Review

Are We Missing the Opportunity of Low-Carbon Lifestyles? International Climate Policy Commitments and Demand-Side Gaps

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Abstract: Current commitments in nationally determined contributions (NDCs) are insufficient to remain within the 2-degree climate change limit agreed to in the Paris Agreement. The Intergovernmental Panel on Climate Change (IPCC) states that lifestyle changes are now necessary to stay within the limit. We reviewed a range of NDCs and national climate change strategies to identify inclusion of low-carbon lifestyles. We found that most NDCs and national climate change strategies do not yet include the full range of necessary mitigation measures targeting lifestyle change, particularly those that could reduce indirect emissions. Some exceptional NDCs, such as those of Austria, Slovakia, Portugal and the Netherlands, do include lifestyle changes, such as low-carbon diets, reduced material consumption, and low-carbon mobility. Most countries focus on supply-side measures with long lag times and might miss the window of opportunity to shape low-carbon lifestyle patterns, particularly those at early stages of development trajectories. Systemic barriers exist that should be corrected before new NDCs are released, including changing the accounting and reporting methodology, accounting for extraterritorial emissions, providing guidance on NDC scope to include the menu of options identified by the IPCC, and increasing support for national level studies to design demand-side policies.

Keywords: climate change policies; UNFCCC; demand-side management; behavioral change; consumption-based emissions; low-carbon lifestyles; indirect emissions; carbon footprint

1. Introduction

Human-induced climate change threatens ecosystems and populations around the world today and increasingly in the future [1]. The majority of countries around the world recognize that only collective action will mitigate climate change. This led to 197 countries coming together in 1992 to adopt a multilateral environmental treaty called the United Nations Framework Convention on Climate Change. Their objective was “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner” [2]. The timing of this agreement is relevant given that there was less scientific evidence at the time regarding climate change, and yet member States were driven “to act in the interests of human safety even in the face of scientific uncertainty”. It took more than 20 years to agree on the common goal of keeping climate change-related temperature increases to less than 2 degrees, and to pursue efforts to limit global heating to 1.5 degrees, through the 2015 Paris Agreement [3].

The first round of nationally determined contributions was largely complete (186 submissions from 197 members) by 2020. Studies have modeled the implementation measures...
and goals set out in the nationally determined contributions and the consensus is that they are not sufficient to reach the 2-degree binding, or 1.5-degree aspirational, goal [4]. UNEP’s 2020 Emission Gap Report estimates that the global emissions resulting from nationally stated mitigation ambitions currently submitted under the Paris Agreement would lead to global greenhouse gas emissions in 2030 of 53–56 GtCO\(_2\)-eq per year, aligned with 3 degrees of global heating. Modeled trajectories of global anthropogenic emissions limiting global heating to 1.5 degrees are in the 25 GtCO\(_2\)-eq per year range [4].

The implications of this mismatch between goals and trajectories are significant. It means more widespread disruption to climate as well as changing ecosystem services that are fundamental to supporting a functional economy and global population of 10 billion [1].

In most cases, analysis indicates that each country’s NDC indicates that it would use most of its allowed emissions space for the entire 21st century by 2030 [5], showing that there is a need to look beyond the conventional strategies for climate change mitigation, or that planned measures are not being included in the NDCs. There is consensus that technological solutions alone will not ensure that the 1.5-degree threshold is not crossed [6–9]. Furthermore, the time scales needed to implement these are long term due to the time needed to transition to low-carbon energy and infrastructure, thus they will not generate the immediate reductions needed, and even when they are in place, studies have shown that carbon reductions from technological improvements are far outweighed by economic growth [10].

The Paris Agreement states that “sustainable lifestyles and sustainable patterns of consumption and production, with developed country parties taking the lead, play an important role in addressing climate change”. Recent studies estimate that two-thirds of GHG emissions are linked to household consumption—around 6 tCO\(_2\)-eq per capita globally, and double that in North America [11]. Since household consumption is driving the majority of emissions, sustainable lifestyles and consumption patterns are a large opportunity for reductions.

This paper will explore whether sustainable lifestyles and sustainable consumption are reflected in nationally determined contributions to climate change mitigation and make the case for shifting the focus in the next round of NDCs from supply-side and territorial emissions to demand-side strategies encompassing low-carbon lifestyles.

We will first make and support our argument that demand-side strategies involving drastic lifestyle changes are required to meet the 1.5-degree goal. We will then review whether, where, and to what extent NDCs embrace measures that consider and support lifestyle changes and explore what barriers might exist that prevent governments from implementing such measures. Finally, we will conclude with recommendations and a future outlook for policy.

2. Methodology

This paper addresses the research question in three steps: (1) reviewing different conceptual frameworks regarding impacts to understand and analyze the role of low-carbon lifestyles (Section 2.1), (2) reviewing the UNFCCC through the lens of a typical policy cycle in order to identify various instruments where low-carbon lifestyles could be included (Section 2.2), and (3) application of these two frameworks to conduct a review of whether and how various policy documents under the UNFCCC address low-carbon lifestyles (Section 2.3).

2.1. Framing Low-Carbon Lifestyles

In order to explore whether sustainable lifestyles and sustainable consumption are included in NDCs and other climate policy documents relevant to the Paris Agreement, we will first summarize different frameworks that have been used to make the case that lifestyles are a vital element of mitigation strategies.

Mitigation pathways can be analyzed in different ways when looking for the role of individual or collective lifestyles in achieving these targets. Various frameworks help
to understand the dynamics that contribute to emissions, and hence the leverage points along supply chains where responses to climate change mitigation would be most effective and efficient.

In this section, we will review frameworks before selecting a categorization methodology to assess to what extent sustainable lifestyles and sustainable consumption are included in NDCs and climate change policies.

2.1.1. IPAT

The IPAT equation [12] takes a top-down view to understanding which driving forces have the largest impact on greenhouse gas emissions. Population, wealth, and technology are the three compounding factors:

\[
\text{Impact (kgCO}_2\text{-eq)} = \text{Population (cap)} \times \text{Affluence ($/cap)} \times \text{Technology (kgCO}_2\text{-eq/$)}
\]

Population, economic growth, and technology each contribute to greenhouse gas emissions, and conversely, strategies to reduce emissions can—at the macro level—focus on one of the variables.

Technology change, such as renewable energy replacing fossil-fuel based energy, is most often the central and dominating approach of climate change mitigation plans. Many countries, particularly but not exclusively developing countries, set reduced carbon intensity (kgCO2-equivalent/$) as their climate mitigation goal, rather than absolute reduction. Studies using this framework have shown that technology change aimed at decarbonizing our economy has resulted in large and steady reductions in absolute growth of carbon emissions [6,13]. It should also be noted here that studies have pointed out that ‘technology’ measured by production-based carbon intensity can reduce emissions in a country due to outsourcing of carbon-intensive sectors, and hence is different to consumption-based carbon intensity which includes full supply chains [7].

The same studies have shown that economic growth, or affluence measured in $/cap, overtakes reductions from technology and results in absolute increases in greenhouse gas emissions [6,9,14,15]. For example, Hubacek et al. show that in China, affluence drove increases in emissions by 136%, 85%, and 154% in 1979–1988, 1989–1998, and 1999–2008 respectively. In those same periods, technologies reduced carbon emissions by 44%, 29%, and 30%. Population only increases emissions by between 6–14% in each of those periods [6]. Other studies map out global trends. Lan et al. show that while energy efficiency has reduced energy use by 550 EJ between 1990 and 2010, but this was offset by changes in the production recipe, which added 40 EJ, and eclipsed by increases in energy demand driven by affluence (528 EJ) and final demand composition (56 EJ) [13]. Far reaching changes to the ‘affluence’ part of the equation are now considered essential to complement technological change if we are to transition to sustainability, as overconsumption by affluent consumers is the overwhelming driver of global environmental impacts [8]. Climate mitigation goals and strategies aiming at the affluence dynamics are less common, particularly in NDCs. This is despite the rise in calls for degrowth or a steady state economy [8,16].

Population does not change as dramatically as technology or affluence, and thus has moderate impacts on climate change, although there are geographic variations. It is generally not featured in climate change policy, likely due to the human rights challenges associated with population control and the economic challenges of an aging population.

In reviewing policy, ‘affluence’ options are most relevant to sustainable lifestyles, and would steer choices that reduce the overall volume of consumption or shift expenditures to lower impact sectors. Examples of reducing volume include downsizing housing or reducing food waste (as long as this reduces the amount of food purchased, not overeating to avoid food waste). Examples of shifting to lower impact sectors include moving from 100% personal vehicle use, to mixed mobility including car rental, public transport, and non-motorized transport. Technology options would include shifts to more efficient goods and services within the same sector, such as switching to produce from low impact agriculture, or an electric vehicle, or an energy efficient fridge.
Nationally determined contributions mostly focus on the “T” in the IPAT equation, making goods and services low-carbon rather than invoking discernable change for people, and may as a result be missing opportunities to move closer to the absolute reductions set out in the Paris Agreement.

2.1.2. Direct vs. Indirect Emissions (Carbon Footprints; Territorial vs. Imported; Scope 1, 2, 3)

Direct emissions refer to the physical emission of greenhouse gases, such as burning fossil fuels and releasing CO\(_2\). Indirect emissions are greenhouse gas emissions that are a consequence of an activity but occur at an upstream or downstream stage of a supply chain; for example, red meat consumption in households drives methane emissions from cows. A wide range of terminology exists to describe sub-classifications of direct and indirect emissions [17], such as production- vs. consumption-based accounting, carbon footprints, Scope 1, 2, or 3 emissions, and territorial vs. extraterritorial emissions. Direct emissions are associated with territorial, Scope 1, production-based accounting, whereas indirect emissions are associated with Scope 2 and 3, extraterritorial, consumption-based accounting, and carbon footprints.

The GHG Protocol [18] classifies direct emissions as Scope 1. Indirect emissions can be classified into Scope 2 and Scope 3 emissions. Scope 2 emissions include emissions from purchased electricity, steam, heating or cooling, and occur very close in the supply chain from a specified activity. Scope 3 emissions are all other indirect emissions, both upstream and downstream in the supply chain that are not included in Scope 2. In the case of consuming milk, for example, there would be no Scope 1 emissions, Scope 2 emissions would include the share of electricity needed to power the fridge, and Scope 3 emissions would include the share of methane emissions from the cow, greenhouse gas emissions from any heating or cooling purchased during processing, vehicle emissions from transport, all indirect emissions from packaging, and finally emissions such as methane during waste management of the portion of discarded milk and packaging.

Carbon footprints are the sum of direct and indirect emissions, though some accounting frameworks omit downstream emissions.

Another classification distinguishes between territorial and extraterritorial emissions. Territorial emissions are direct emissions within a given territory, whereas extraterritorial emissions are the indirect emissions of domestic activities that occur beyond national borders. When it comes to emissions reporting under the UNFCCC and its climate agreements, only territorial emissions that occur within a country’s borders are counted. These include Scope 1, Scope 2, and Scope 3 emissions of consumption only as far as the supply chain is domestic.

Supply driven mitigation strategies align more closely with territorial emissions, whereas demand-side mitigation pathways are more closely associated with non-territorial emissions given the globalized nature of supply chains. In European countries, 25–30% of emissions related to lifestyles occur abroad, due to their highly globalized supply chains [19]. Therefore, including sustainable lifestyles in international or policy commitments is disincentivized as the emission reductions credited to the country are only 70–75% of what they may have achieved in reality. This is a potential area of opportunity in the near term, since reduction strategies for territorial emissions are rapidly reaching their limitations in developed countries with highly globalized supply chains [20,21], and it might be more cost effective to reduce extraterritorial emissions than further territorial emissions. Another indication of the growing importance of indirect emissions is the disproportionate growth of company level Scope 2 and 3 emissions compared to Scope 1. A recent study found that between 1995 and 2015, Scope 1 emissions had grown by 47%, whereas Scope 2 and Scope 3 emissions grew by 78% and 84%, respectively.

Addressing only direct or indirect emissions in climate policy leaves out significant opportunities to implement and achieve climate goals [22]. Once direct domestic emission reductions are achieved, neglecting to include the outsourced, indirect impacts will potentially undermine global mitigation efforts on climate change [8].
2.1.3. Final Demand Categories

At the meso, or sectoral, level, studies have analyzed the contribution of different sectors that contribute to climate change from two perspectives—supply and demand.

The supply side looks at the sectors where emissions directly occur, for instance in the conversion of fossil fuels to CO$_2$. Energy and transport dominate the sectors contributing to direct emissions, with waste, forestry, and agriculture coming in on the next tier [23]. Nationally determined contributions tend to align well with these identified priorities with most outlining actions addressing energy, transport, and forestry.

A demand perspective, through indirect emission accounting, looks at the consumption categories that drive the volume of output of these sectors and hence the quantity of associated emissions. This is an important approach, because structural decomposition analyzes based on the IPAT equation have shown that changing the carbon intensity of supply while keeping demand constant or increasing will not result in the absolute reductions needed to achieve the Paris Agreement. Methodologies such as input-output analyses and life-cycle assessment enable quantification of the contributions of different demand sectors to overall greenhouse gas emissions. They also enable quantification of demand-side climate mitigation measures [24]. The findings are consistent and “unambiguous”, with food, mobility, and housing accounting for 70–80% of life-cycle carbon emissions [23].

On the demand side, buildings feature prominently as drivers of indirect emissions from electricity use and are also frequently included in nationally determined contributions.

2.1.4. Sustainable Consumption and Production, SCP 1.0, 2.0, 3.0

Sustainable consumption and production (SCP) was first adopted as an international policy goal under Agenda 21 in 1992 [25]. Ten years later, the UN adopted the 10 Year Framework Programme of Sustainable Consumption and Production, which included a task force on sustainable lifestyles and education that aimed to advance sustainable lifestyles policy and mainstreaming. In 2015, the UN adopted the Sustainable Development Goals, which included a goal on responsible consumption and production that specifically mentioned “lifestyles in harmony with nature”. Worth also mentioning here is the inclusion of material footprints as an indicator for sustainable resource management (target 12.2) and resource efficiency (target 8.4), showing that international policy frameworks have included extraterritorial environmental pressures in other domains.

Over this period, the conceptual framework of sustainable consumption and production broadened from an approach anchored on industry support for cleaner production and education support for sustainable lifestyles, to creating the right enabling frameworks for sustainable consumption, including policy. Hotta et al. [26] developed a classification of the evolution of the SCP policy discourse that is useful for analyzing approaches to sustainable consumption in climate policies.

SCP 1.0 refers to more nascent stages of SCP policy development, which focus largely on cleaner production and pollution prevention. The policy discourse centered on the supply side, direct emissions, with little reference to sustainable consumption or sustainable lifestyles. Although at the international level this perspective was mainstream in the 1970s and 1980s, and later evolved to include life-cycle and demand-side, it is still a dominant approach in countries at early stages of their SCP journey.

SCP 2.0 broadened the perspective of SCP to include the product life cycle in the 1990s. A few factors led to this expansion, such as increasing globalization and fracturing of supply chains, increases in the visibility of environmental impacts, and the development of life-cycle assessment and other supply chain accounting methodologies. Another factor was the maturing of ecological economic theory, which found compatibility between economic competitiveness and environmental sustainability to be possible through resource efficiency, the ‘technology’ component of the IPAT equation. The introduction of life-cycle assessment made the connection between emissions from the production stage to the consumption phase and started to make the case for sustainable consumption decisions.
SCP 3.0 policy approaches are society-wide, multidisciplinary, and could have significantly higher benefits than SCP 1.0 and 2.0 paradigms. They encompass concepts such as planetary boundaries and sufficiency, which are closely linked to degrowth and dematerialization. Sustainable lifestyles also emerge as a core concept, but are closely linked with creating conducive social context and infrastructure. Sustainable lifestyles policy under this framework is less about appealing to consumers directly through awareness raising campaigns, and more about using policy to change social design. Mao et al. [27] suggest applying this broader, societal context approach to foresight analyses that can support the formulation of sustainable lifestyles policy frameworks.

2.1.5. Sustainable Lifestyles, Sustainable Consumption, Individual Action

This section reviews the literature that frames sustainable consumption or sustainable lifestyles in more granular or nuanced ways. Creutzig et al. [28] distinguish between demand and supply sides, with the demand side including a broad spectrum of “technology choices, consumption, behavior, lifestyles, coupled production-consumption infrastructures and systems, service provision, and associated socio-technical transitions”. Moran et al. [29] consider a slightly narrower subset of “consumer options” only including low-carbon choices that are possible for consumers today without requiring government or supply-side actions. The broad categories include: reduce consumption; reduce disposal; change consumption pattern/purchase alternative product; change use behavior; change disposal behavior; purchase more efficient products.

Addressing individual (or household) action directly is shown to be worthwhile. Estimates from Dubois, Sovacool et al. [30] show that households drive 72% of global greenhouse gas emissions. Other studies [31] found that seventeen actions could collectively reduce household (territorial) emissions in the US by 20%, equating to almost 2% of global emissions and more than France’s total emissions. Moran, Wood et al. found that a portfolio of household actions achievable today without infrastructure investments can reduce carbon footprints by 25% in Europe [29]. Of the 6 tons CO$_2$-eq per capita per year that is attributed to households, 1.7 tons CO$_2$-eq per capita could be reduced from sustainable transport choices such as car-free living, 0.9 tons CO$_2$-eq per capita from food choices including a plant-based diet, and 1.6 tons CO$_2$-eq per capita could be reduced in housing including shifting to renewable electricity and renovating [11]. Sector-specific studies also support the shift to demand-side policies, such as food policy which has long addressed consumption patterns in order to achieve health policy goals [32] and in household electrification [33,34].

These findings make individuals key actors in reaching the 1.5-degree goal of the Paris Agreement. However, there is limited understanding and treatment of behavioral change and the relevant policies in mitigation pathways currently submitted by countries to contribute to achieving 1.5-degree ambition of the Paris Agreement. This is surprising as the Paris Agreement itself states that “sustainable lifestyles and sustainable patterns of consumption and production, with developed country parties taking the lead, play an important role in addressing climate change”, and the IPCC’s 2018 special report dedicated a chapter to behavior change strategies [1].

Numerous studies have found that citizens would accept and moreover expect governments to put in place policies that control consumption choices [35]. However, most demand-side-oriented policies use financial instruments that still largely depend on market forces to steer behavior change, crucially leave low-cost carbon-intensive options on the market, and furthermore generally target low-impact behaviors [30]. They generally neglect the most carbon-intensive consumption patterns (meat and air travel).

2.1.6. Environmental Kuznets Curve

A fundamental principle of the Paris Agreement is ‘common but differentiated responsibility’ (CBDR) with developed countries taking the lead. This principle refers to the cumulative, or historic, carbon emissions, most often higher for developed countries, which
have a higher share of the total greenhouse gas emission concentrations in the atmosphere. Based on this rationale, developing countries, or countries with low cumulative historic greenhouse gas emissions, have lower responsibility and/or economic capacity to mitigate climate change now, even if their annual emissions are high.

The environmental Kuznets curve is a hypothesis that there is an inverted U-shape relationship between economic development and environmental pollution. Countries start with small economies and small pollution levels, and both factors grow until pollution peaks, at which point economic growth continues while pollution reduces. Under this proposition, and in line with CBDR, developing countries may not include ambitious greenhouse gas mitigation goals in their NDCs. This matter is an important factor when analyzing how developing country NDCs tackle sustainable lifestyles and consumption.

Grottera, La Rovere et al. argue that developing countries have greater potential to apply demand-side mitigation strategies [36]. This is partly because developing and middle-income countries like India and China have fast-growing GDP rates, and affluence has been proven to be the driving force behind emissions. This is particularly so because, despite having emerging economy or developing country status, and low per capita GDP rates, they still are home to a large and growing absolute number of affluent consumers. For instance, there are more billionaires in China and India combined than in Europe or the US [37]. Given that affluent consumers drive environmental impacts, it is important to consider affluence in developing country NDCs where there are a large number of affluent consumers.

As countries that will grow the most, and still make decisions and policies that affect consumption patterns that are not yet locked in, much of the mitigation potential lies with developing countries. In normal trajectories, countries may argue to follow an environmental Kuznets curve, developing first then integrating environmentally friendly practices later. However, this has been shown to be ineffectual for global environmental issues such as carbon footprints (more effective for highly local impacts like smog) [38]. As low-income consumers rapidly shift into middle- and upper-class consumption patterns, and countries that are classified as ‘low-income’ and yet still are home to large numbers of high-income consumers, they will need to address the environment impacts of consumption. Particularly countries such as China and India have the opportunity for “lifestyle leapfrogging” where they skip the carbon-intensive lifestyles of the industrialized countries, but improve their quality of life [39].

This means that developing countries need to integrate climate change into their development agenda. A transition to lower carbon-intensive lifestyles is not easy due to systemic barriers: lack of existing capital, lack of awareness, upfront costs, inertia, and other priorities. Hence a proactive policy is needed at early stages of development trajectories. The dominant development approach of grow first clean up later, along a Kuznets curve, does not occur from a consumption-based perspective [38,40].

2.2. Framing the UNFCCC Policy Process

The policy instrument this paper focuses on, the NDC, generally does not refer to demand-side mitigation to a large extent. In order to identify where barriers to inclusion of demand-side measures might occur, we will present and refer to the policy cycle and how it applies to the Paris Agreement. The Paris Agreement is a policy framework managed by the UNFCCC, which follows a typical policy cycle to shape and implement. UNEP describes a typical environmental policy as follows [41]:

1. Problem framing. This is when information is gathered, analyzed and the nature of the problem is agreed on. In the context of global cooperation on climate change, this is done through the science policy interface called the Intergovernmental Panel on Climate Change, which was established in 1988 “to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation [1]. IPCC assessment reports help to shape the
PA, and subsequent assessment reports are intended to provide independent scientific evidence to support national action and global cooperation.

2. Policy framing. Once enough knowledge is gathered through the problem framing stage, policy goals are defined, along with guiding principles. The climate change policy goal finally agreed on was staying under 2 degrees warming, or 1.5 degrees ideally, and is described in the Paris Agreement [3]. The UNFCCC also includes guiding principles, the most prominent being “principle of equity and common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.”

3. Policy implementation. Once the policy goals are established, policymakers must outline how they will be achieved, through a selection of policy instruments and allocation of budgets and other resources, and how they will be monitored. Under the Paris Agreement, member States are required to submit successively more ambitious nationally determined contributions every five years, outlining how the member States will contribute to the policy goal and enable monitoring [42]. In many cases, these are kept high level in nature, and are complemented by national climate policy documents that provide detail about the strategies that will be employed to meet the targets outlined in the NDCs.

4. Policy monitoring and evaluation. In this step, regular monitoring and reporting support evaluation of the selection of policy implementation mechanisms compared to the stated policy goal. Nationally determined contributions enable monitoring of progress, as well as modeling and forecasting whether we are on track for the 2-degree target and reviewing who is contributing to what extent. In addition, biennial updates provide details about mitigation plans and progress, and hence include significant amounts of data not covered in the NDCs. The measurement framework of carbon accounting is the IPCC’s 2006 reporting guidelines [43], which quantify greenhouse gas emissions by country.

2.3. Reviewing Climate Policy Documents to Identify How Sustainable Lifestyles Are Integrated

Reviews of climate policies mostly assess their headline targets on absolute or intensity reductions. There has not yet been a review of whether the call to include sustainable lifestyles has been reflected in climate change policy under the Paris Agreement.

In order to determine whether climate policies are including sustainable lifestyles, we first differentiated between different types of climate policies relevant to international climate change policy development and monitoring. Table 1 summarises which types of policies have been included in the study.

Climate policies exist at the international, national, sectoral, and local level. It was beyond the scope of this paper to determine which levels are the most effective on climate change mitigation. Local and sectoral policies may have a closer alignment between mitigation options and the respective mandates and budgets. However, only headline NDCs are counted in the UNFCCC and third-party international monitoring of climate change policy therefore this was selected as a first step. In some cases, particular for non-Annex 1 countries, the NDCs did not offer significant details, but the biennial update report submissions from non-Annex I parties [44] compiled significant detail on mitigation strategies (India, Indonesia). This might be because they are reports, rather than binding commitments. Particularly for Annex 1 countries, NDCs do not always include details of strategies or policy measures that will be applied in order to reach the targets. Therefore, the second tier of policies to review includes the national climate change policies. This was particularly useful in the case of EU NDCs, which all follow a common template despite each country having vastly different contexts and mitigation plans. In some cases (Malaysia, China), national socioeconomic policies were useful to include since they included commitments on sustainable lifestyles that were missing in the climate change strategies and were considered binding enough to include.
Table 1. Climate change policy instruments under consideration.

| Type of Policy Document                        | What Is It?                                                                 | Rational for Inclusion or Exclusion                                      |
|-----------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------|
| Nationally Determined Contribution (NDC)      | Documentation of climate policy goal, together with the actions that will be taken to achieve the goal. To date, 197 NDCs have been submitted. | Included, as it is the formal, universal policy instrument in international climate policy and assessments. |
| Biennial Update Report (BUR)                  | An update of climate mitigation, support needed and greenhouse gas accounts by non-Annex-1 parties. To date, 24 BURs have been submitted.       | Included, as it is a formal climate policy instrument, and contains relevant details that are lacking in NDCs. |
| National socioeconomic development strategy   | Macro-level economic and/or development strategies that serve as a chapeau for national policy. Examples include China’s 5 Year Plans [45], or the Eleventh Malaysia Plan [46]. | Partially included where known to include policy relevant to sustainable lifestyles. |
| Sectoral policy                               | Detailed policies for sectors, which in the case of energy, transport and buildings, often include specific mention of key measures to achieve greenhouse gas emission reductions. | Not included in this study, as too large in number to be feasible to systematically review. |
| Subnational policy                            | Detailed planning strategies for states, provinces or cities, which also often have highly specific mentions of climate change mitigation measures and are much closer to the point of greenhouse gas emissions. | Not included, as too large in number to be feasible to systematically review. |

The second step was to determine the country selection of the study. Given that 187 countries had submitted NDCs, it was not possible to review each of them. Three criteria were used to determine the geographic scope. First was alignment of other reviews of NDCs to facilitate cross referencing. The Climate Action Tracker [47], for instance, reviews both the headline commitments of countries to GHG reductions as well as actions in five sectors—energy, industry, transport, buildings, and forestry. This omits two sectors key to demand-side management and affluence: food and consumer goods/waste. The UN Emissions Gap report reviews the NDCs of G20 countries, mainly analyzing the headline commitments, and reviewing the national policies most relevant [48]. This report reviews progress against key sectoral climate change goals in energy, industry, transport, buildings, and agriculture, but limited targets related to demand-side management. This aligned closely with the second criterion, which was to capture the bulk of global GDP, given that carbon-intensive lifestyles requiring policy attention are more likely to be in wealthier countries. Our third criterion was to include countries that had relevance to sustainable lifestyles, but were not included in the above two criteria. This included countries with carbon-intensive lifestyles, or countries known for a compelling approach to sustainable lifestyles.

The final scope included the following selection: first, G20 member states, in line with the UN Emissions Gap report (Argentina, Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, USA, EU28 (countries with recent climate change strategies available in English: Germany, Netherlands, Norway, Sweden, Denmark, Estonia, Portugal, France, Slovakia, Austria)). Secondly, additional countries that had high per capita carbon footprints (Monaco, Qatar), and thirdly those with a compelling approach in their climate change mitigation policy (Norway, Bhutan, Seychelles, Sri Lanka, Thailand, Vietnam, Kenya, Israel, Pakistan, Switzerland, Malaysia, New Zealand).
3. Results

This section will specifically review the lifestyles or affluence strategies captured in NDCs, in national policies mentioned in NDCs, or apex national climate change strategies. The aim is to assess whether NDCs and relevant national policies are capturing the full potential range of climate change mitigation options. We will first explain our approach in reviewing NDCs and policy documents, followed by a structured presentation of findings.

3.1. Structuring Findings

For the purpose of this paper, the choice of how to structure sustainable lifestyles elements of NDCs was made with the aim of (1) providing insights into how NDCs and relevant climate change policies refer to low-carbon lifestyles, and (2) supporting the identification of the type of lifestyle changes missing from NDCs that could contribute significantly to the additional climate change reductions needed to remain within the 1.5-degree target.

First a distinction was made between five categories—housing, mobility, food, goods/waste, and leisure—in line with Section 2.1.3. Within each category, mitigation measures that would satisfy the criteria of Creutzig et al. [28] in Section 2.1.6 were included, in the sense that they had to involve a decision by a consumer or an otherwise involuntary change in their life. This extended more broadly than the criteria of Moran et al. [29], because their classification focused on present-day possibilities, whereas NDCs and climate change mitigation strategies are planned to 2050, thereby including options not yet available or requiring initial investment in infrastructure by government. Two further categories were then added, one reflecting SCP 3.0 approaches (infrastructure, social norms, sufficiency, lifestyles) in line with Section 2.1.5, and a category for special references to extraterritorial emissions.

3.2. Results of the Policy Review

The table in the Note Information outlines which countries included sustainable lifestyles in their NDCs or national climate change policies, and attempts to distinguish between territorial emissions, which are within the scope of the Paris Agreement, and non-territorial emissions (or footprints), which are not directly included yet in reporting but referred to in the IPCC reports as necessary to mitigating climate change.

We make four general observations. First, all NDCs reviewed included housing and/or mobility, and therefore did touch on sustainable lifestyles. Most NDCs cover building energy efficiency, many cover public transport. Increasingly, they also cover indirect emissions, such as from food and consumer goods. The circular economy is also emerging as a cross-cutting strategy with many consumer-facing implications. Second, some NDCs or national climate change policies go further to mention reducing consumption, particularly reducing transport consumption through flexible work policies and urban planning, food waste prevention, and switching to share economy systems over personal ownership. Thirdly, several specifically include references to carbon footprinting (Switzerland, France, Japan, Republic of Korea), which was also included in the IPCC AR5 (though omitted from the summary for policymakers). Last, policies released most recently are more likely to include lifestyles, possibly due to the findings of the IPCC 2018 special report. There are exceptions, including China and Japan. In China’s case, 85% of its carbon footprint is domestic, therefore the motivation may be to reduce territorial emissions, and remain within carrying capacity of its own environmental systems. In Japan’s case, there is a larger footprint abroad, therefore the motivation may be based on common but differentiated responsibility.

More specific observations are listed in Table 2.
Table 2. Summary of findings: four different levels of inclusion of sustainable lifestyles in climate policy.

| Level of Inclusion of Sustainable Lifestyles | Findings |
|---------------------------------------------|----------|
| Inclusion of lifestyles/carbon footprints directly in the NDC | One NDC included direct reference to demand-side policy goals directly in the text of the NDC. China’s 2016 NDC [49] includes a section on “promoting the low-carbon way of life” which calls for a reduction of materials consumption: “moderate consumption, encourage the use of low-carbon products and curb extravagance and waste”. Other sections also include behavior or consumption change measures that fit in direct emissions, such as low-carbon buildings, spatial planning, public transport, and pedestrian and bicycle infrastructure. |
| Inclusion of lifestyles in national climate change policy | In many cases where NDCs do not directly include demand-side or lifestyle change, the respective national strategy does include demand-side strategies. This includes the EU countries, which did not specify in their joint NDC [50] how they would achieve their mitigation goals but were required to submit long term mitigation strategies (Slovak Republic [51], Portugal [52], Austria [53], Denmark [54], Estonia [55], France [56], The Netherlands [57], as well as Switzerland [58], Norway [59], Monaco [60], Malaysia [61]). Food: Austria [53], France [56], Slovak Republic [51], Norway [59], Switzerland [58], the Netherlands [57] included climate-friendly diets, specifically lowering consumption of meat and dairy. Portugal [52] and Denmark [54] referenced shifting diets towards local and organic produce. Several countries also mentioned food waste reductions. Goods/Waste: Austria [53], Denmark [54], Estonia [55], the EU [50], France [56], Japan [62], Malaysia [61], Monaco [60], Sweden [63], Portugal [52], Seychelles [64], Slovak Republic [51], Switzerland [58], included references to shifting consumption habits towards share, reuse, rental, repair, and extended product lifespans. Cross-cutting: Several countries made a specific reference to carbon footprints and emissions outside of national boundaries, and linked this to product labeling or calculators, including Sweden [63], Republic of Korea [65], Switzerland [58], France [56], Japan [62], EU [50], Denmark [54], Austria [53]. |
| Reference to sustainable lifestyles without referring to specific measures | In several cases, inclusion of sustainable lifestyles occurred in a headline or macro level manner, without significant, specific or quantified details. Germany [66] did reference food waste reductions, but did not quantify them or refer to dietary change. New Zealand [67], Singapore [68], Sri Lanka [69], Thailand [70], and Pakistan [71] each reference lifestyle changes, but either in a broad way, or in a way that would not significantly reduce emissions (e.g., reducing packaging waste). |
| No inclusion of lifestyles in NDC or national climate policy | Many NDCs and the climate change policies reviewed did not include reference to lifestyles or footprint/indirect emission reductions, including those of Brazil [72], Qatar [73], Australia [74], India [75], Indonesia [76], Israel [77], Kenya [78], South Africa [79], USA [80]. |

4. Discussion

The global community now has access to a broad range of studies confirming that lifestyle change across all consumption domains will be needed to keep climate change within 1.5 degrees of warming. In this paper we confirmed that the majority of NDCs do not significantly include lifestyle change, in particular the large emitters (USA, Australia, Singapore, India, Russia). There are signs that this is changing, and some more recent NDCs and climate change strategies do include demand-side measures including those related to indirect emissions (food, goods and services). Given the limited time left to change course, climate change stakeholders must address barriers to addressing the full range of mitigation measures recommended by the IPCC, including significant demand-side measures. Table 3 provides an overview of potential barriers that may explain the trends in Section 3.
Table 3. Potential barriers to inclusion of demand-side mitigation measures in climate policy.

| Nature of the Barrier                                                                 | Explanation                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Agreed scope of NDCs                                                                 | The Paris Agreement refers to NDCs in Article 4. This negotiated text refrains from laying out a mandatory scope for NDCs; therefore it is up to each country to develop its own scope and format. However, there are some keywords in the text that may serve as barriers to inclusion of lifestyles related emissions. For instance, Article 4/2 states that “parties shall pursue domestic mitigation measures”, which can be interpreted as territorial emissions, and hence may disincentivize action on indirect emissions that partly reduce emissions abroad rather than domestically. An exception to the focus on the territorial emissions rule is the case of offsets, whereby a country may take credit for emission reductions abroad, but not emission increases. |
| Leaving room for improvement                                                        | Article 4/3 states that “successive nationally determined contribution will represent a progression beyond the party’s then current nationally determined contribution”. Considering that the Paris Agreement calls for increasing levels of ambition every five years in successive NDCs, some countries may wish to reserve the full portfolio of mitigation measures for future NDCs. They may also withhold early ambition in order to negotiate deals in the future if they are developing countries not required to achieve absolute reductions. |
| GHG accounting does not include extraterritorial emissions                          | Extraterritorial emissions are not included in the IPCC accounting framework. Article 4/13 states that member States must “ensure the avoidance of double counting.” Therefore although carbon-intensive lifestyle choices, with inherent extraterritorial emission footprints, are not accounted for, since the supply side emissions are accounted for in another NDC [81]. A significant proportion of GHG footprints occur abroad (23–30%) [19] and therefore reductions will be accounted for in other country NDCs. If reductions in extraterritorial emissions associated with domestic consumption are not measured, and not reported in the Member State updates to the UNFCCC, there is no incentive to reduce them in mitigation strategies, despite the IPCC stating that demand-side strategies are critical to meeting Paris Agreement goals. |
| Lag time between NDCs and the IPCC special report, unclear science-policy link      | There is a lag time between the IPCC report clear messages on lifestyles, and the time it takes to formulate new NDCs is at least 2 years. Most NDCs pre-date the call from the IPCC’s special report in 2018 for inclusion of sustainable lifestyles in climate mitigation plans. Some evidence of this is that more recent climate change policies (notably from Europe and Japan) arising approximately two years after the IPCC special report have included sustainable lifestyles. A related issue is that although the Paris Agreement specifically called for the IPCC special report, it did not specify how the findings would be applied in climate change mitigation strategies. This is a missing link in the policy cycle, between problem framing and policy implementation, as outlined in Section 1. |
| Perspective of negotiators vs. the perspectives of practitioners                    | The Paris Agreement and NDCs are the responsibility of negotiators skilled in strategic foreign policy. This skill set may be more biased towards more conservative levels of ambition, particularly given the nascent nature of the Paris Agreement and the requirement for continual increases in ambition. However, the skill set needed in designing national mitigation strategies would need to be more practical, ambitious, and risk tolerant in order to achieve the magnitude of change required. Practitioners and experts are thus key stakeholders in the NDC drafting process. |
| Prescription vs. consensus                                                           | There are no templates or internationally agreed guidelines for NDC development that outline a menu of mitigation options, aligned with IPCC recommendations, to support those tasked with NDC design. Although officially recognized (and costly) scientific assessments such as the IPCC special report lay out policy relevant findings regarding mitigation options, these remain separate from the policy guidance on mitigation options, for instance through templates or manuals. One reason behind this is to avoid prescriptive policy messaging that may jeopardize the consensus that is critically needed as a minimum to maintain the Paris Agreement. NDCs are nationally, not internationally, determined, as the name indicates, so all member States are able to arrive at their mitigation strategies independently of any international recommendation. |
Table 3. Cont.

| Nature of the Barrier                                           | Explanation                                                                                                                                                                                                 |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Developing countries are not required to commit to absolute      | The Paris Agreement states that developed countries should take the lead with absolute reductions, whereas developing countries should “continue enhancing their mitigation efforts” (Article 4/4). Not all developed countries do commit to absolute reductions (e.g., Singapore has committed to a reduction in carbon intensity), and none of the developing countries did so. This is another disincentive to reach for mitigation measures that maximize reductions that are not required. Countries with low per capita or cumulative emissions may also wish to avoid politically and officially accepting responsibility for mitigation through consumption under the principle of common but differentiated responsibility. |
| reductions                                                        |                                                                                                                                                                                                              |
| Lack of awareness or appetite for demand-side climate change    | There are several factors that could be at play. First, the fear of public backlash to policies that affect lifestyles. Second is the perception that they do not have responsibility for extraterritorial emissions, particularly in the case of import-dependent countries (such as Singapore) or countries with low per capita emissions (such as developing countries with significant and rapidly growing affluent communities, like India, Thailand, and Indonesia). Third is the mismatch between the mandate of the national agency setting aspirational mitigation targets (often a ministry of environment or climate change), and the know-how of the sectoral agencies tasked to provide the mitigation strategies (ministries of industry, transport or agriculture) which are less accustomed to dealing with demand-side strategies that involve significant understanding of behavior change. There are exceptions, however, as many developing countries are addressing the impacts of consumption at early stages of their development trajectory (Sri Lanka, Bhutan, China), and developed countries that are integrating deep behavior change strategies in their national mitigation plans (Slovakia, Austria, Portugal, the Netherlands). |
| mitigation                                                       |                                                                                                                                                                                                              |
| Open question on whether the demand-side should be prioritized  | While demand is the key driver of environmental impacts, it is not the point of actual emissions. Consumers do not directly control or easily find information about impacts behind supply chains, even if they do have the ultimate power over the consumption decision [19]. Both actors, producers and consumers, have responsibility and opportunity to mitigate climate change, since one approach of the other will not be sufficient in isolation. Different macroeconomic theories can be used to support this [82]. |
| Reduced control over implementation effectiveness from reduced   | Indirect emission reductions are not easy to guarantee, since demand reduction or change may not eliminate the upstream emissions associated with the consumption activity. Reduced demand for a carbon-intensive product may have unexpected impacts such as a reduction of price that increases demand elsewhere. |
| consumption                                                      |                                                                                                                                                                                                              |
| Lack of methodological frameworks to support policy action on    | Many countries, particularly in Europe, have research institutions that can support the development of evidence-based, demand-side policies, as well as quantification of carbon footprints. In countries that do not yet have this expertise, the lack of scientific basis is a barrier to demand-side policy commitments. The outlook is positive here, as the body of literature on sustainable lifestyles and other demand-side solutions is “growing exponentially”, though slower than the growth in climate-related studies [83]. |
| behavior change                                                  |                                                                                                                                                                                                              |

5. Conclusions: Recommendations

The policy cycle framework outlined in Section 1 shows how environmental policies, including those on climate action, should be developed and monitored based on scientific evidence. Climate policies, such as NDCs, should apply the full range of scientifically identified climate change mitigation strategies in order to reduce emissions sufficiently and efficiently, and to more accurately monitor the combined commitments. However, there are a range of barriers when it comes to demand-side policies. In order to overcome them, researchers and policymakers need to collaborate far more to increase the uptake of methodological frameworks that can quickly and comprehensively support countries in selecting the right policy goals and instruments. Below are some recommendations on potential solutions to address the barriers identified in Section 4.

The accounting and reporting methodology plays a fundamental role, and is currently not conducive to demand-side or extraterritorial emission reductions. Despite this, indirect emissions, or footprints, are increasingly referred to in climate change mitigation strategies (Korea, France, Austria, Japan) and can be powerful strategies to bridge the gap to climate...
change goals. However, the pressure to deliver on domestic emission reductions, and concerns about double counting extraterritorial emissions remain unresolved. Therefore, member States should agree on a globally accepted accounting methodology that enables them to report on indirect extraterritorial emission reductions while addressing double counting concerns.

Second, a move away from national borders would help optimize climate mitigation measures and inclusion of demand-side measures. The globalized nature of our supply chains has stifled the optimization of climate change action. Instead of aiming for the largest mitigation opportunities, countries are focused on domestic mitigation, with the exception of the EU. The EU has shown that submitting one common regional NDC can encourage inclusion of supply chain emissions or footprints, since a large percentage of EU countries’ extraterritorial emissions are still within the EU [29] and hence contribute to the common emission reduction target. Climate policymakers should consider the transboundary impacts and mitigation opportunities related to domestic demand within their NDCs. There is some precedent for this. The international nature of emissions is already acknowledged in the Paris Agreement through offsets, where countries can be credited for reducing extraterritorial emissions through offset programs. Article 14 of the Paris Agreement opens doors for this under the terms of “collective progress” and “enhancing international cooperation for climate action”.

Third, there could be more official guidance on NDC scope, particularly on linking the NDCs to the IPCC findings. The inconsistencies between NDCs make it difficult to monitor progress against mitigation pathways and compare countries. More guidance could be provided on how to arrange demand-side climate mitigation actions according to existing or additional sectoral categorization. This could encourage countries to reflect existing measures already in national policy in the NDC, and also provide a nudge to include demand-side mitigation strategies. Climate mitigation is generally categorized according to energy, transport, industry, agriculture, Land Use, Land-Use Change and Forestry (LULUCF), and waste; demand-side measures could be added as a cross-cutting sector or as subsectors in the existing sectors.

Related to the above, a strengthening of the science–policy interface could be achieved through dedicated training for NDC developers on how to include demand-side and extraterritorial mitigation measures recommended by the IPCC. The decision to adopt the Paris Agreement (1/CP.2) included a paragraph (Article II/21) under the article covering NDCs that the IPCC “provide a special report in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways”). There is no mention of how this report’s findings should be used in the design of nationally determined contributions going forward. Training for NDC developers can help them address domestic political and strategic concerns, while also employing the full spectrum of climate change mitigation options identified through international scientific assessment.

Lastly, countries need nationally tailored support to establish the evidence base for, and design of, demand-side policies. There is an urgent need for more country level assessments of options for demand-side climate change mitigation to even out the asymmetry in availability of such assessments for countries. While all countries should reduce supply side and territorial emissions, there may be cost effective, fast options available to them that are either indirect or occurring abroad in upstream supply chains or both. National studies should provide a quantification of the demand-side mitigation options, and also seek solutions to harmonize demand-side options with national political and economic contexts. This is particularly urgent in developing countries undergoing rapid growth and hence holding significant future cumulative responsibility for GHG emissions under business-as-usual projections.

6. Future Outlook

From an academic point of view, findings from different multi-regional input–output assessments are converging [84], institutional and governance requirements are clear [85],
Implications of consumption-based accounting are understood [86], and case studies from policy practice exist [30]. In short, the scientific domain of carbon footprinting and sustainable lifestyles policy has reached a level of maturity and agreement to be ripe for application in climate policy.

Member States have already agreed to including a different footprint metric, the material footprint, in another international agreement—the Sustainable Development Goals indicator framework. It serves as an indicator for SDG 8.4 on resource efficient growth, and SDG 12.2 on sustainable resource management. The metadata include a methodology, based on the multi-regional input output framework [87], under the caretaker organization, the UN Environment Programme. Its inclusion in the SDGs is not binding, since all member States can select their own indicators, and the goals themselves and reporting processes are also voluntary. However, the endorsement of this methodology and survival in a multilateral agreement process dependent on consensus give some hope that carbon footprints can also be integrated into the methodological and reporting framework under the Paris Agreement. Linkages between climate policy and the Sustainable Development Goals may also create synergies that enable demand-side mitigation strategies [88].

Climate policy and research has made promising progress in the spirit of the Paris Agreement’s statement that “sustainable lifestyles and sustainable patterns of consumption and production, with developed country parties taking the lead, play an important role in addressing climate change”. Six years into the Paris Agreement implementation, it is urgent that all countries apply the best available knowledge on the full range of climate mitigation options to the NDCs. Sustainable lifestyles are considered essential to achieving targets, therefore the barriers to including them in NDCs and national climate policies need to be further investigated so that the solutions can be shaped and implemented well before the global carbon budget is depleted.

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References
1. IPCC. Global Warming of 1.5 °C: An IPCC Special Report on the Impacts of Global Warming of 1.5 °C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty; Intergovernmental Panel on Climate Change: Geneva, Switzerland, 2018.
2. UN. United Nations Framework Convention on Climate Change; United Nations: New York, NY, USA, 1992.
3. UN. Paris Agreement; United Nations: New York, NY, USA, 2015.
4. UNEP. Emissions Gap Report 2020; UN Environment Programme: Nairobi, Kenya, 2020.
5. Pan, X.; Elzen, M.D.; Höhne, N.; Teng, F.; Wang, L. Exploring fair and ambitious mitigation contributions under the Paris Agreement goals. Environ. Sci. Policy 2017, 74, 49–56. [CrossRef]
6. Hubacek, K.; Feng, K.; Chen, B. Changing Lifestyles towards a Low Carbon Economy: An IPAT Analysis for China. Energies 2012, 5, 22–31. [CrossRef]
7. Xiaojun, H.; Sun, K.-J.; Bi, H.-M.; Xue, J.-J. Changes in carbon intensity globally and in countries: Attribution and decomposition analysis. Appl. Energy 2019, 235, 1492–1504. [CrossRef] [PubMed]
8. Wiedmann, T.; Lenzen, M.; Keyßer, L.T.; Steinberger, J.K. Scientists’ warning on affluence. Nat. Commun. 2020, 11, 3107. [CrossRef] [PubMed]
9. Le, T.-H. Drivers of Greenhouse Gas Emissions in ASEAN + 6 Countries: A New Look. Environ. Dev. Sustain. 2021, 1–20. [CrossRef]
10. Malik, A.; Lan, J.; Lenzen, M. Trends in global greenhouse gas emissions from 1990 to 2010. *Environ. Sci. Technol.* 2016, 50, 4722–4730. [CrossRef] [PubMed]

11. Ivanova, D.; Barrett, J.; Wiedenhofer, D.; Macura, B.; Callaghan, M.; Creutzig, F. Quantifying the potential for climate change mitigation of consumption options. *Environ. Res. Lett.* 2020, 15, 093001. [CrossRef]

12. Ehrlich, P.R.; Holdren, J.P. Impact of Population Growth. *Science* 1971, 171, 1212–1217. [CrossRef]

13. Lan, J.; Malik, A.; Lenzen, M.; McBain, D.; Kanemoto, K. A structural decomposition analysis of global energy footprints. *Appl. Energy* 2016, 163, 436–451. [CrossRef]

14. Lenzen, M. Structural analyses of energy use and carbon emissions—An overview. *Econ. Syst. Res.* 2016, 28, 119–132. [CrossRef]

15. Wiedenhofer, D.; Smetschka, B.; Akenji, L.; Jalas, M.; Haberl, H. Household time use, carbon footprints, and urban form: A review of the potential contributions of everyday living to the 1.5 °C climate target. *Curr. Opin. Environ. Sustain.* 2018, 30, 7–17. [CrossRef]

16. Vandeveer, J.S.; Cattaneo, C.; Zografos, C. A Degrowth Transition: Pathways for the Degrowth Niche to Replace the Capitalist-Growth Regime. *Ecol. Econ.* 2019, 156, 272–286. [CrossRef]

17. Hertwich, E.G.; Wood, R. The growing importance of scope 3 greenhouse gas emissions from industry. *Environ. Res. Lett.* 2018, 13, 104013. [CrossRef]

18. Bhatia, P.; Cummins, C.; Brown, A.; Rich, D.; Draucker, L.; Lahd, H. *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*; Greenhouse Gas Protocol: Washington, DC, USA, 2011.

19. Wiedmann, T.; Lenzen, M. Environmental and social footprints of international trade. *Nat. Geosci.* 2018, 11, 314–321. [CrossRef]

20. Malik, A.; Lan, J. The role of outsourcing in driving global carbon emissions. *Econ. Syst. Res.* 2016, 28, 168–182. [CrossRef]

21. Hoekstra, R.; Michel, B.; Suh, S. The emission cost of international sourcing: Using structural decomposition analysis to calculate the contribution of international sourcing to CO2-emission growth. *Econ. Syst. Res.* 2016, 28, 151–167. [CrossRef]

22. Steininger, K.W.; Munoz, P.; Karsten, J.; Peters, G.P.; Strohmaier, R.; Velázquez, E. Austria’s consumption-based greenhouse gas emissions: Identifying sectoral sources and destinations. *Glob. Environ. Chang.* 2018, 45, 226–242. [CrossRef]

23. Tukker, A.; Cohen, M.; Hubacek, K.; Mont, O. The Impacts of Household Consumption and Options for Change. *J. Ind. Ecol.* 2010, 14, 13–30. [CrossRef]

24. Hertwich, E.G. The life cycle environmental impacts of consumption. *Econ. Syst. Res.* 2011, 23, 27–47. [CrossRef]

25. Nations, U. Agenda 21: The United Nations Programme of Action from Rio. In Proceedings of the United Nations Conference on Environment & Development, Rio de Janeiro, Brazil, 3–14 June 1992.

26. Hotta, Y.; Tasaki, T.; Koide, R. Expansion of Policy Domain of Sustainable Consumption and Production (SCP): Challenges and Opportunities for Policy Design. *Sustainability* 2021, 13, 6763. [CrossRef]

27. Mao, C.; Koide, R.; Akenji, L. Applying Foresight to Policy Design for a Long-Term Transition to Sustainable Lifestyles. *Sustainability* 2020, 12, 6200. [CrossRef]

28. Creutzig, F.; Roy, J.; Lamb, W.F.; Azevedo, I.M.L.; de Bruin, W.B.; Dakkum, H.; Edelenbosch, O.Y.; Geels, F.W.; Grubler, A.; Hepburn, C.; et al. Towards Demand-Side Solutions for Mitigating Climate Change. *Nat. Clim. Chang.* 2018, 8, 260–263. [CrossRef]

29. Moran, D.; Wood, R.; Hertwich, E.; Mattson, K.; Rodriguez, J.F.D.; Schanes, K.; Barrett, J. Quantifying the potential for consumer-oriented policy to reduce European and foreign carbon emissions. *Clim. Policy* 2020, 20, S28–S38. [CrossRef]

30. Dubois, G.; Sovacool, B.; Aall, C.; Nilsson, M.; Barbier, C.; Herrmann, A.; Bruyère, S.; Andersson, C.; Skold, B.; Nadaud, F.; et al. It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures. *Energy Res. Soc. Sci.* 2019, 52, 144–158. [CrossRef]

31. Dietz, T.; Gardner, G.T.; Gilligan, J.; Stern, P.C.; Vandenbergh, M.P. Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proc. Natl. Acad. Sci. USA* 2009, 106, 18452–18456. [CrossRef] [PubMed]

32. Temme, E.H.; Vellinga, R.E.; de Ruiter, H.; Kugelberg, S.; van de Kamp, M.; Milford, A.; Alessandri, R.; Bartolini, F.; Sanz-Cobena, A.; Leip, A. Demand-Side Food Policies for Public and Planetary Health. *Curr. Opin. Environ. Sustain.* 2018, S28–S38. [CrossRef]

33. Almohaimed, S.; Suryanarayanan, S.; O’Neill, P. Reducing Carbon Dioxide Emissions from Electricity Sector Using Demand Side Management. Available online: https://www.tandfonline.com/doi/abs/10.1080/15567036.2021.1922548 (accessed on 1 November 2021).

34. Sakamoto, S.; Nagai, Y.; Sugiyama, M.; Fujimori, S.; Kato, E.; Komiyama, R.; Matsu, Y.; Oshiro, K.; Herran, D.S. Demand-side decarbonization and electrification: EMF 35 JIMP study. *Sustain. Sci.* 2021, 16, 395–410. [CrossRef]

35. Sköld, B.; Baltrusowicz, M.; Aall, C.; Andersson, C.; Herrmann, A.; Amelung, D.; Barbier, C.; Nilsson, M.; Bruyère, S.; Sauerborn, R. Household Preferences to Reduce Their Greenhouse Gas Footprint: A Comparative Study from Four European Cities. *Sustainability* 2018, 10, 4044. [CrossRef]

36. Grottera, C.; La Rovere, E.L.; Wills, W.; Pereira, A.O., Jr. The role of lifestyle changes in low-emissions development strategies: An economy-wide assessment for Brazil. *Clim. Policy* 2020, 20, 217–233. [CrossRef]

37. Anker, S. The 15 Top Countries for Billionaires, Ranked by How Many Live There. Business Insider 2020. Available online: https://www.businessinsider.com/slideshows/miscellaneous/the-15-top-countries-for-billionaires-ranked-by-how-many-live-there/slidelist/74266779.cms (accessed on 1 November 2021).

38. Haberl, H.e.a. A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: Synthesizing the insights. *Environ. Res. Lett.* 2020, 15, 065003. [CrossRef]
39. Schroeder, P.; Anantharaman, M. “Lifestyle Leapfrogging” in Emerging Economies: Enabling Systemic Shifts to Sustainable Consumption. J. Consum. Policy 2016, 40, 3–23. [CrossRef]
40. Parrique, T.; Barth, J.; Briens, F.; Kerschner, C.; Kraus-Polk, A.; Kuokkanen, A.; Spangenberg, J.H. Decoupling Debunked: Evidence and Arguments against Green Growth as a Sole Strategy for Sustainability; European Environmental Bureau: Bruxelles, Belgium, 2019.
41. UNEP. Sustainable Consumption and Production—A Handbook for Policymakers; United Nations Environment Programme: Nairobi, Kenya, 2015.
42. UN. Report of the Conference of the Parties on Its Twenty-First Session, Held in Paris from 30 November to 13 December 2015; United Nations: New York, NY, USA, 2016.
43. IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories; IPCC: Geneva, Switzerland, 2006.
44. UNFCCC. Biennial Update Reports; UNFCCC: Bonn, Germany, 2020.
45. NDRC. The 13th Five-Year Plan for Economic and Social Development of the People’s Republic of China; National Development and Reform Commission, NDRC: Beijing, China, 2016.
46. Malaysia Economic Planning Unit. Eleventh Malaysia Plan 2016–2020: Anchoring Growth on People; Malaysia Economic Planning Unit: Putrajaya, Malaysia, 2015.
47. CAAN Institute. The Climate Action Tracker. Available online: https://climateactiontracker.org/about/ (accessed on 1 November 2021).
48. UNEP. Emissions Gap Report 2019; United Nations Environment Programme: Nairobi, Kenya, 2019.
49. NDRC. Enhanced Actions on Climate Change: China’s intended Nationally Determined Contributions; National Development and Reform Commission, NDRC: Beijing, China, 2015.
50. Latvian Presidency of the Council of the European Union. Intended Nationally Determined Contribution of the EU and Its Member States. Available online: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/European%20Union%20First/LV-03-06-EU%20INDC(Archived).pdf (accessed on 1 November 2021).
51. Ministry of Environment of the Slovak Republic. Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050; Ministry of Environment of the Slovak Republic: Bratislava, Slovakia, 2020.
52. República Portuguesa. Roadmap for Carbon Neutrality 2050 (rcn2050) Long-Term Strategy for Carbon Neutrality of the Portuguese Economy by 2050; Ambiente e Transico Energetica: Lisbon, Portugal, 2019.
53. Federal Ministry of Agriculture, Regions and Tourism. Langfriststrategie—Österreich; Federal Ministry of Agriculture, Regions and Tourism: Vienna, Austria, 2019.
54. Danish Ministry of Climate Energy and Utilities. Denmark’s Integrated National Energy and Climate Plan; Danish Ministry of Climate Energy and Utilities: Copenhagen, Denmark, 2019.
55. Government of the Republic of Estonia. Resolution of the Riigikogu General Principles of Climate Policy until 2050; Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB): Tallinn, Estonia, 2017.
56. Ministry of Ecological Transition. La Stratégie Nationale Bas-Carbone: La Transition Écologique et Solidaire Vers la Neutralité Carbone; Ministry of Ecological Transition: Paris, France, 2020.
57. Ministry of Economic Affairs and Climate Policy. Long Term Strategy on Climate Mitigation; Ministry of Economic Affairs and Climate Policy: The Hague, The Netherlands, 2019.
58. Federal Office for the Environment. Switzerland’s Climate Policy—Implementation of the Paris Agreement; Federal Office for the Environment (FOEN): Bern, Switzerland, 2018.
59. Norwegian Ministry of Climate and Environment. Norway’s Climate Strategy for 2030: A transformational approach within a European cooperation framework; Norwegian Ministry of Climate and Environment: Oslo, Norway, 2017.
60. UNFCCC. Principality of Monaco National Contribution; UNFCCC: Bonn, Germany, 2015.
61. Ministry of Environment and Water. Malaysia Third Biennial Update Report to the UNFCCC; Ministry of Environment and Water: Putrajaya, Malaysia, 2020.
62. The Government of Japan. The Long-Term Strategy under the Paris Agreement; The Government of Japan: Tokyo, Japan, 2019.
63. Regeringskansliet. En samlad politik för klimatet—klimatpolitisk handlingsplanverk; Regeringskansliet: Stockholm, Växel, 2019.
64. Minister for Agriculture, Climate Change and Environment. Seychelles’ Updated Nationally Determined Contribution; Minister for Agriculture, Climate Change and Environment: Mahé, Seychelles, 2021.
65. Ministry of Environment. The 2030 Greenhouse Gas Reduction Roadmap and the Allocation Plan for 2018–2020 Emissions; Ministry of Environment: Sejong-si, Korea, 2018.
66. Federal Ministry for the Environment, Building and Nuclear Safety (BMUB). Climate Action Plan 2050—Principles and Goals of the German Government’s Climate Policy; Nature Conservation, Building and Nuclear Safety (BMUB): Berlin, Germany, 2016.
67. UNFCCC. Submission under the Paris Agreement: Communication and Update of New Zealand’s Nationally Determined Contribution; UNFCCC: Bonn, Germany, 2020.
68. NCCS. Singapore’s Climate Action Plan: Take Action Today, For a Carbon-Efficient Singapore; National Climate Change Secretariat: Singapore, Singapore, 2016.
69. Ministry of Mahaweli Development and Environment. Nationally Determined Contributions; Ministry of Mahaweli Development and Environment: Colombo, Sri Lanka, 2016.
70. UNFCCC. Thailand’s third Biennial Update Report (BUR); UNFCCC: Bonn, Germany, 2020.
71. UNFCCC. Pakistan’s Intended Nationally Determined; Contribution (Pak-Indc); UNFCCC: Bonn, Germany, 2015.
72. UNFCCC. Brazil’s Third Biennial Update Report to the United Nations Framework Convention on Climate Change; UNFCCC: Bonn, Germany, 2019.
73. Ministry of Environment. Intended Nationally Determined Contributions (INDCs) Report; Ministry of Environment: Doha, Qatar, 2015.
74. Australian Government. Australia’s Intended Nationally Determined Contribution to a New Climate Change Agreement; Australian Government: Canberra ACT, Australia, 2015.
75. Ministry of Environment, Forest and Climate Change. India Third Biennial Update Report to the United Nations Framework Convention on Climate Change; Ministry of Environment, Forest and Climate Change, Government of India: New Delhi, India, 2021.
76. Minister of Environment and Forestry. Indonesia Second Biennial Update Report under the United Nations Framework Convention on Climate Change; Minister of Environment and Forestry: Jakarta, Indonesia, 2018.
77. Israel Ministry of Environment Protection. Israel’s First Biennial Update Report—Submitted to the United Nations Framework Convention on Climate Change; Israel Ministry of Environment Protection: Jerusalem, Israel, 2015.
78. UNFCCC. Kenya’s Intended Nationally Determined Contribution (INDC); UNFCCC: Bonn, Germany, 2015.
79. UNFCCC. South Africa’s 3rd Biennial Update Report to the United Nations Framework Convention on Climate Change; UNFCCC: Bonn, Germany, 2019.
80. UNFCCC. The United States of America Nationally Determined Contribution—Reducing Greenhouse Gases in the United States: A 2030 Emissions Target; UNFCCC: Bonn, Germany, 2021.
81. Lenzen, M. Double-Counting in Life Cycle Calculations. J. Ind. Ecol. 2008, 12, 583–599. [CrossRef]
82. Lange, S. Macroeconomics without growth: Sustainable economies in neoclassical, Keynesian and Marxian theories. In Wirtschaftswissenschaftliche Nachhaltigkeitsforschung; Metropolis-Verlag: Marburg, Germany, 2018.
83. Creutzig, F.; Callaghan, M.W.; Ramakrishnan, A.; Javaid, A.; Niamir, L.; Minx, J.C.; Müller-Hansen, F.; Sovacool, B.K.; Afroz, Z.; Andor, M.; et al. Reviewing the scope and thematic focus of 100,000 publications on energy consumption, services and social aspects of climate change: A big data approach to demand-side mitigation. Environ. Res. Lett. 2020, 16, 033001. [CrossRef]
84. Moran, D.; Wood, R. Convergence between the eora, wiiod, exiobase, and openeu’s consumption-based carbon accounts. Econ. Syst. Res. 2014, 26, 245–261. [CrossRef]
85. Wiedmann, T.; Wilting, H.C.; Lenzen, M.; Lutter, S.; Palm, V. Quo vadis MRIO? Methodological, data and institutional requirements for Multi-Region Input-Output analysis. Ecol. Econ. 2011, 70, 1937–1945. [CrossRef]
86. Peters, G.P. From production-based to consumption-based national emission inventories. Ecol. Econ. 2008, 65, 13–23. [CrossRef]
87. Leontief, W.W.; Strout, A.A. Multiregional input-output analysis. In Structural Interdependence and Economic Development; Barna, T., Ed.; Macmillan: London, UK, 1963; pp. 119–149.
88. Roy, J.; Some, S.; Das, N.; Pathak, M. Demand side climate change mitigation actions and SDGs: Literature review with systematic evidence search. Environ. Res. Lett. 2021, 16, 043003. [CrossRef]