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POLICY BRIEF

Why achieving the Paris Agreement requires reduced overall consumption and production

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ABSTRACT

Technological solutions to the challenge of dangerous climate change are urgent and necessary but to be effective they need to be accompanied by reductions in the total level of consumption and production of goods and services. This is for three reasons. First, private consumption and its associated production are among the key drivers of greenhouse-gas (GHG) emissions, especially among highly emitting industrialized economies. There is no evidence that decoupling of the economy from GHG emissions is possible at the scale and speed needed. Second, investments in more sustainable infrastructure, including renewable energy, needed in coming decades will require extensive amounts of energy, largely from fossil sources, which will use up a significant share of the two-degree carbon budget. Third, improving the standard of living of the world's poor will consume a major portion of the available carbon allowance. The scholarly community has a responsibility to put the issue of consumption and the associated production on the research and policy agenda.

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1. Introduction

Recent emissions calculations draw attention to the shrinking time horizon left to fulfill the Paris Agreement and to avoid 'dangerous climate change.'[1] Even as the window for action quickly narrows, the most recent Emissions Gap Report (UNEP 2017) suggests there has been inadequate progress since the Paris Agreement (Figure 1). Responding to these challenges, the campaign Mission 2020 (Revill and Harris 2017) sets forth a list of 'What needs to happen by 2020,' which was also featured in a recent commentary that received wide circulation (Figueres et al. 2017). The authors list six 'milestones' that must be achieved: (1) a transition to renewable energy sources; (2) zero-emission transport; (3) decarbonized infrastructure; (4) land restoration to replace deforestation; (5) decarbonized heavy industry, and (6) strong investments in climate action by the finance sector.

These milestones emphasize technical solutions to climate threats while ignoring the fact that growing affluence and consumerist lifestyles typically offset the gains that accrue through technological improvements. The extensive body of accumulated knowledge shows that global consumption of goods and services are among the key drivers of GHG emissions. It is therefore imperative that society's 'to-do list' also includes efforts to *reduce* aggregate production-consumption levels and associated energy and materials use. The reductions should not be indiscriminate: while production of renewable energy sources and consumption among people living on low incomes need to increase, the highly consuming lifestyles among the affluent classes need to be addressed.

2. Income and associated production and consumption are primary GHG emission drivers

Decades of research on sustainable consumption and production systems confirm that income levels are the primary predictors of material and energy use and GHG emissions (Ayres and Voudouris 2014; Hubacek et al. 2017; Weber and Matthews 2008). The promotion of a culture of consumerism in highly industrialized countries continuously redefines upwardly expected levels of acceptable comfort, which

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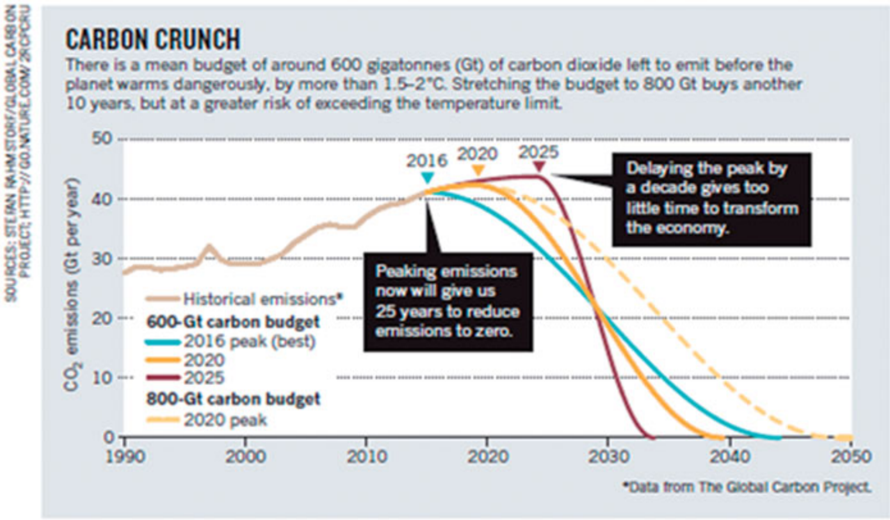

Figure 1. Pathways for reaching the Paris Climate Agreement. Reproduced with permission from Figueres et al. (2017).

translates into growing per capita consumption of materials and energy. A recent study by Sager (2017), for instance, shows that although households with the highest income have on average a less carbon intensive consumption mix (per dollar spent), total household emissions nonetheless increase with income. The 10% of households in the United States with the highest incomes had an average annual carbon footprint of 59.4 metric tons of carbon dioxide (CO_2) in 2009 while a similar percentage of households with the lowest incomes had a carbon footprint of 18.1 metric tons. This culture is hard to change because it is part of a 'system of consumption,' that includes established institutions, infrastructures, economic planning objectives, and political priorities (Cohen, Brown, and Vergragt 2017). The expanding middle classes worldwide are rapidly adopting this consumption-based model of social organization.

Even though the energy intensity of economic growth has been decreasing (relative decoupling), this improved efficiency has not yet produced the necessary reductions in GHG emissions (UNEP 2011; Ward et al. 2016) and fossil fuels are likely to continue their domination for decades. York (2012) showed that each unit of total national energy use from non-fossil fuel sources displaced less than one-quarter of a unit of fossil fuel-energy use. Also, technological innovations often seek to improve productivity by replacing labor with capital and energy (Cleveland et al. 1984), but the resulting decline in costs and prices tends to stimulate demand and consumption on multiple scales, from the household to economy-wide (known as the rebound effect) (Azevedo et al. 2013; Barker and Scrieciu 2010; Gillingham, Rapson, and Wagner 2016; Greening, Greene, and Difiglio 2000; Jenkins, Nordhaus, and Shellenberger 2011).

For example, the emphasis during the past three decades on reuse and recycling has decreased the costs of waste disposal but has done little to reduce GHG emissions. In fact, the newly emergent recycling industries thrive on a growing waste stream which locks in the current system of high production, consumption, and disposal.

In developed countries, production is generally more energy- and emission-efficient, but this is partly due to structural shifts in the global economy, as carbon-intensive production has been outsourced to countries where labor is cheaper. The outsized carbon footprint in the United States and Western Europe [22.5 and 13.1 tons of carbon-dioxide equivalent per capita (tCO_2e/capita), respectively, including imports of goods manufactured abroad] reflects this transition and the resulting role-sharing in the global economy (Chancel and Piketty 2015; Isenhour 2016). Substantial off-shoring of production from industrial countries may create an illusion of progress, but global GHG emissions do not change and, in fact, increase because of the lower energy and carbon efficiency in the energy and production sectors.

The concept of unsustainable production and consumption *patterns* was launched at the 1992 Rio Earth Summit. Research on the effect of more sustainable patterns has, however, shown that, while greener production systems often do result in less carbon- and materials-intensive market offerings, these gains are outpaced by increased volumes as incomes grow (Alfredsson 2004). Production and consumption are interdependent elements in a socio-technical system (Geels et al. 2017; Jensen 2017; Lebel and Lorek 2008). Achieving a sustainable production and consumption system requires both elements to be addressed in tandem.

3. Growing infrastructure investments require a significant share of the available carbon budget

Transitioning to a low-carbon economy entails substantial upfront investments – in alternative and renewable energy systems, energy-efficient buildings, and new transport systems – which will require large amounts of energy, largely from fossil sources. The International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA) recently analyzed the scale and scope of investments in low-carbon technologies in power generation, transportation, buildings, and industry (including heating and cooling) that are needed to facilitate decarbonization of these sectors (OECD/IEA and IRENA 2017). Their estimated CO_2 emissions of 790 gigatons (Gt) for transitioning the energy sector alone are higher than the total carbon budget proposed by Mission 2020.

Transitioning to a renewable energy system is also challenging in energy terms. Even with continuous increases in energy return on energy invested (EROI) for renewable sources, the time horizon for meeting projected global energy demands with renewables is long—too long to reduce emission at the speed which is required to meet the targets of the Paris Agreement. For example, in Germany, after almost two decades of sustained and focused national commitment, only one-third of the country's electricity is produced from renewable sources, while the manufacturing and transportation sectors still largely depend on fossil fuels (Appunn et al. 2018).

4. Improving the quality of life of billions of people in the developing world requires increased consumption of energy and materials

People currently suffering from lack of access to basic necessities, such as food, shelter, safe water, sanitation, and education have the moral right to increase their consumption. It is estimated that achieving the Sustainable Development Goals (SDGs) requires investments in developing countries on the order of US$3.3 to 4.5 trillion per year (OECD 2016). Hubacek et al. (2017) estimate that moving the global poor to an income level of US$3–8 per day income will consume 66% of the available two degree global carbon budget.

The existence of global limits that human society should not transgress—both for GHG emissions and resource use in general—requires a fair sharing of the available carbon budget and ecological space, and redistribution of carbon shares from the global elites to the global poor, something that would involve a deep systemic societal transformation, beyond efficiency gains and technological advances (Holz, Kartha, and Athanasiou 2017). Various institutions have tried, and continue to try, to operationalize sustainable consumption pathways toward such fair shares, formulating upper and lower limits on consumption. While lower limits as conditions for a dignified life receive global attention—including the Human Development Reports of the United Nations Development Program—upper limits are not yet part of a broader societal discourse. In the 1990s, the concept of 'environmental space' initiated this conversation. Raworth's (2012, 2017) concept of 'doughnut economics' suggests ways for a safe and just space for humanity respecting social foundation and environmental ceiling. The more recent notion of 'consumption corridors' takes a needs-based approach in which needs—not desires—of all people on Earth are fulfilled by satisfiers that respect global limits (Di Giulio and Fuchs 2014; Fuchs 2017).

5. Conclusions

The Mission 2020 campaign underscores the important role that technology must play in our struggle to avoid catastrophic climate change, but gives no attention to one of the primary drivers of GHG emissions, namely the level of consumption and production. It is necessary that we place on the global agenda the imperative of transforming whole systems of consumption and production, including both their carbon and material intensity. In the last two decades an extensive body of literature has emerged that discusses potential ways in which transition to sustainable production and consumption systems could occur (Cohen, Brown, and Vergragt 2017), but these issues need to be further analyzed by the wider research community.

The task at hand includes transforming economies toward less dependence on personal consumption and toward increased public investment relative to private consumption. The global research and policy agendas also need to focus on how to establish economic systems that can support people's well-being and needs fulfilment while simultaneously reducing global energy and material flows, and on reconciling competing interests within countries and around the world.

It is beyond the scope of this brief commentary to offer specific proposals on how to shift society and its economic systems to a lower dependency on consumption and how to evolve—or leapfrog—beyond the culture of consumerism. These are some of the greatest intellectual and political challenges of our times. But the responsibility of the scholarly community is clear: it is not enough to set goals for temperature rise, document the extent of—and the dangers from—climate change, and facilitate technological transitions. Researchers must also be upfront about the fact that growing global consumption and production will outpace or significantly erode the gains produced by technological progress for decades to come. Once the topic of more sustainable consumption and production is included in the global research and action agenda, it will surely attract great minds and funding streams toward this urgent problem. And hopefully the policy and politics will follow. The recently launched Future Earth Knowledge-Action Network on Systems of Sustainable Consumption and Production, of which the authors are all active members, aims to contribute to such agenda-setting and to facilitate related research.[2]

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Notes

1. Scenarios and calculations by Yale University, Carbon Tracker, and Climate Action Tracker (a consortium of Ecofys, New Climate Institute, and Climate Analytics), and with a contribution by the Potsdam Institute for Climate Impact Research.
2. See http://www.futureearth.org/future-earth-sscp.

Disclosure statement

No potential conflict of interest was reported by the authors.

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