jica.go.jp/pdf/11633419_16.PDF

Karkour, S., Ihara, T., Kuwayama,T., Yamaguchi, K. and N. Itsubo. 2020. Life Cycle Assessment Considering the Benefits of their Use: A Case Study in Indonesia. *Energies 2021*, 14, p. 447. https://doi.org/10.3390/en14020447.

Kharas, H. 2017. *The unprecedented growth of the middle class: An update*. World Bank.

Kharas, H. and K. Hamel. 2018. A global tipping point: Half the world is now middle class or wealthier. Blog. Brooking Institution.

Kjellstrom, Tord. 2016. Impact of Climate Conditions on Occupational Health and Related Economic Losses: A New Feature of Global and Urban Health in the Context of Climate Change. *Asia Pacific Journal of Public Health* 28 (Supplement 2)

Khosla, R., Miranda, N., Trotter, P., Mazzone, A., Renaldi, R., McElroy, C., Cohen, F., Jani, A. Perera-Salazar, R.. McCulloch, M. 2021 Cooling for sustainable development. *Nature Sustainability* 4, pp. 201–208.

Kollmuss, A. and Agyeman, J. 2002. Midn the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research* 8, 239-260.

Kuhn, S., Kutzner, Fl and J.Thogersen. 2022: How to make energy efficiency labels more effective: insights from a discrete choice experiment in Ghana and the Philippines. *Energy Research & Social Science* 84, 102320.

Lanzini, P. and J. Thogersen. 2014. Behavioral spillover in the environmental domain: an intervention study. *Journal of Environmental Psychology* 40, pp. 381–390.

Lee, J., Taherzadeh, O. and K.Kanemoto. 2021a. The scale and drivers of carbon footprints in households, cities and regions across India. *Global Environmental Change* 66, 102205.

Lee, R., Tschoepe, M. and R. Voss. 2021b. Perception of chemical recycling and its role in the transition towards a circular economy: a case study in Germany. *Waste Management* 125, pp. 280–292.

Li, G. 2015. Investigations of life cycle climate performance and material life cycle assessment of packaged air conditioners for residential application. *Sustain. Energy Technology Assessment* 11, pp. 114–125.

Maki, A., Carrico, A., Raimi, K., Truelove, H., Araujo, B. and K. Yeung. 2019. Meta-analysis of pro-environmental behavioral spillover. *Nature Sustainability* 2, pp. 307–315.

Malerba, D., Gaenztsch, A. and H. Ward. 2020. Mitigating poverty: the patterns of multiple carbon tax and recycling regimes for Peru. *Energy Research & Social Science*, online first, article number 111961.

Malerba, D., B.Never, and T. Altenburg. 2020. What Africa's middle classes consume and how this could foster local economic development. Presentation at Conference Africa in 20250. 20 February 2020. Bonn.

Mazzone, A. and R. Khosla. 2021. Socially constructed or physiologically informed? Placing humans at the centre of understanding cooling needs. *Energy Research & Social Science* 77, 102088.

McKinsey. 2021. Asia's consumers on the move: the future of mobility. https://www.mckinsey.com/featured-insights/future-of-asia/asias-consumers-on-the-move-the-future-of-mobility.

Meckling, J., Sterner, T, Wagner, G. 2017. Policy sequencing towards decarbonization. *Nature Energy* 2, 918-922.

Mi, L., Ding, C., Yang, J. and X.Yu. 2019. Using goal and contrast feedback to motivate Chinese urban families to save electricity actively – a randomized controlled field trial. *Journal of Cleaner Production* 226, pp. 443–454.

Moore, E. S., Wilkie, W. and J. Alder. 2001. Lighting the torch: How do intergenerational influences develop? *Advances in Consumer Research*, 28, pp. 287–293.

Nag, D., B.S.A. Manoj, K. Goswami, and S. Bharule. 2019. Framework for public transport integration at railway stations and its implications for quality of life. *ADBI Working Paper* 1054. Retrieved from https://www.adb.org/publica-tions/framework-public-transport-integration-railway-stations-implications-quality.

NEDA 2014. National Economic Development Authority & Japan International Cooperation Agency. Roadmap for transport infrastructure development for Metro Manila and surrounding areas. Retrieved from http://www.neda.gov.ph/wp-content/uploads/2015/03/FR-MAIN-TEXT.-12149605_01.pdf

Neubert, D. and F Stoll. 2018. The narrative of the African middle class and its conceptual limitations. In Kroeker, L., D. O'Kane, and T. Scharrer, eds. *Middle classes in Africa*. Frontiers of Globalization (pp. 57–79). Palgrave Macmillan.

Never, B. 2022. Green and social regulation of used appliances: the case of air-conditioners in the Philippines. *Circular Economy and Sustainability (2022),* https://doi.org/10.1007/s43615-022-00212-7.

Never, B., Kuhn, S.; Fuhrmann-Riebel, H., Albert. J.R., Gsell, S., Jaramillo, M., Sendaza, B. (2022): Energy saving behaviours of middle class households in Ghana, Peru and the Philippines. *Energy for Sustainable Development* (68), 170-181

Never, B. and J.R. Albert. 2021. Unmasking the middle class in the Philippines: aspirations, lifestyles, and prospects for sustainable consumption. *Asian Studies Review*.

Never, B., Albert, J., Fuhrmann, H., Gsell, S., Jaramillo, M., Kuhn, S. and B. Senadza. 2020: Carbon consumption patterns of the emerging middle classes. Discussion Paper 13. Bonn: German Development Institute/Deutsches Institut für Entwicklungspolitik.

Never, B. and R. Kemp. 2017. Developing green technologies and phasing them in. In Altenburg, Tilman and Claudia Assmann, eds. *Green industrial policy: concept, policies, country experiences*. Geneva and Bonn: UN Environment and German Development Institute (Deutsches Institut für Entwicklungspolitik), pp. 87–101.

Newell, P., Daley, F. and M.Twena. 2021. *Changing our ways? Behaviour change and the climate crisis*. Report of the Cambridge Sustainability Comission on Scaling Behaviour Change.

Otto, I., Donges, J., Cremades, R. and H.J. Schellnhuber. 2020: Social tipping dynamics for stabilizing Earth's climate by 2050. *Proceedings of the National Academy of Sciences* 117 (5): pp. 2354–2365.

Pegels, A. 2022. Behavioural insights interventions in practice. Manuscript. Bonn: German Institute of Development and Sustainability (IDOS).

Ramakrishnan, A., Kalkuhl, M., Ahmad, S. and F.Creutzig. 2020. Keeping up with the Patels: Conspicuous consumption drives the adoption of cars and appliances in India. *Energy Research & Social Science*, 70, Article 101742.

Ross, S. and L. Cheah. 2016. Uncertainty Quantification in Lifecycle Assessments: Interindividual Variability and Sensitivity Analysis in LCA of Air-Conditioning Systems. *Journal of Industrial Ecology* 21 (5), pp. 1103–1114.

Seto, K., Davis, J., Mitchell, R., Stokes, E.Unruh, G. and D. Ürge-Vorsatz. 2016. Carbon lock-in: types, causes, and policy implications. *Annual Review of Environment and Resources* 2016. 41: pp .19.1–19.28

Sahakian, M. 2014. *Keeping cool in Southeast Asia: Energy consumption and urban airconditioning*. Palgrave Macmillan.

Schleich, J., Durand, A. and J. Bruggers. 2021. How effective are EU minimum energy performance standards and energy labels for cold appliances? *Energy Policy* 149, 112069.

Seimetz, H., Kumar, S. and H. Moser. 2016. Effects of an awareness raising campaign on intention and behavioral determinants for handwashing. *Health Education Research* 31 (2), pp. 109–120.

Shah, V.P., D.C. DeBella, and R.J. Ries. 2008: Life cycle assessment of residential heating and cooling systems in four regions in the United States. *Energy Build*. 40, pp. 503–513.

Statista. 2020. *Demand for air conditioners in the Philippines from 2012 to 2021.* https://www.statista.com/statistics/909967/philippines-ac-demand-units/.

Tschirley, D. et al. 2015. The rise of a middle class in East and Southern Africa: Implications for food system transformation. *Journal of International Development* 27 (5), pp. 628–646.

UNEP. 2021. *Global Methane Assessment Report*. Nairobi: United Nations Environment Programme.

Van den Broek, K. 2019. Household energy literacy: A critical review and a conceptual typology. *Energy Research & Social Science* 57, 01256.

Verma, M. 2015. Growing Car Ownership and Dependence in India and its Policy Implications. *Case Studies on Transport Policy* 3 (3), 304–310.

Verma, M., Manoj, M. and A. Verma. 2016. Analysis of the influences of attitudinal factors on car ownership decisions among urban young adults in a developing country like India. *Transportation Research Part F: Traffic Psychology and Behaviour* 42(1), pp. 90–103.

Wallis, H. and C. Klöckner. 2020. The Transmission of Energy Saving Behaviour in Families. *Environment and Behavior* 52 (3), pp. 275–304.

Wei, L., Li, C., Wang, J., Wang, X., Wang, Z., Cui, C., Peng, S., Liu, Y., Yu, S. Wang. L. and Z. Shi. 2020. Rising middle and rich classes drove (the People's Republic of) China's carbon emissions. *Resources, Conservation, Recycling* 159, 104839

Whitmarsh, L., Poortinga, W. and S. Capstick. 2021. Behaviour change to address climate change. *Current Opinion in Psychology* 42, pp. 76–81.

Wiedenhofer, D., Guan, D., Liu, Z., Meng, J., Zhang, N. and Y.-M. Wei. 2016 Unequal carbon footprints in (the People's Republic of) China. *Nature Climate Change* 7, pp. 75–80.

World Data Lab. 2021. *Beyond India and China: Middle class consumer growth.* https://worlddata.io/.

Zhao, L., Zeng, W. and Z. Yuan. 2015. Reduction of potential greenhouse gas emissions of room air-conditioner refrigerants: a life cycle carbon footprint analysis. *Journal of Cleaner Production* 100, pp. 262–268.