Global Environmental Change 25 (2014) 5–15

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Climate policy through changing consumption choices: Options and obstacles for reducing greenhouse gas emissions

Bastien Girod [a,b,*], Detlef Peter van Vuuren [b,c], Edgar G. Hertwich [d]

[a] Swiss Federal Institute of Technology Zurich (ETH Zurich), Department of Management, Technology, and Economics, Chair of Sustainability and Technology, Weinbergstrasse 56, 8032 Zurich, Switzerland
[b] Copernicus Institute of Sustainable Development, Utrecht University, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands
[c] PBL-Netherlands Environment Assessment Agency, P.O. Box 1, 3720 BA Bilthoven, The Netherlands
[d] Industrial Ecology Program and Department of Energy and Process Engineering, Norwegian University of Science and Technology, 7491 Trondheim, Norway

ARTICLE INFO

Article history:
Received 18 October 2013
Received in revised form 25 December 2013
Accepted 6 January 2014
Available online 1 February 2014

Keywords:
Sustainable consumption
Climate policy
Life-cycle assessment
RCP2.6 climate target
Behavioral economics

ABSTRACT

While national climate policy can address countries' production or consumption, climate mitigation via changes in consumption has previously received relatively little attention in climate policy literature. In the absence of an effective international climate policy, the focus on consumption is gaining relevance since it has advantages regarding carbon leakage and competitiveness concerns. In addition, consumption oriented climate policy allows for low cost climate mitigation because of behavioral market failures. Therefore, a systematic evaluation of low greenhouse gas consumption options is needed. This article reviews the carbon footprint of products in the five main consumption categories (food, shelter, travel, goods and service) and compares their compatibility with the greenhouse gas intensity required in 2050 to meet the 2° climate target. The evaluation then identifies consumption options compatible with this climate target in all categories. The description of these consumption options allows for the recognition of barriers to their selection. In contrast to production oriented climate policy, besides costs, relevant barriers include consumer preferences, the skills required to find or adopt the product and high initial investments. We conclude that there is substantial climate mitigation potential from changing consumption choices which can be tapped through climate policy by addressing non-cost barriers.

1. Introduction

To avoid dangerous levels of climate change, nearly all countries subscribed, in the Copenhagen Protocol and the subsequent Cancun Agreement, to limit global average temperature rise to no more than 2° compared to preindustrial levels (UN, 2011). Of the Representative Concentration Pathways (RCP) evaluated by the IPCC (van Vuuren et al., 2011a), only the lowest pathway, the RCP2.6 (van Vuuren et al., 2011b), is consistent with this climate target (Meinshausen et al., 2011).

In the past, climate policy and research has mostly focused on approaches that relate greenhouse gas emissions to production. This is apparent from the greenhouse inventories which categorize emissions from a territorial, and hence production, perspective (Peters and Hertwich, 2008). This approach corresponds well to the underlying assumption that countries are responsible for the emissions within their territory. One advantage of this approach is that it is methodologically more straightforward to assign emissions on the basis of their geographical location (thus related to production) (Peters and Hertwich, 2008). Policies promoting innovation and deployment of low carbon technologies also tend to favor production compared to end-use energy technologies (Wilson et al., 2012). Studies evaluating the feasibility of the RCP2.6 have typically used a modeling approach, in which a carbon tax is introduced, and most often these models tend to be much more detailed on production activities than on consumption (e.g. Vuuren et al., 2011).

While a production-oriented perspective has its advantages, it also has clear limitations. At the moment, ambitious climate policies via the UN Framework Convention on Climate Change seem impossible before 2020 (Jacobs, 2012). This means that strengthening current policies relies mostly on a climate "coalition of the willing" formed by countries, cities and citizens (Schnoor,

* Corresponding author at: Swiss Federal Institute of Technology Zurich (ETH Zurich), Department of Management, Technology, and Economics, Chair of Sustainability and Technology, Weinbergstrasse 56, 8032 Zurich, Switzerland. Tel.: +41 44 632 63 13.
E-mail address: bgirod@ethz.ch (B. Girod).

0959-3780/$ – see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.gloenvcha.2014.01.004

2012). For such a coalition, the consumption perspective can be more attractive for at least three different reasons: embodied emissions, economic competitiveness, and behavioral market failures. First, contrary to the production perspective, the consumption perspective includes the embodied emissions (Peters and Hertwich, 2006). It is more effective in avoiding carbon leakage (Böhringer et al., 2012) and extending the influence of the "coalition of the willing" to the production of imported products. The consumption perspective is relevant because this coalition typically represents entities such as cities, which show rather high tertiary sector activity and import a relevant share of products responsible for greenhouse gas (GHG) emissions (Larsen and Hertwich, 2009). Second, policies oriented toward changes in consumption choices have a lower effect on international competitiveness, because they do not affect the cost of exported products and equally affect products in the home market, whether imported or produced locally. In contrast, production side policies can lead to a disadvantage for domestic industry on the home market, as well as on foreign markets, according to theoretical and empirical finding of the OECD (2007). Model simulations show possible disadvantages of unilateral environmental taxes on industry, and a policy survey shows that environmentally related taxes are levied almost exclusively on households and the transport sector. The producing sector (industry) is usually exempted due to competitiveness concerns. The ineffectiveness of unilateral, domestically oriented climate policies in reducing emissions from the production of energy-intensive goods has been confirmed by international energy modeling forums (Böhringer et al., 2012). Third, findings from behavioral economics emphasize the important role of behavioral market failures (e.g. underestimation of energy efficiency savings) representing barriers to the adoption of low GHG consumption options (Gillingham and Sweeney, 2012). Adjustment in the choice architecture of consumers (e.g. default products, information, standards) can therefore provide climate mitigation potential at low or even negative costs (Allcott and Mullainathan, 2010). Examples of measures allowing for negative costs are increases in energy efficiency through labels indicating the lower energy costs for more efficient cars, or building codes requiring economically optimal levels of insulation (Dietz et al., 2009; Sunstein, 2013).

Despite the increasing support for consumption oriented climate policy, little research is available on its climate mitigation potential. Studies have evaluated the potential for changes in consumption patterns for single sectors, such as food (Stehfest et al., 2009a) or passenger transportation (Girod et al., 2013a). However, by focusing on a single sector they do not provide the full picture across the different consumption categories. A broader focus was applied by Dietz et al. (2009). They evaluate the potential of a selection of 17 household action types, including changes in purchase as well as the use of energy consuming appliances, focusing on the GHG emissions resulting from direct energy consumption at home or through personal vehicles. We contribute to this literature by combining the broader evaluation across consumption categories with a global perspective including emissions embodied in non-energy goods. Since changes in the purchase of climate friendly products show broader acceptance compared to life style changes (Dietz et al., 2009; Tobler et al., 2012), we focus on the former and evaluate the difference in the GHG emissions of consumption options.

In earlier work we developed a concept to translate global climate policy targets to the consumption level (Girod et al., 2013b). This concept is applied to identify consumption options in line with the international climate target (RCP2.6). This article extends the previous work by evaluating a broad range of products through a review of life-cycle assessment studies in the consumption categories of food, shelter, travel, goods and services. This allows for a direct quantitative comparison of different consumption items with the required GHG intensity for the 2° climate target. In this way, it is possible to identify various low GHG options consistent with the 2° target across all consumption categories. As a final step we discuss the barriers to low GHG consumption based on these options and derive implications for climate policy aimed at changing consumption choices.

The article is organized as follows: first, we give a overview on levers for climate mitigation and position the evaluated demand side strategy relative to other strategies (Section 2). Next, we present the method used to evaluate the climate mitigation potential of changes in consumption choices (Section 3). In Section 4 we present and identify low GHG consumption options in line with the 2° climate target. On this basis, we discuss barriers to the low GHG options and draw policy implications. Finally, we present our conclusions on climate policy through changing consumption choices (Section 5).

2. Scope: overview on climate mitigation strategies

In this section we give a systematic overview of possible strategies to lower GHG emissions by applying the IPAT equation (Commoner and Corr, 1971; Ehrlich et al., 1971). This allows us to clarify the scope of this article. Using 'GHG emissions' to specify the environmental impact, 'consumption per capita' to represent the affluence and 'GHG emissions per unit of consumption' to describe the technology, the global emissions can be decomposed according to the IPAT equation:

$$\underbrace{GHG\ \ Emissions_c}_{Impact} = Population \cdot \underbrace{\frac{Consumption_c}{Capita}}_{Affluence} \cdot \underbrace{\frac{GHG\ \ Emissions_c}{Consumption_c}}_{Technology} \quad (1)$$

Consumption can be divided into different categories, *c*, or even further disaggregated to the different product and service items, *i*. By replacing the consumption, $Consumption_c$, with production, $Production_c$, this equation can also be applied to evaluate emissions reduction from a production perspective. We differentiate the strategies to lower global GHG emissions by the term of the GHG-IPAT equation which they address. Depending on whether consumption is measured in monetary units or physical units, further strategies can be differentiated. An overview of these strategies and corresponding examples from literature is given in Table 1. In this article we focus on low GHG consumption, which includes the choice of similar but less GHG intensive products (changing patterns) or the same product produced with less GHG emissions (product improvement).

Since there is not always a clear line between the different strategies, we describe the similarities and differences between the evaluated low GHG consumption strategies and the rest. With the rather broad categories applied in this study (food, shelter, travel, goods, services), changes within consumption categories are in some cases (e.g. dietary changes) similar to lifestyle changes. The difference to lifestyle change is determined by the definition of the main consumption categories. The reduction of the consumption of a certain GHG intensive product (e.g. car use) is also similar to the sufficiency strategy. However, in contrast to sufficiency and lifestyle change, in the low GHG consumption strategy, the amount of eating, traveling and shopping remains the same but alternative low GHG options are chosen instead of GHG intensive products. The similarity to the low GHG user behavior strategy is that neither changes the consumption level. However, low GHG behavior focuses on changing the use of the same product (e.g. driving a car more gently) rather than choosing an alternative